

ASME BPVC.I-2025

SECTION I

2025

ASME Boiler and
Pressure Vessel Code
An International Code

Rules for Construction
of Power Boilers

 **ASME**
SETTING THE STANDARD

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

2025 ASME Boiler & Pressure Vessel Code

2025 Edition

July 1, 2025

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, 2025

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 ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code or standard was made available for public review and comment, which provided 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 does ASME 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 representatives or persons 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

All rights reserved. “ASME” and the above ASME symbols are registered trademarks of The American Society of Mechanical Engineers. No part of this document may be copied, modified, distributed, published, displayed, or otherwise reproduced in any form or by any means, electronic, digital, or mechanical, now known or hereafter invented, without the express written permission of ASME. No works derived from this document or any content therein may be created without the express written permission of ASME. Using this document or any content therein to train, create, or improve any artificial intelligence and/or machine learning platform, system, application, model, or algorithm is strictly prohibited.

Library of Congress Catalog Card Number: 56-3934

Adopted by the Council of The American Society of Mechanical Engineers, 1914; latest edition 2025.

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

Copyright © 2025 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

TABLE OF CONTENTS

List of Sections	xxiv
Foreword	xxv
Statement of Policy on the Use of the ASME Single Certification Mark and Code Authorization in Advertising	xxvii
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items	xxvii
Personnel	xxviii
Correspondence With the Committee	li
Preamble	liii
Summary of Changes	lv
Cross-Referencing in the ASME BPVC	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	4
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	11
PG-13 Stays	11
PG-14 Rivets	11
Design	12
PG-16 General	12
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	26
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	33
PG-35	Compensation Required for Openings in Flat Unstayed Heads and Flat Stayed Plates	36
PG-36	Limits of Metal Available for Compensation	36
PG-37	Strength of Compensation	37
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	40
PG-43	Nozzle Neck Thickness	43
PG-44	Inspection Openings	43
PG-46	Stayed Surfaces	43
PG-47	Staybolts	44
PG-48	Location of Staybolts	45
PG-49	Dimensions of Staybolts	45
PG-50	Drilled Holes Not Penetrating Through a Vessel Wall	45
PG-52	Ligaments	45
PG-53	Ligaments Not Forming a Definite Pattern	48
PG-55	Supports and Attachment Lugs	48
PG-56	Loading on Structural Attachments	50
	Boiler External Piping and Boiler Proper Connections	52
PG-58	Boiler External Piping (BEP)	52
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	65
PG-67	Boiler	65
PG-68	Superheater and Reheater	69
PG-69	Certification of Capacity of Pressure Relief Valves	69
PG-70	Capacity of Pressure Relief Valves	70
PG-71	Mounting of Pressure Relief Valves	70
PG-72	Operation of Pressure Relief Valves	72
PG-73	Minimum Requirements for Pressure Relief Valves	72
	Fabrication	77
PG-75	General	77

PG-76	Cutting Plates and Other Stock	78
PG-77	Material Identification	78
PG-78	Repairs of Defects in Materials	78
PG-79	Tube Holes and Ends	78
PG-80	Permissible Out-Of-Roundness of Cylindrical Shells	79
PG-81	Tolerance for Formed Heads	80
PG-82	Holes for Stays	80
	Inspection and Tests	80
PG-90	General	80
PG-91	Qualification of Inspectors	81
PG-93	Examination and Repair of Flat Plate in Corner Joints	81
PG-99	Hydrostatic Test	81
	Certification by Stamping and Data Reports	82
PG-101	Heating Surface Computation	82
PG-104	General	82
PG-105	Certification Marks	82
PG-106	Stamping of Boilers	84
PG-107	Field Assembly	86
PG-108	Stamping for Field-Assembled Boilers	87
PG-109	Stamping of Pressure Piping	87
PG-110	Stamping of Boiler Pressure Relief Valves	88
PG-111	Location of Stampings	88
PG-112	Manufacturer's Data Report Forms	89
PG-113	Master Data Report Form	91
Part PW	Requirements for Boilers Fabricated by Welding	92
	General	92
PW-1	General	92
	Materials	92
PW-5	General	92
	Design	93
PW-8	General	93
PW-9	Design of Welded Joints	93
PW-10	Heat Treatment	95
PW-11	Volumetric Examination of Welded Butt Joints	95
PW-13	Head-To-Flange Requirements	97
PW-14	Openings in or Adjacent to Welds	97
PW-15	Welded Connections	97
PW-16	Minimum Requirements for Attachment Welds	97
PW-17	Forged Flat Heads With Integral Hubbed Flange	104
PW-19	Welded-In Stays	104
	Fabrication	107
PW-26	General	107
PW-27	Welding Processes	107
PW-28	Welding Qualification and Weld Records	109
PW-29	Base Metal Preparation	110

PW-31	Assembly	110
PW-33	Alignment Tolerance, Shells and Vessels (Including Pipe or Tube Used As a Shell)	111
PW-34	Alignment, Tube and Pipe	111
PW-35	Finished Longitudinal and Circumferential Joints	111
PW-36	Miscellaneous Welding Requirements	112
PW-38	Preheating and Interpass Temperatures	112
PW-39	Requirements for Postweld Heat Treatment	114
PW-40	Repair of Defects	126
PW-41	Circumferential Joints in Pipes, Tubes, and Headers	128
PW-42	Joints in Valves and Other Boiler Appurtenances	129
PW-44	Fabrication Rules for Bimetallic Tubes When the Clad Strength Is Included	129
	Inspection and Tests	131
PW-46	General	131
PW-47	Check of Welding Procedure	132
PW-48	Check of Welder and Welding Operator Performance Qualifications . .	132
PW-49	Check of Heat Treatment Practice	132
PW-50	Qualification of Nondestructive Examination Personnel	132
PW-51	Radiographic Examination	132
PW-52	Ultrasonic Examination	133
PW-53	Test Plates	133
PW-54	Hydrostatic Test	134
Part PR	Requirements for Boilers Fabricated by Riveting	139
	General	139
PR-1	Scope	139
PR-2	Responsibility	139
	Materials	139
PR-3	General	139
	Design	139
PR-4	General	139
PR-5	Strength of Plates	139
PR-6	Strength of Rivets	139
PR-7	Crushing/compressive Strength of Plates	139
PR-8	Joint Efficiency and the Thickness of Shells and Drums	140
PR-9	Thickness of Buttstraps	140
PR-10	Longitudinal Joints	140
PR-11	Circumferential Joints	140
PR-12	Transverse Pitch (Back Pitch) of Rows of Rivets	140
PR-13	Preparation of Plate Edges for Calking	141
PR-14	Edge Distance	141
PR-15	Riveted Connections	141
PR-16	Reinforcement of Openings	142
PR-17	Reinforcing Shells of Watertube Boilers	142
	Fabrication	143
PR-18	General	143

PR-19	Welded Connections in Riveted Boilers	143
PR-20	Buttstraps	143
PR-21	Rivet Holes	143
PR-22	Assembly of Longitudinal Joints	144
PR-23	Riveting	144
PR-24	Joint Tightness	144
	Inspection, Tests, and Data Reports	144
PR-25	General	144
PR-26	Hammer Test	144
PR-27	Hydrostatic Test	144
PR-28	Data Reports	145
Part PB	Requirements for Boilers Fabricated by Brazing	146
	General	146
PB-1	General	146
	Materials	147
PB-5	General	147
PB-6	Brazing Filler Metals	147
PB-7	Fluxes and Atmospheres	147
	Design	147
PB-8	General	147
PB-9	Strength of Brazed Joints	147
PB-10	Brazed Joint Efficiency	147
PB-14	Application of Brazing Filler Metal	147
PB-15	Permissible Types of Joints	148
PB-16	Joint Clearance	148
PB-17	Joint Brazing Procedure	148
PB-18	Openings	148
PB-19	Brazed Connections	149
	Fabrication	149
PB-26	General	149
PB-28	Qualification of Brazing Procedure	149
PB-29	Qualification of Brazers and Brazing Operators	149
PB-30	Cleaning of Surfaces to Be Brazed	150
PB-31	Clearance Between Surfaces to Be Brazed	150
PB-32	Postbrazing Operations	150
PB-33	Repair of Defective Brazing	150
	Inspection and Tests	150
PB-46	General	150
PB-47	Check of Brazing Procedure	150
PB-48	Brazer and Brazing Operator	150
PB-49	Visual Examination	150
PB-50	Exemptions	151
	Marking and Reports	151
PB-51	General	151
Part PL	Requirements for Locomotive Boilers	152

	Introduction	152
PL-1	General	152
PL-2	Scope	152
PL-3	Testing and Stamping	152
	Materials	152
PL-5	General	152
PL-6	In the Course of Preparation	155
PL-7	Allowable Stress Values for Materials	155
	Design	155
PL-17	General	155
PL-18	Cylindrical Boiler Shell	155
PL-20	Reinforcing and Doubling Plates on Unstayed Portions of the Boiler .	155
PL-21	Requirements for Domes of Locomotive Boilers	156
PL-24	Flues	160
PL-27	Stayed Surfaces	160
PL-28	Mudring (Firebox Foundation Ring)	165
PL-30	Staybolts	166
PL-33	Crown Bars	168
PL-36	Braces	168
PL-39	Arch Tubes, Circulators, and Thermic Syphons	173
PL-42	Gage Glasses and Water Columns	176
PL-43	Boiler Blowoff Systems	177
PL-45	Feedwater Supply	177
PL-48	Dry Pipe	177
PL-49	Internal or Dome Throttle Valves	177
PL-54	Pressure Relief Valves	177
Part PA	Alternative Rules for Boiler Construction	180
PA-1	General	180
PA-2	Code Boundaries and Interfaces	180
PA-3	Design Specification and Design Report	180
PA-4	Construction	180
PA-4.1		180
PA-4.2		180
PA-5	Materials	180
PA-6	Hydrostatic Test	180
PA-6.1		180
PA-6.2		180
PA-6.3		180
PA-7	Data Reports and Stamping	180
PA-7.1		180
PA-7.2		180
Part PWT	Requirements for Watertube Boilers	181
	General	181
PWT-1	General	181
	Materials	181