

ASME BPVC.I-2021

SECTION I

2021

ASME Boiler and
Pressure Vessel Code
An International Code

Rules for Construction
of Power Boilers



Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME,” ASME logos, or the ASME Single Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code or Standard. Use of the ASME Single Certification Mark requires formal ASME certification; if no certification program is available, such ASME markings may not be used. (For Certification and Accreditation Programs, see <https://www.asme.org/certification-accreditation>.)

Items produced by parties not formally possessing an ASME Certificate may not be described, either explicitly or implicitly, as ASME certified or approved in any code forms or other document.

AN INTERNATIONAL CODE

2021 ASME Boiler & Pressure Vessel Code

2021 Edition

July 1, 2021

I RULES FOR CONSTRUCTION OF POWER BOILERS

ASME Boiler and Pressure Vessel Committee
on Power Boilers



The American Society of
Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2021

This international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

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

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



ASME Collective Membership Mark



ASME Single Certification Mark

"ASME" and the above ASME symbols are registered trademarks of The American Society of Mechanical Engineers.

No part of this document may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Library of Congress Catalog Card Number: 56-3934
Printed in the United States of America

Adopted by the Council of The American Society of Mechanical Engineers, 1914; latest edition 2021.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

Copyright © 2021 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved

TABLE OF CONTENTS

List of Sections		xxiv
Foreword		xxvi
Statement of Policy on the Use of the ASME Single Certification Mark and Code Authorization in Advertising		xxviii
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items		xxviii
Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees		xxix
Personnel		xxxii
Preamble		liii
Summary of Changes		lv
List of Changes in Record Number Order		lviii
Cross-Referencing and Stylistic Changes in the Boiler and Pressure Vessel Code		lix
Part PG	General Requirements for All Methods of Construction	1
	General	1
PG-1	Scope	1
PG-2	Service Limitations	1
PG-3	Referenced Standards	1
PG-4	Units of Measure	1
	Materials	2
PG-5	General	2
PG-6	Plate	3
PG-7	Forgings	3
PG-8	Castings	3
PG-9	Pipes, Tubes, and Pressure-Containing Parts	4
PG-10	Material Identified With or Produced to a Specification Not Permitted by This Section, and Material Not Fully Identified	6
PG-11	Prefabricated or Preformed Pressure Parts Furnished Without a Certification Mark	8
PG-12	Water Level Indicators and Connector Material	10
PG-13	Stays	11
PG-14	Rivets	11
	Design	11
PG-16	General	11
PG-17	Fabrication by a Combination of Methods	12
PG-18	Design Validation by Proof Test	12
PG-19	Cold Forming of Austenitic Materials	12
PG-20	Cold Forming of Carbon, Carbon-Molybdenum, and Creep Strength Enhanced Ferritic Steels	14
PG-21	Maximum Allowable Working Pressure	15

PG-22	Loadings	16
PG-23	Stress Values for Calculation Formulas	16
PG-25	Quality Factors for Steel Castings	16
PG-26	Weld Joint Strength Reduction Factor	18
PG-27	Cylindrical Components Under Internal Pressure	18
PG-28	Components Under External Pressure	23
PG-29	Dished Heads	25
PG-30	Stayed Dished Heads	27
PG-31	Unstayed Flat Heads and Covers	27
	Openings and Compensation	31
PG-32	Openings in Shells, Headers, and Dished Heads	31
PG-33	Compensation Required for Openings in Shells and Dished Heads	32
PG-34	Flanged-In Openings in Formed Heads	35
PG-35	Compensation Required for Openings in Flat Unstayed Heads and Flat Stayed Plates	35
PG-36	Limits of Metal Available for Compensation	36
PG-37	Strength of Compensation	36
PG-38	Compensation for Multiple Openings	37
PG-39	Methods of Attachment of Pipe and Nozzle Necks to Vessel Walls	38
PG-42	General Requirements for Flanges, Pipe Fittings, and Valves	39
PG-43	Nozzle Neck Thickness	42
PG-44	Inspection Openings	42
PG-46	Stayed Surfaces	43
PG-47	Staybolts	44
PG-48	Location of Staybolts	44
PG-49	Dimensions of Staybolts	44
PG-50	Drilled Holes Not Penetrating Through a Vessel Wall	44
PG-52	Ligaments	44
PG-53	Ligaments	47
PG-55	Supports and Attachment Lugs	49
PG-56	Loading on Structural Attachments	49
	Boiler External Piping and Boiler Proper Connections	51
PG-58	Boiler External Piping (BEP)	51
PG-59	Application Requirements for the Boiler Proper	59
	Design and Application	61
PG-60	Design and Application Requirements for Miscellaneous Pipe, Valves, and Fittings	61
PG-61	Feedwater Supply	64
	Overpressure Protection Requirements	64
PG-67	Boiler	64
PG-68	Superheater and Reheater	68
PG-69	Certification of Capacity of Pressure Relief Valves	70
PG-70	Capacity of Pressure Relief Valves	79
PG-71	Mounting of Pressure Relief Valves	79
PG-72	Operation of Pressure Relief Valves	80
PG-73	Minimum Requirements for Pressure Relief Valves	80

	Fabrication	85
PG-75	General	85
PG-76	Cutting Plates and Other Stock	85
PG-77	Material Identification	85
PG-78	Repairs of Defects in Materials	86
PG-79	Tube Holes and Ends	86
PG-80	Permissible Out-of-Roundness of Cylindrical Shells	86
PG-81	Tolerance for Formed Heads	86
PG-82	Holes for Stays	86
	Inspection and Tests	87
PG-90	General	87
PG-91	Qualification of Inspectors	88
PG-93	Examination and Repair of Flat Plate in Corner Joints	88
PG-99	Hydrostatic Test	88
	Certification by Stamping and Data Reports	89
PG-101	Heating Surface Computation	89
PG-104	General	89
PG-105	Certification Marks	90
PG-106	Stamping of Boilers	91
PG-107	Field Assembly	94
PG-108	Stamping for Field-Assembled Boilers	94
PG-109	Stamping of Pressure Piping	95
PG-110	Stamping of Boiler Pressure Relief Valves	95
PG-111	Location of Stampings	95
PG-112	Manufacturer's Data Report Forms	96
PG-113	Master Data Report Form	99
Part PW	Requirements for Boilers Fabricated by Welding	100
	General	100
PW-1	General	100
	Materials	100
PW-5	General	100
	Design	101
PW-8	General	101
PW-9	Design of Welded Joints	101
PW-10	Heat Treatment	103
PW-11	Volumetric Examination of Welded Butt Joints	103
PW-13	Head-to-Flange Requirements	104
PW-14	Openings in or Adjacent to Welds	104
PW-15	Welded Connections	104
PW-16	Minimum Requirements for Attachment Welds	105
PW-17	Forged Flat Heads With Integral Hubbed Flange	112
PW-19	Welded-In Stays	112
	Fabrication	116
PW-26	General	116
PW-27	Welding Processes	116

PW-28	Welding Qualification and Weld Records	117
PW-29	Base Metal Preparation	118
PW-31	Assembly	118
PW-33	Alignment Tolerance, Shells and Vessels (Including Pipe or Tube Used as a Shell)	118
PW-34	Alignment, Tube and Pipe	119
PW-35	Finished Longitudinal and Circumferential Joints	119
PW-36	Miscellaneous Welding Requirements	119
PW-38	Preheating and Interpass Temperatures	120
PW-39	Requirements for Postweld Heat Treatment	122
PW-40	Repair of Defects	134
PW-41	Circumferential Joints in Pipes, Tubes, and Headers	136
PW-42	Joints in Valves and Other Boiler Appurtenances	137
PW-44	Fabrication Rules for Bimetallic Tubes When the Clad Strength Is Included Inspection and Tests	137 139
PW-46	General	139
PW-47	Check of Welding Procedure	139
PW-48	Check of Welder and Welding Operator Performance Qualifications . . .	139
PW-49	Check of Heat Treatment Practice	140
PW-50	Qualification of Nondestructive Examination Personnel	140
PW-51	Radiographic Examination	140
PW-52	Ultrasonic Examination	140
PW-53	Test Plates	141
PW-54	Hydrostatic Test	146
Part PR	Requirements for Boilers Fabricated by Riveting	148
	General	148
PR-1	Scope	148
PR-2	Responsibility	148
	Materials	148
PR-3	General	148
	Design	148
PR-4	General	148
PR-5	Strength of Plates	148
PR-6	Strength of Rivets	148
PR-7	Crushing/Compressive Strength of Plates	148
PR-8	Joint Efficiency and the Thickness of Shells and Drums	149
PR-9	Thickness of Buttstraps	149
PR-10	Longitudinal Joints	149
PR-11	Circumferential Joints	149
PR-12	Transverse Pitch (Back Pitch) of Rows of Rivets	149
PR-13	Preparation of Plate Edges for Calking	150
PR-14	Edge Distance	150
PR-15	Riveted Connections	150
PR-16	Reinforcement of Openings	151
PR-17	Reinforcing Shells of Watertube Boilers	151

	Fabrication	152
PR-18	General	152
PR-19	Welded Connections in Riveted Boilers	152
PR-20	Buttstraps	152
PR-21	Rivet Holes	152
PR-22	Assembly of Joints	153
PR-23	Riveting	153
PR-24	Joint Tightness	153
	Inspection, Tests, and Data Reports	153
PR-25	General	153
PR-26	Hammer Test	153
PR-27	Hydrostatic Test	153
PR-28	Data Reports	153
Part PB	Requirements for Boilers Fabricated by Brazing	155
	General	155
PB-1	General	155
	Materials	156
PB-5	General	156
PB-6	Brazing Filler Metals	156
PB-7	Fluxes and Atmospheres	156
	Design	156
PB-8	General	156
PB-9	Strength of Brazed Joints	156
PB-10	Brazed Joint Efficiency	156
PB-14	Application of Brazing Filler Metal	156
PB-15	Permissible Types of Joints	157
PB-16	Joint Clearance	157
PB-17	Joint Brazing Procedure	157
PB-18	Openings	157
PB-19	Brazed Connections	158
	Fabrication	158
PB-26	General	158
PB-28	Qualification of Brazing Procedure	158
PB-29	Qualification of Brazers and Brazing Operators	158
PB-30	Cleaning of Surfaces to Be Brazed	159
PB-31	Clearance Between Surfaces to Be Brazed	159
PB-32	Postbrazing Operations	159
PB-33	Repair of Defective Brazing	159
	Inspection and Tests	159
PB-46	General	159
PB-47	Check of Brazing Procedure	159
PB-48	Brazer and Brazing Operator	159
PB-49	Visual Examination	159
PB-50	Exemptions	160
	Marking and Reports	160

PB-51	General	160
Part PL	Requirements for Locomotive Boilers	161
	Introduction	161
PL-1	General	161
PL-2	Scope	161
PL-3	Testing and Stamping	161
	Materials	161
PL-5	General	161
PL-6	In the Course of Preparation	164
PL-7	Allowable Stress Values for Materials	164
	Design	164
PL-17	General	164
PL-18	Cylindrical Boiler Shell	164
PL-20	Reinforcing and Doubling Plates on Unstayed Portions of the Boiler . .	164
PL-21	Requirements for Domes of Locomotive Boilers	165
PL-24	Flues	169
PL-27	Stayed Surfaces	169
PL-28	Mudring (Firebox Foundation Ring)	174
PL-30	Staybolts	175
PL-33	Crown Bars	177
PL-36	Braces	177
PL-39	Arch Tubes, Circulators, and Thermic Syphons	182
PL-42	Gage Glasses and Water Columns	185
PL-43	Boiler Blowoff Systems	186
PL-45	Feedwater Supply	186
PL-48	Dry Pipe	186
PL-54	Pressure Relief Valves	186
Part PA	Alternative Rules for Boiler Construction	188
PA-1	General	188
PA-2	Code Boundaries and Interfaces	188
PA-3	Design Specification and Design Report	188
PA-4	Construction	188
PA-4.1	.....	188
PA-4.2	.....	188
PA-5	Materials	188
PA-6	Hydrostatic Test	188
PA-7	Data Reports and Stamping	188
PA-7.1	.....	188
PA-7.2	.....	188
Part PWT	Requirements for Watertube Boilers	189
	General	189
PWT-1	General	189
	Materials	189
PWT-5	General	189
	Design	189

PWT-8	General	189
PWT-9	Tubes and Pipe	189
PWT-11	Tube Connections	189
PWT-12	Staybolting Box-Type Headers and Waterlegs	191
PWT-13	Staying Segment of Heads	191
PWT-14	Firing Doors	191
PWT-15	Access and Firing Doors	191
Part PFT	Requirements for Firetube Boilers	192
	General	192
PFT-1	General	192
	Materials	192
PFT-5	General	192
	Design	192
PFT-8	General	192
PFT-9	Thickness Requirements	192
PFT-10	Shell Joints	192
PFT-11	Attachment of Heads and Tubesheets	192
PFT-12	Tubes	193
	Combustion Chambers	194
PFT-13	Combustion Chamber Tubesheet	194
PFT-14	General	195
PFT-15	Plain Circular Furnaces	195
PFT-17	Ring-Reinforced Type	195
PFT-18	Corrugated Furnaces	196
PFT-19	Combined Plain Circular and Corrugated Type	197
PFT-20	Attachment of Furnaces	197
PFT-21	Fireboxes and Waterlegs	198
	Stayed Surfaces	199
PFT-22	General	199
PFT-23	Working Pressure for Stayed Curved Surfaces	199
PFT-24	Staying Horizontal Return Tube Boilers	200
PFT-25	Staying Segments of Heads	200
PFT-26	Area Supported by Stay	200
PFT-27	Maximum Spacing	201
PFT-28	Staybolts and Stays	202
PFT-29	Flexible Staybolts	202
PFT-30	Crown Bars and Girder Stays	202
PFT-31	Stay Tubes	205
PFT-32	Stresses in Diagonal Stays	205
	Doors and Openings	206
PFT-40	Welded Door Openings	206
PFT-41	Openings in Wrapper Sheets	206
PFT-42	Fireside Access Openings	206
PFT-43	Requirements for Inspection Openings	206
PFT-44	Opening Between Boiler and Pressure Relief Valve	206

	Domes	206
PFT-45	Requirements for Domes	206
	Setting	207
PFT-46	Method of Support	207
	Piping, Fittings, and Appliances	208
PFT-47	Water Level Indicators	208
PFT-48	Feed Piping	208
PFT-49	Blowoff Piping	208
Part PFH	Optional Requirements for Feedwater Heater (When Located Within Scope of Section I Rules)	209
Part PMB	Requirements for Miniature Boilers	210
	General	210
PMB-1	General	210
PMB-2	Scope	210
	Materials	210
PMB-5	General	210
	Design	210
PMB-8	General	210
PMB-9	Welding	210
PMB-10	Washout Openings	210
PMB-11	Feedwater Supply	211
PMB-12	Blowoff	211
PMB-13	Gage Glasses	211
PMB-14	Fixtures and Fittings	211
PMB-15	Pressure Relief Valves	211
PMB-16	Steam Stop Valves	211
PMB-17	Automatic Devices	211
PMB-21	Hydrostatic Tests and Inspection	211
Part PEB	Requirements for Electric Boilers	213
	General	213
PEB-1	General	213
PEB-2	Scope	213
PEB-3	Optional Requirements for the Boiler Pressure Vessel	213
	Materials	213
PEB-5	General	213
	Design	214
PEB-8	General	214
PEB-9	Welding	214
PEB-10	Inspection Openings	214
PEB-11	Feedwater Supply	214
PEB-12	Bottom Blowoff	214
PEB-13	Water Level Indicators	214
PEB-14	Pressure Gages	215
PEB-15	Pressure Relief Valves	215
PEB-16	Automatic Devices	215

PEB-17	Hydrostatic Test	215
PEB-18	Inspection and Stamping of Boilers	215
PEB-19	Manufacturer's Data Report for Electric Boilers	216
Part PVG	Requirements for Organic Fluid Vaporizers	217
	General	217
PVG-1	General	217
	Materials	217
PVG-5	General	217
	Design	217
PVG-8	General	217
PVG-9	General Requirements	217
PVG-10	Gage Glasses	217
PVG-11	Drain Valves	217
PVG-12	Pressure Relief Valves	217
Part PFE	Requirements for Feedwater Economizers	219
PFE-1	General	219
PFE-2	Design	219
PFE-2.1	. . . . .	219
PFE-2.2	. . . . .	219
PFE-3	Pressure Relief	219
PFE-3.1	. . . . .	219
PFE-3.2	. . . . .	219
PFE-3.3	. . . . .	219
PFE-4	Materials	219
Part PTFH	Requirements for Liquid Phase Thermal Fluid Heaters	220
	General	220
PTFH-1	General	220
PTFH-2	Scope	220
PTFH-3	Thermal Fluids	220
	Materials	220
PTFH-5	General	220
	Design	220
PTFH-8	General Requirements	220
PTFH-9	Appurtenances and External Piping	220
PTFH-10	Provisions for Thermal Expansion of the Heat Transfer Medium	221
PTFH-11	Instrumentation	221
PTFH-12	Overpressure Protection	222
PTFH-13	Temperature-Limiting Controls	223
Part PHRSG	Requirements for Heat Recovery Steam Generators	224
PHRSG-1	General	224
PHRSG-2	Scope	224
PHRSG-3	Requirements for Superheater and Reheater Condensate Removal Connections	224
PHRSG-3.1	. . . . .	224
PHRSG-3.2	. . . . .	224

PHRSG-3.3	.....	224
PHRSG-3.4	.....	224
PHRSG-3.5	.....	225
PHRSG-4	Desuperheater Drain Pots	225
PHRSG-5	Certification	225
Mandatory Appendix III	Criteria for Reapplication of a Certification Mark	227
III-1	Introduction	227
III-2	Conditions	227
III-3	Rules	227
Mandatory Appendix IV	Localthinareasin Cylindrical Shellsandin Spherical Segments of Heads	230
IV-1	Scope	230
IV-2	Cylindrical Shells	230
IV-3	Spherical Segments of Heads	231
Mandatory Appendix V	Additional Rules for Boilers Fabricated by Riveting	234
V-1	Scope	234
V-2	Fireboxes, Combustion Chambers, and Furnaces	234
V-2.1	General	234
V-2.2	Plain Circular Furnaces	234
V-2.3	Ring-Reinforced Type	234
V-2.4	Corrugated Furnaces	234
V-2.5	Combined Plain Circular and Corrugated Type	234
V-2.6	Attachment of Furnaces	234
V-2.7	Fireboxes and Waterlegs	234
V-3	Design of Stay Pins and Riveted Stay Attachments	235
V-4	Staying of Upper Segments of Tube Heads by Steel Structural Shapes .	235
V-5	Riveted Attachments	235
V-6	Domes	237
Mandatory Appendix VI	Establishing Governing Code Editions, Addenda, and Cases for Boilers and Replacement Parts	238
VI-1	General	238
VI-2	Design	238
VI-3	Materials	238
VI-4	Fabrication	238
VI-5	Examination	238
VI-6	Inspection	238
VI-7	Testing	239
VI-8	Overpressure Protection	239
VI-9	Field Assembly	239
VI-10	Certification	239
Mandatory Appendix VII	Alternate Methods for Applying the ASME Certification Mark . . .	240
VII-1	Requirements for Alternate Methods	240
Mandatory Appendix VIII	Local Heating of Welds in Cylindrical Components of P-No. 15E Materials When Using Electric Resistance Heating	241
VIII-1	Scope	241
VIII-2	General	241

VIII-3	Terminology for Local Heating	241
VIII-4	Local Circumferential Band Heating	242
VIII-4.1	Soak Band	242
VIII-4.2	Heated Band	242
VIII-4.3	Gradient Control Band	242
VIII-4.4	Axial Temperature Gradient	244
VIII-5	Measurement of Temperature	244
VIII-5.1	Temperature-Indicating Crayons and Paints	244
VIII-5.2	Selection of Thermocouples	244
VIII-5.3	Installation of Thermocouples	244
VIII-5.4	Control Thermocouples	244
VIII-5.5	Monitoring Thermocouples	244
VIII-6	Design of the Heating Process	244
VIII-6.1	Preheat	245
VIII-6.2	Postheating	245
VIII-6.3	Postweld Heat Treatment	245
VIII-6.4	Special Considerations	245
VIII-7	The Thermal Cycle, PWHT	250
VIII-8	Insulation	252
VIII-9	Quality Assurance System	252
VIII-9.1	Introduction	252
VIII-9.2	Process Control	252
VIII-9.3	Documentation	252
VIII-9.4	Control of Inspection, Measuring, and Test Equipment	252
VIII-9.5	Training	253
VIII-9.6	Servicing	253
VIII-10	Other Considerations	253
Nonmandatory Appendix A	Explanation of the Code Containing Matter Not Mandatory Unless Specifically Referred to in the Rules of the Code	257
	Efficiency of Joints	257
A-1	Efficiency of Riveted Joints	257
A-2	Single-Riveted Lap Joint	257
A-3	Double-Riveted Lap Joint	257
A-4	Double-Riveted Buttstrap and Double-Strap Joint	258
A-5	Triple-Riveted Buttstrap and Double-Strap Joint	258
A-6	Quadruple-Riveted Buttstrap and Double-Strap Joint	259
	Braced and Stayed Surfaces	259
A-8	. . . . .	259
	Method of Checking Pressure Relief Valve Capacity by Measuring Maximum Amount of Fuel That Can Be Burned	260
A-12	. . . . .	260
A-13	Example 1	260
A-14	Example 2	260
A-15	Example 3	260
A-16	Example 4	260
A-17	. . . . .	260

	Automatic Gage Glasses	261
A-18	. . . . .	261
	Fusible Plugs	266
A-19	. . . . .	266
A-20	. . . . .	267
A-21	. . . . .	267
	Proof Tests to Establish Maximum Allowable Working Pressure	267
A-22	. . . . .	267
A-24	Table PG-23.1	271
A-25	Table PG-23.2	271
A-26	Table PG-23.3	271
A-27	Table PG-23.4	271
A-28	Figures G and CS-1 Through CS-6	271
	Suggested Rules Covering Existing Installations	271
A-30	. . . . .	271
	Pressure Relief Valves for Power Boilers	271
A-44	. . . . .	271
A-45	. . . . .	271
A-46	. . . . .	272
A-48	. . . . .	272
A-63	. . . . .	272
A-64	Repairs to Existing Boilers	272
	Examples of Methods of Computation of Openings in Vessel Shells	272
A-65	. . . . .	272
A-66	. . . . .	273
A-67	. . . . .	274
A-68	. . . . .	276
A-69	. . . . .	277
A-70	. . . . .	281
	Examples of Computation of Allowable Loading on Structural Attachments to Tubes	286
A-71	. . . . .	286
A-72	. . . . .	286
A-73	. . . . .	286
A-74	. . . . .	287
	Computations of Typical Nozzle Fittings Attached by Rivets	288
A-75	Example	288
	Preheating	291
A-101	Heating and Cooling Rates for Postweld Heat Treatment	291
	Rounded Indication Charts	291
A-250	Acceptance Standard for Radiographically Determined Rounded Indications in Welds	291
	Methods for Magnetic Particle Examination (MT)	292
A-260	. . . . .	292
	Methods for Liquid Penetrant Examination (PT)	299
A-270	. . . . .	299

	Quality Control System	299
A-301	General	299
A-302	Outline of Features to Be Included in the Written Description of the Quality Control System	300
A-311	Laboratory, Personnel, and Test Requirements for Capacity Certification	301
A-317	Cylindrical Components Under Internal Pressure	301
	Data Report Forms and Guides	303
A-350	Guides for Completing Manufacturers' Data Report Forms	303
	Codes, Standards, and Specifications Referenced in Text	347
A-360	Referenced Standards	347
	Sample Calculations for External Pressure Design	347
A-381	. . . . .	347
A-382	. . . . .	350
A-383	. . . . .	351
	Guidance for the Use of U.S. Customary and SI Units in the ASME Boiler and Pressure Vessel Code	353
A-391	Use of Units in Equations	353
A-392	Guidelines Used to Develop SI Equivalents	353
A-393	Soft Conversion Factors	355
Nonmandatory Appendix B	Positive Material Identification Practice	356
B-1	Introduction	356
B-2	Definitions	356
B-3	Scope	356
B-4	Basis	356
B-5	Materials	357
B-6	Written Practice	357
B-7	Method	357
B-8	Acceptance Criteria	358
B-8.1	. . . . .	358
B-8.2	. . . . .	358
B-8.3	. . . . .	358
B-8.4	. . . . .	358
B-9	Sampling Plan	358
B-9.1	. . . . .	358
B-9.2	Exempt	358
B-10	Documentation	358
B-10.1	. . . . .	358
B-10.2	. . . . .	358
B-10.3	. . . . .	358
B-10.4	. . . . .	359
B-11	Identification	359
Nonmandatory Appendix C	Local Heating of Welds in Cylindrical Components of P-No. 15E Materials When Using Electric Resistance Heating	360
Nonmandatory Appendix D	Design Guidelines for Corrosion, Erosion, and Steam Oxidation of Boiler Tubes	361
D-1	Introduction	361

D-2	Corrosion — Fireside of Waterwall Boiler Tubes	361
D-2.1	Influence of Chlorine on Furnace-Wall Corrosion	362
D-2.2	Effect of No _x Emission Control Technology	362
D-2.3	Acid Dew-Point Corrosion	362
D-2.4	Corrosion — Fireside of Reheater and Superheater Tubes	363
D-2.5	Steam-Side Oxidation	363
D-3	Ash-Particle Impact Erosion	363
Nonmandatory Appendix E	Alternative Method for Ultrasonic Examination	365
E-1	Introduction	365
E-2	Examination Volume	365
E-3	Demonstration Standard	365
E-4	Procedure Qualification	365
E-5	Initial Examination	365
E-6	Personnel Qualification	365
E-7	Flaw Sizing	366
E-8	Flaw Evaluation and Acceptance Criteria	372
Nonmandatory Appendix F	Design Guidelines for Dissimilar Metal Welds Between CSEF and Austenitic Stainless Steels	373
F-1	Introduction	373
F-2	Best Practice Guidelines for Design and Fabrication	373
F-2.1	Location	373
F-2.2	Loading	373
F-3	Fabrication	374
F-3.1	Filler Metals	374
F-3.2	Transition Pieces	375
F-4	Alternative Weld Geometries for Dmws	375
F-5	Welding Technique	375
F-6	Postweld Heat Treatment	376
F-7	Postweld Surface Profiling	376
F-8	Tube-to-Tube Butt Welds	376
F-9	Thick-Section Welds	376
F-10	Attachments to Piping and Headers	376
F-11	Attachments to Tubing	377
F-12	Thermowells	377
F-13	Steam Flow Elements	377
F-14	Drain Lines	377
F-15	Postconstruction and Monitoring	377
Nonmandatory Appendix G	Guide to the Relocation of Requirements for Capacity Certification of Pressure Relief Valves	379
G-1	General	379
Figures		
PG-28	Maximum Internal Projection of Welded Access or Inspection Openings	24
PG-31	Some Acceptable Types of Unstayed Flat Heads and Covers	28
PG-33.1	Nomenclature and Equations for Reinforced Openings	33
PG-33.2	Some Representative Configurations Describing the Dimensions t_e , h , and d	34

PG-33.3	Chart for Determining Value of F	35
PG-38.1-1	Example of Two Openings Spaced With Limits of Reinforcement Overlapping	37
PG-38.2-1	Example of More Than Two Openings Spaced With Limits of Reinforcement Overlapping	37
PG-38.4-1	Illustrations of the Rule Given in PG-38.4	38
PG-42.1	Welding End Transitions Maximum Envelope	41
PG-46.2	Acceptable Proportions for Ends of Through-Stays	43
PG-52.1	Diagram for Determining the Efficiency of Longitudinal and Diagonal Ligaments Between Openings in Cylindrical Shells	45
PG-52.2	Example of Tube Spacing With Pitch of Holes Equal in Every Row	46
PG-52.3	Example of Tube Spacing With Pitch of Holes Unequal in Every Second Row	46
PG-52.4	Example of Tube Spacing With Pitch of Holes Varying in Every Second and Third Row	47
PG-52.5	Example of Tube Spacing With Tube Holes on Diagonal Lines	47
PG-52.6	Diagram for Determining Equivalent Longitudinal Efficiency of Diagonal Ligaments Between Openings in Cylindrical Shells	48
PG-53.2.2-1	Example of Tube Spacing That Does Not Form a Definite Pattern	49
PG-56.1.2	Method of Computation of Attachments to Tubes	50
PG-56.2	Chart for Determining Load Factor, L_f	51
PG-58.2-1	Code Jurisdictional Limits for Piping — Drum-Type Boilers	52
PG-58.2-2	Code Jurisdictional Limits for Piping — Isolable Economizers Located in Feedwater Piping and Isolable Superheaters in Main Steam Piping (Boiler Pressure Relief Valves, Blowoff, and Miscellaneous Piping for Boiler Proper Not Shown for Clarity)	53
PG-58.2-3	Code Jurisdictional Limits for Piping — Reheaters and Nonintegral Separately Fired Superheaters	54
PG-58.2-4	Code Jurisdictional Limits for Piping — An Example of Forced-Flow Steam Generators With No Fixed Steam and Waterline	55
PG-58.2-5	Code Jurisdictional Limits for Piping — An Example of Steam Separator Type Forced-Flow Steam Generators With No Fixed Steam and Waterline	56
PG-58.2-6	Code Jurisdictional Limits for Piping — Firetube Boiler	57
PG-59.1	Typical Boiler Bushings	60
PG-60.3.7	Y-Type Globe Valve	63
PG-60.3.9	Typical Arrangement of Steam and Water Connections for a Water Column	63
PG-67.4	Requirements for Overpressure Protection Forced-Flow Steam Generator	66
PG-80	Maximum Permissible Deviation From a Circular Form, e , for Cylindrical Parts Under External Pressure	87
PG-105.1	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard for Boilers	91
PG-106	Form of Stamping	92
PW-9.3.1	Butt Welding of Plates of Unequal Thickness	101
PW-9.3.3	Heads Attached to Shells	102
PW-9.4	Prohibited Welded Joint	103
PW-15	Examples of Weld Strength Calculations	106

PW-16.1	Some Acceptable Types of Welded Nozzles and Other Connections to Shells, Drums, and Headers	107
PW-16.2	Some Acceptable Forms of Welds for Lugs, Hangers, and Brackets on Shells, Drums, and Headers (See PG-55)	111
PW-16.8	Some Acceptable Designs for Partial-Penetration-Weld-Type Nozzles and Other Connections Designed for 900°F (480°C) or Higher Service	113
PW-17-1	Forged Flat Head With Integral Butt-Welded Hubbed Flange	115
PW-19.4(a)	Some Acceptable Types of Diagonal Braces for Installation by Welding	115
PW-19.4(b)	Unacceptable Types of Diagonal Braces for Installation by Welding	116
PW-53.1	Test Specimens From Longitudinal Welded Test Plates	142
PW-53.2	Method of Forming Longitudinal Test Plates	143
PW-53.3(a)	Details of Tension Test Specimens	144
PW-53.3(b)	Details of Bend Test Specimens	145
PR-13-1	Typical Plate Edge Beveled for Sealing by Calking in a Riveted Joint	150
PR-15.4-1	Location of Seams in Inside and Outside Calking Boundaries	151
PR-17.2-1	Boundary of Reinforcing Plate on Outside and Inside of Drum	151
PR-20.2-1	Allowable Welding of Plate Edges at Ends of Buttstraps	152
PB-15	Some Acceptable Types of Brazed Joints	157
PL-2.2-1	Steam Locomotive Boiler With Dome Throttle	162
PL-2.2-2	Steam Locomotive Boiler With Front-End Throttle	163
PL-20.4.1-1	Round Riveted Plate	165
PL-20.4.2-1	Diamond Riveted Plate	165
PL-20.5-1	Manhole Frame	166
PL-21.4.1-1	Steam Dome Top Flange	168
PL-27.5-1	Examples of Doubler Attachment Methods	172
PL-27.6.3-1	Double-Riveted Lap Seam in Stayed Area	173
PL-27.6.3-2	Double-Fillet-Welded Lap Seam in Stayed Area	173
PL-27.7-1	Upper Corner of Firebox	174
PL-28.2-1	Some Examples of Acceptable Mudring Construction	175
PL-30.4.2-1	Fillet-Welded Staybolts	176
PL-33-1	Example of Crown Bar Installation	177
PL-36.2.1-1	Support Perimeters	178
PL-36.5-1	Typical Forms of Diagonal Braces	179
PL-36.7-1	Typical Forms of Gusset Braces	180
PL-36.9-1	Tee Iron	181
PL-36.9-2	Tee-Iron Support Area	181
PL-39.1-1	Arch Tubes	183
PL-39.2.1-1	Circulators	184
PL-39.2.1-2	Circulator Attachment Section Views	184
PL-39.3-1	Example of Thermic Syphon Installation	185
PWT-11	Examples of Acceptable Forms of Tube Attachment	190
PFT-12.1	Some Acceptable Forms of Tube Attachment on Firetube Boilers	194
PFT-17.2	Acceptable Type of Ring-Reinforced Furnace	195
PFT-18.1	Morison Furnace	196
PFT-19	Connection Between Plain and Corrugated Furnace	197
PFT-20	Welding Ogee Ring	197

PFT-21	Some Acceptable Methods of Forming Waterleg Joints by Welding . . .	198
PFT-23.1	Stayed Wrapper Sheet of Locomotive-Type Boiler	199
PFT-25	Example of Staying of Heads Adjacent to Cylindrical Furnaces	201
PFT-26.3-1	Area Supported by Stay Defined in PFT-26.3	203
PFT-27.2-1	Maximum Spacing as Defined in PFT-27.2	204
PFT-27.11-1	Pitch of Staybolts Adjacent to Upper Corners of Fireboxes	204
PFT-32	Measurements for Determining Stresses in Diagonal Stays	205
PFT-46.1	Spacing and Weld Details for Wall-Support Lugs Set in Pairs on Horizontal-Return Tubular Boilers	207
PFT-46.2	Welded Bracket Connection for Horizontal-Return Tubular Boilers . . .	208
PVG-12	Constant, C , for Vapor Related to Ratio of Specific Heats ($k = c_p/c_v$) . .	218
PTFH-9.1-1	Liquid Phase Thermal Fluid Heater: External Piping	221
PHRSG-4	Some Acceptable Desuperheater Spraywater Protection Device Arrangements	226
	Guide for Completing the Certificate of Conformance for Reapplication of the Certification Mark	229
IV-2-1	Symbols	231
IV-3-1	Blend Requirements	232
IV-3-2	. . . . .	232
IV-3-3	. . . . .	232
IV-3-4	. . . . .	233
IV-3-5	. . . . .	233
V-2.2-1	Riveted Circumferential Joint for Circular Furnace Plates Over $\frac{5}{8}$ in. (16 mm)	235
V-2.2-2	Proper Location of Staybolts Adjacent to Longitudinal Joint in Furnace Sheet	235
V-4-1	Staying of Head With Steel Angles in Tubular Boiler	236
V-5-1	Method of Riveting Manhole Frames to Shells or Drums With Two Rows of Rivets	237
VIII-3-1	Definitions of Terms for Local Circumferential Band Heating of Cylindrical Component Welds	242
VIII-3-2	Definitions of Terms for Local Circumferential Band With Branch Connection Attachment Weld to Cylindrical Component	243
VIII-6.3.4-1	Location of Thermocouples (Monitoring and Control) for Pipe Sizes Up to 6 NPS (150 DN) and One Control Zone	246
VIII-6.3.4-2	Location of Thermocouples (Monitoring and Control) for Pipe Sizes 8 NPS Through 12 NPS (200 DN Through 300 DN) and Two Control Zones	247
VIII-6.3.4-3	Location of Thermocouples (Monitoring and Control) for Pipe Sizes 14 NPS Through 30 NPS (350 DN Through 750 DN) and Four Control Zones	248
VIII-6.3.4-4	Location of Monitoring Thermocouples for Branch Nozzle or Attachment	249
VIII-6.4.5-1	Example of One Approach When the Heated Band from Weld Requiring PWHT Intersects Weld Not Requiring PWHT	251
A-2-1	Single-Riveted Lap Joint, Longitudinal or Circumferential	257
A-3-1	Double-Riveted Lap Joint, Longitudinal or Circumferential	258
A-4-1	Double-Riveted Buttstrap and Double-Strap Joint	258
A-5-1	Triple-Riveted Buttstrap and Double-Strap Joint	259
A-6-1	Quadruple-Riveted Buttstrap and Double-Strap Joint	260
A-6-2	Joints That May Be Used to Avoid Eccentric Stresses	261

A-8	Detail Illustrations Showing Application of PG-48 and PFT-27 to the Staying of Boilers	262
A-19	Typical Forms of Fusible Plugs	266
A-66	Example for Typical Nozzle Computations	273
A-67	Example for Typical Nozzle Computations	275
A-68	Example for Typical Nozzle Computations	276
A-69	Example for Typical Nozzle Computations	278
A-70.1	Example for Typical Nozzle Computations	282
A-70.2	Example for Typical Nozzle Computations	284
A-71	Structural Attachment With Radial Load	286
A-72	Structural Attachment With Eccentric Load	286
A-73	Structural Attachment With Moment Load	287
A-74	Structural Attachment on Tube Bend	287
A-75-1	Example of Nozzle Attached by Riveting	288
A-250.3.4-1	Aligned Rounded Indications	293
A-250.3.4-2	Groups of Aligned Rounded Indications	294
A-250.3.6-1	Charts for t $\frac{1}{8}$ in. (3 mm) to $\frac{1}{4}$ in. (6 mm), Inclusive	295
A-250.3.6-2	Charts for t Over $\frac{1}{4}$ in. (6 mm) to $\frac{3}{8}$ in. (10 mm), Inclusive	295
A-250.3.6-3	Charts for t Over $\frac{3}{8}$ in. (10 mm) to $\frac{3}{4}$ in. (19 mm), Inclusive	296
A-250.3.6-4	Charts for t Over $\frac{3}{4}$ in. (19 mm) to 2 in. (50 mm), Inclusive	296
A-250.3.6-5	Charts for t Over 2 in. (50 mm) to 4 in. (100 mm), Inclusive	297
A-250.3.6-6	Charts for t Over 4 in. (100 mm)	298
E-7-1	Single Indications	367
E-7-2	Multiple Planar Flaws Oriented in Plane Normal to Pressure-Retaining Surface	368
E-7-3	Surface and Subsurface Flaws	369
E-7-4	Nonaligned Coplanar Flaws in Plane Normal to Pressure-Retaining Surface (Illustrative Flaw Configurations)	370
E-7-5	Multiple Aligned Planar Flaws	371
F-2.2-1	Difference in Mean Coefficient of Thermal Expansion for Grade 91 and Common Nickel-Base Filler Metals	374
F-4-1	Examples of Improved Performance DMW Joint Designs	376
Tables		
PG-4-1	Standard Units for Use in Equations	2
PG-19	Post Cold-Forming Strain Limits and Heat-Treatment Requirements for Austenitic Materials and Nickel-Based Alloys	13
PG-20	Post Cold-Forming Strain Limits and Heat-Treatment Requirements	14
PG-26	Weld Strength Reduction Factors to Be Applied When Calculating Maximum Allowable Working Pressure or Minimum Required Thickness of Components Fabricated With a Longitudinal Seam Weld	19
PG-39	Minimum Number of Threads Per Connection	39
PG-56.2	Tube Attachment Angle Design Factor, K	50
PG-67.5	Supercritical Correction Factor, K_{sc}	69
PG-67.5M	Supercritical Correction Factor, K_{sc}	71
PG-68.7	Superheat Correction Factor, K_{sh}	73
PG-68.7M	Superheat Correction Factor, K_{sh}	76

PW-11	Required Volumetric Examination of Welded Butt Joints	104
PW-33	Alignment Tolerance of Sections to Be Butt Welded	119
PW-38-1	Recommended Preheat Temperatures for Welding of Pressure Parts and Attachments	120
PW-39-1	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 1	123
PW-39-2	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 3	124
PW-39-3	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 4	125
PW-39-4	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 5A and P-No. 5B	126
PW-39-5	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 15E	127
PW-39-6	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 6	128
PW-39-7	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 7	128
PW-39-8	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 8	129
PW-39-9	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 10H	129
PW-39-10	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 10I	129
PW-39-11	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 31	130
PW-39-12	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 43	130
PW-39-13	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 45	130
PW-39-14	Mandatory Requirements for Postweld Heat Treatment of Pressure Parts and Attachments — P-No. 51	131
PW-39.1	Alternate Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels	131
PW-39.2	Mandatory Requirements for Postweld Heat Treatment Temperature Ranges for Welds Between P-No. 1, 3, 4, 5A, 5B Group 1, 6, 7, 8, and 15E Group 1	132
PR-9-1	Minimum Thickness of Buttstraps	149
PR-15.3-1	Allowable Stress on Rivets in Tension	150
PB-1	Maximum Design Temperatures for Brazing Filler Metal	156
PB-16	Recommended Joint Clearance at Brazing Temperature	158
PL-21.3.4-1	Thickness of Riveted Reinforcing Rings for Dome Openings	167
PL-24.1-1	Maximum Allowable Working Pressure for Steel Flues for Firetube Locomotive Boilers	170
PL-28.4-1	Radii for Firebox Mudrings	176
PL-30.4.5-1	Fillet-Welded Staybolt: Examples of Nominal Dimensions Permitted ± 0.02 in. (± 0.5 mm)	177
PHRSG-4	Minimum Drain Pot Size	225
V-4-1	Sizes of Angles Required for Staying Segments of Heads	236

VIII-6.3.2-1	Control Zones	245
A-44	Guide for Estimating Steaming Capacity Based on Heating Surface . . .	271
A-75-1	. . . . .	290
A-250.3.2	Maximum Permissible Size of Rounded Indication (Examples Only) . . .	292
A-351	Guide for Completing Manufacturer's Data Report, Form P-2 (See PG-112.2.1)	306
A-351.1	Guide for Completing Manufacturer's Data Report, Form P-2A (See PG-112.2.1.1)	311
A-351.2	Guide for Completing Manufacturer's Data Report, Form P-2B (See PG-112.2.1.2)	315
A-352	Guide for Completing Manufacturer's Data Report, Form P-3 (See PG-112.2.2)	320
A-353	Guide for Completing Engineering-Contractor Data Report for a Complete Boiler Unit, Form P-3A (See PG-112.2.3)	324
A-354	Guide for Completing Manufacturer's Partial Data Report, Form P-4 (See PG-112.2.4)	327
A-354.1	Guide for Completing Manufacturer's Data Report, Form P-4A (See PG-112.2.5)	330
A-354.2	Guide for Completing Manufacturer's Data Report, Form P-4B (See PG- 112.2.5)	332
A-355	Guide for Completing Summary Data Report for Process Steam Generators, Form P-5 (See PG-112.2.6)	334
A-356	Guide for Completing Manufacturer's Data Report for Pressure Relief Valves, Form P-7 (See PG-112.2.8)	338
A-357	Guide to Data Report Forms Distribution	339
A-358	Guide for the Preparation of Manufacturer's or Assembler's Certificate of Conformance, Form P-8	341
A-359	Guide for Completing Manufacturer's Data Report for Locomotive Boilers, Form PL-1 (See PG-112.2.9)	346
A-360	Codes, Standards, and Specifications Referenced in Text	348
B-1	Identification Elements	357
E-3-1	Flaw Acceptance Criteria for ½ in. (13 mm) to Less than 1 in. (25 mm) Thick Weld	366
E-3-2	Flaw Acceptance Criteria for 1 in. (25 mm) to 12 in. (300 mm) Thick Weld	366
E-3-3	Flaw Acceptance Criteria for Larger Than 12 in. (300 mm) Thick Weld	366
G-1-1	Cross-Reference List	379
 Forms		
III-1A	Certificate of Conformance for Reapplication of the Certification Mark .	228
VIII-9.2-1	Standard Procedure for Local Heating	254
VIII-9.3-1	Standard Documentation Checklist for Local Heating	256
P-2	Manufacturer's Data Report for All Types of Boilers Except Watertube and Electric	304
P-2A	Manufacturer's Data Report for All Types of Electric Boilers	308
P-2B	Manufacturer's Data Report for Electric Superheaters and Reheaters . .	313
P-3	Manufacturer's Data Report for Watertube Boilers, Superheaters, Waterwalls, and Economizers	317

P-3A	Engineering-Contractor Data Report for a Complete Boiler Unit	322
P-4	Manufacturer's Partial Data Report	325
P-4A	Manufacturer's Data Report for Fabricated Piping	328
P-4B	Manufacturer's Data Report for Field Installed Mechanically Assembled Piping	331
P-5	Summary Data Report for Process Steam Generators	333
P-6	Manufacturer's Data Report Supplementary Sheet	335
P-7	Manufacturer's Data Report for Pressure Relief Valves	336
P-8	Manufacturer's or Assembler's Certificate of Conformance for Pressure Relief Valves	340
PL-1	Manufacturer's Data Report for Locomotive Boilers	342
Endnotes	. . . . .	380

LIST OF SECTIONS

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 (Customary)
 - Part D — Properties (Metric)
- III Rules for Construction of Nuclear Facility Components
 - Subsection NCA — General Requirements for Division 1 and Division 2
 - Appendices
 - Division 1
 - Subsection NB — Class 1 Components
 - Subsection NCD — Class 2 and Class 3 Components*
 - Subsection NE — Class MC Components
 - Subsection NF — Supports
 - Subsection NG — Core Support Structures
 - Division 2 — Code for Concrete Containments
 - Division 3 — Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
 - Division 5 — High Temperature Reactors
- 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, Brazing, and Fusing Qualifications
- X Fiber-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Power Plant Components
 - Division 1 — Rules for Inspection and Testing of Components of Light-Water-Cooled Plants
 - Division 2 — Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Power Plants
- XII Rules for Construction and Continued Service of Transport Tanks
- XIII Rules for Overpressure Protection

* In the 2021 Edition, Subsections NC and ND have been incorporated into one publication, Subsection NCD (BPVC.III.1.NCD), Class 2 and Class 3 Components.

INTERPRETATIONS

Interpretations are issued in real time in ASME's Interpretations Database at <http://go.asme.org/Interpretations>. Historical BPVC interpretations may also be found in the Database.

CODE CASES

The Boiler and Pressure Vessel Code committees meet regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2021 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements. Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2023 Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. Code Case users can check the current status of any Code Case at <http://go.asme.org/BPVCCDatabase>. Code Case users can also view an index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases at <http://go.asme.org/BPVCC>.

FOREWORD*

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

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

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

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

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

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL STANDARDS COMMITTEES (21)

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the applicable Boiler and Pressure Vessel (BPV) Standards Committee (hereinafter referred to as the Committee). See the guidelines on approval of new materials under the ASME Boiler and Pressure Vessel Code in Section II, Part D for requirements for requests that involve adding new materials to the Code. See the guidelines on approval of new welding and brazing materials in Section II, Part C for requirements for requests that involve adding new welding and brazing materials (“consumables”) to the Code.

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

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

(2) *Code Cases.* Code Cases represent alternatives or additions to existing Code requirements. Code Cases are written as a Question and Reply, and are usually intended to be incorporated into the Code at a later date. When used, Code Cases prescribe mandatory requirements in the same sense as the text of the Code. However, users are cautioned that not all regulators, jurisdictions, or Owners automatically accept Code Cases. The most common applications for Code Cases are as follows:

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

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

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

(3) *Code Interpretations*

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

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

(b) Code requirements, Code Cases, and Code Interpretations established by the Committee are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or Owners to choose any method of design or any form of construction that conforms to the Code requirements.

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

2 INQUIRY FORMAT

Submittals to the Committee should include the following information:

(a) *Purpose.* Specify one of the following:

(1) request for revision of present Code requirements

(2) request for new or additional Code requirements

(3) request for Code Case

(4) request for Code Interpretation

(b) *Background.* The Inquirer should provide the information needed for the Committee’s understanding of the Inquiry, being sure to include reference to the applicable Code Section, Division, Edition, Addenda (if applicable), paragraphs, figures, and tables. This information should include a statement indicating why the included paragraphs, figures, or tables are ambiguous or convey conflicting requirements. Preferably, the Inquirer should provide a copy of, or relevant extracts from, the specific referenced portions of the Code.