

ASME B31.1-2012
(Revision of ASME B31.1-2010)

Power Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



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CONTENTS

Foreword	vii	
Committee Roster	viii	
Introduction	xii	
Summary of Changes	xiv	
Chapter I	Scope and Definitions	1
100	General	1
Chapter II	Design	12
Part 1	Conditions and Criteria	12
101	Design Conditions	12
102	Design Criteria	13
Part 2	Pressure Design of Piping Components	19
103	Criteria for Pressure Design of Piping Components	19
104	Pressure Design of Components	19
Part 3	Selection and Limitations of Piping Components	34
105	Pipe	34
106	Fittings, Bends, and Intersections	34
107	Valves	35
108	Pipe Flanges, Blanks, Flange Facings, Gaskets, and Bolting	36
Part 4	Selection and Limitations of Piping Joints	37
110	Piping Joints	37
111	Welded Joints	37
112	Flanged Joints	38
113	Expanded or Rolled Joints	38
114	Threaded Joints	38
115	Flared, Flareless, and Compression Joints, and Unions	43
116	Bell End Joints	43
117	Brazed and Soldered Joints	43
118	Sleeve Coupled and Other Proprietary Joints	44
Part 5	Expansion, Flexibility, and Pipe Supporting Element	44
119	Expansion and Flexibility	44
120	Loads on Pipe Supporting Elements	46
121	Design of Pipe Supporting Elements	47
Part 6	Systems	51
122	Design Requirements Pertaining to Specific Piping Systems	51
Chapter III	Materials	66
123	General Requirements	66
124	Limitations on Materials	67
125	Materials Applied to Miscellaneous Parts	69
Chapter IV	Dimensional Requirements	70
126	Material Specifications and Standards for Standard and Nonstandard Piping Components	70
Chapter V	Fabrication, Assembly, and Erection	78
127	Welding	78
128	Brazing and Soldering	89
129	Bending and Forming	90
130	Requirements for Fabricating and Attaching Pipe Supports	93
131	Welding Preheat	93



132	Postweld Heat Treatment	94
133	Stamping	101
135	Assembly	101
Chapter VI	Inspection, Examination, and Testing	103
136	Inspection and Examination	103
137	Pressure Tests	107
Chapter VII	Operation and Maintenance	110
138	General	110
139	Operation and Maintenance Procedures	110
140	Condition Assessment of CPS	110
141	CPS Records	111
144	CPS Walkdowns	111
145	Material Degradation Mechanisms	111
Figures		
100.1.2(A.1)	Code Jurisdictional Limits for Piping — An Example of Forced Flow Steam Generators With No Fixed Steam and Water Line	2
100.1.2(A.2)	Code Jurisdictional Limits for Piping — An Example of Steam Separator Type Forced Flow Steam Generators With No Fixed Steam and Water Line	3
100.1.2(B)	Code Jurisdictional Limits for Piping — Drum-Type Boilers	4
100.1.2(C)	Code Jurisdictional Limits for Piping — Spray-Type Desuperheater	5
102.4.5	Nomenclature for Pipe Bends	17
104.3.1(D)	Reinforcement of Branch Connections	24
104.3.1(G)	Reinforced Extruded Outlets	28
104.5.3	Types of Permanent Blanks	31
104.8.4	Cross Section Resultant Moment Loading	33
122.1.7(C)	Typical Globe Valves	55
122.4	Desuperheater Schematic Arrangement	59
127.3	Butt Welding of Piping Components With Internal Misalignment	79
127.4.2	Welding End Transition — Maximum Envelope	80
127.4.4(A)	Fillet Weld Size	83
127.4.4(B)	Welding Details for Slip-On and Socket-Welding Flanges; Some Acceptable Types of Flange Attachment Welds	84
127.4.4(C)	Minimum Welding Dimensions Required for Socket Welding Components Other Than Flanges	84
127.4.8(A)	Typical Welded Branch Connection Without Additional Reinforcement	84
127.4.8(B)	Typical Welded Branch Connection With Additional Reinforcement	84
127.4.8(C)	Typical Welded Angular Branch Connection Without Additional Reinforcement	84
127.4.8(D)	Some Acceptable Types of Welded Branch Attachment Details Showing Minimum Acceptable Welds	85
127.4.8(E)	Some Acceptable Details for Integrally Reinforced Outlet Fittings	86
127.4.8(F)	Typical Full Penetration Weld Branch Connections for NPS 3 and Smaller Half Couplings or Adapters	87
127.4.8(G)	Typical Partial Penetration Weld Branch Connection for NPS 2 and Smaller Fittings	88
135.5.3	Typical Threaded Joints Using Straight Threads	102
Tables		
102.4.3	Longitudinal Weld Joint Efficiency Factors	16
102.4.5	Bend Thinning Allowance	17
102.4.6(B.1.1)	Maximum Severity Level for Casting Thickness 4½ in. (114 mm) or Less	18
102.4.6(B.2.2)	Maximum Severity Level for Casting Thickness Greater Than 4½ in. (114 mm)	18



102.4.7	Weld Strength Reduction Factors to Be Applied When Calculating the Minimum Wall Thickness or Allowable Design Pressure of Components Fabricated With a Longitudinal Seam Fusion Weld	20
104.1.2(A)	Values of y	22
112	Piping Flange Bolting, Facing, and Gasket Requirements	39
114.2.1	Threaded Joints Limitations	43
121.5	Suggested Pipe Support Spacing	48
121.7.2(A)	Carrying Capacity of Threaded ASTM A36, A575, and A576 Hot-Rolled Carbon Steel	50
122.2	Design Pressure for Blowoff/Blowdown Piping Downstream of BEP Valves	56
122.8.2(B)	Minimum Wall Thickness Requirements for Toxic Fluid Piping	63
126.1	Specifications and Standards	71
127.4.2	Reinforcement of Girth and Longitudinal Butt Welds	82
129.3.1	Approximate Lower Critical Temperatures	91
129.3.4.1	Post Cold-Forming Strain Limits and Heat-Treatment Requirements	92
132	Postweld Heat Treatment	95
132.1	Alternate Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels	100
136.4	Mandatory Minimum Nondestructive Examinations for Pressure Welds or Welds to Pressure-Retaining Components	105
136.4.1	Weld Imperfections Indicated by Various Types of Examination	106
Mandatory Appendices		
A	Allowable Stress Tables	113
	Table A-1, Carbon Steel	114
	Table A-2, Low and Intermediate Alloy Steel	126
	Table A-3, Stainless Steels	136
	Table A-4, Nickel and High Nickel Alloys	166
	Table A-5, Cast Iron	180
	Table A-6, Copper and Copper Alloys	182
	Table A-7, Aluminum and Aluminum Alloys	186
	Table A-8, Temperatures 1,200°F and Above	194
	Table A-9, Titanium and Titanium Alloys	200
	Table A-10, Bolts, Nuts, and Studs	204
B	Thermal Expansion Data	209
	Table B-1, Thermal Expansion Data	210
	Table B-1 (SI), Thermal Expansion Data	214
C	Moduli of Elasticity	218
	Table C-1, Moduli of Elasticity for Ferrous Material	218
	Table C-1 (SI), Moduli of Elasticity for Ferrous Material	219
	Table C-2, Moduli of Elasticity for Nonferrous Material	220
	Table C-2 (SI), Moduli of Elasticity for Nonferrous Material	222
D	Flexibility and Stress Intensification Factors	224
	Table D-1, Flexibility and Stress Intensification Factors	224
	Chart D-1, Flexibility Factor, k , and Stress Intensification Factor, i	228
	Chart D-2, Correction Factor, c	229
	Fig. D-1, Branch Connection Dimensions	230
F	Referenced Standards	231
G	Nomenclature	235
H	Preparation of Technical Inquiries	242
J	Quality Control Requirements for Boiler External Piping (BEP)	243
Nonmandatory Appendices		
II	Rules for the Design of Safety Valve Installations	245
III	Rules for Nonmetallic Piping and Piping Lined With Nonmetals	265
IV	Corrosion Control for ASME B31.1 Power Piping Systems	286



V	Recommended Practice for Operation, Maintenance, and Modification of Power Piping Systems	290
VI	Approval of New Materials	303
VII	Procedures for the Design of Restrained Underground Piping	304
Index	315



FOREWORD

The general philosophy underlying this Power Piping Code is to parallel those provisions of Section I, Power Boilers, of the ASME Boiler and Pressure Vessel Code, as they can be applied to power piping systems. The Allowable Stress Values for power piping are generally consistent with those assigned for power boilers. This Code is more conservative than some other piping codes, reflecting the need for long service life and maximum reliability in power plant installations.

The Power Piping Code as currently written does not differentiate among the design, fabrication, and erection requirements for critical and noncritical piping systems, except for certain stress calculations and mandatory nondestructive tests of welds for heavy wall, high temperature applications. The problem involved is to try to reach agreement on how to evaluate criticality, and to avoid the inference that noncritical systems do not require competence in design, fabrication, and erection. Someday such levels of quality may be definable, so that the need for the many different piping codes will be overcome.

There are many instances where the Code serves to warn a designer, fabricator, or erector against possible pitfalls; but the Code is not a handbook, and cannot substitute for education, experience, and sound engineering judgment.

Nonmandatory Appendices are included in the Code. Each contains information on a specific subject, and is maintained current with the Code. Although written in mandatory language, these Appendices are offered for application at the user's discretion.

The Code never intentionally puts a ceiling limit on conservatism. A designer is free to specify more rigid requirements as he feels they may be justified. Conversely, a designer who is capable of a more rigorous analysis than is specified in the Code may justify a less conservative design, and still satisfy the basic intent of the Code.

The Power Piping Committee strives to keep abreast of the current technological improvements in new materials, fabrication practices, and testing techniques; and endeavors to keep the Code updated to permit the use of acceptable new developments.



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INTRODUCTION

The ASME B31 Code for Pressure Piping consists of a number of individually published Sections, each an American National Standard, under the direction of ASME Committee B31, Code for Pressure Piping.

Rules for each Section have been developed considering the need for application of specific requirements for various types of pressure piping. Applications considered for each Code Section include

- B31.1 Power Piping: piping typically found in electric power generating stations, in industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems
- B31.3 Process Piping: piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals
- B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids: piping transporting products that are predominately liquid between plants and terminals and within terminals, pumping, regulating, and metering stations
- B31.5 Refrigeration Piping: piping for refrigerants and secondary coolants
- B31.8 Gas Transportation and Distribution Piping Systems: piping transporting products that are predominately gas between sources and terminals, including compressor, regulating, and metering stations; and gas gathering pipelines
- B31.9 Building Services Piping: piping typically found in industrial, institutional, commercial, and public buildings, and in multi-unit residences, which does not require the range of sizes, pressures, and temperatures covered in B31.1
- B31.11 Slurry Transportation Piping Systems: piping transporting aqueous slurries between plants and terminals and within terminals, pumping, and regulating stations
- B31.12 Hydrogen Piping and Pipelines: piping in gaseous and liquid hydrogen service, and pipelines in gaseous hydrogen service

This is the B31.1 Power Piping Code Section. Hereafter, in this Introduction and in the text of this Code Section B31.1, where the word *Code* is used without specific identification, it means this Code Section.

It is the owner's responsibility to select the Code Section that most nearly applies to a proposed piping installation. Factors to be considered by the owner include limitations of the Code Section, jurisdictional requirements, and the applicability of other codes and standards. All applicable requirements of the selected Code Section shall be met. For some installations, more than one Code Section may apply to different parts of the installation. The owner is also responsible for imposing requirements supplementary to those of the selected Code Section, if necessary, to assure safe piping for the proposed installation.

Certain piping within a facility may be subject to other codes and standards, including but not limited to

- ASME Boiler and Pressure Vessel Code, Section III: nuclear power piping
- ANSI Z223.1 National Fuel Gas Code: piping for fuel gas from the point of delivery to the connection of each fuel utilization device
- NFPA Fire Protection Standards: fire protection systems using water, carbon dioxide, halon, foam, dry chemical, and wet chemicals
- NFPA 99 Health Care Facilities: medical and laboratory gas systems
- NFPA 8503 Standard for Pulverized Fuel Systems: piping for pulverized coal from the coal mills to the burners
- building and plumbing codes, as applicable, for potable hot and cold water, and for sewer and drain systems

The Code sets forth engineering requirements deemed necessary for safe design and construction of pressure piping. While safety is the basic consideration, this factor alone will not necessarily govern the final specifications for any piping system. The designer is cautioned that the Code is not a design handbook; it does not eliminate the need for the designer or for competent engineering judgment.

To the greatest possible extent, Code requirements for design are stated in terms of basic design principles and formulas. These are supplemented as necessary with specific requirements to ensure uniform application of principles and to guide selection and application of piping elements. The Code prohibits designs and practices known to be unsafe and contains warnings where caution, but not prohibition, is warranted.

The specific design requirements of the Code usually revolve around a simplified engineering approach to a subject. It is intended that a designer capable of applying more complete and rigorous analysis to special or



unusual problems shall have latitude in the development of such designs and the evaluation of complex or combined stresses. In such cases the designer is responsible for demonstrating the validity of his approach.

This Code Section includes the following:

(a) references to acceptable material specifications and component standards, including dimensional requirements and pressure–temperature ratings

(b) requirements for design of components and assemblies, including pipe supports

(c) requirements and data for evaluation and limitation of stresses, reactions, and movements associated with pressure, temperature changes, and other forces

(d) guidance and limitations on the selection and application of materials, components, and joining methods

(e) requirements for the fabrication, assembly, and erection of piping

(f) requirements for examination, inspection, and testing of piping

(g) requirements for operation and maintenance of piping systems

It is intended that this edition of Code Section B31.1 not be retroactive. Unless agreement is specifically made between contracting parties to use another issue, or the regulatory body having jurisdiction imposes the use of another issue, the latest edition issued at least 6 months prior to the original contract date for the first phase of activity covering a piping system or systems shall be the governing document for all design, materials, fabrication, erection, examination, and testing for the piping until the completion of the work and initial operation.

Users of this Code are cautioned against making use of revisions without assurance that they are acceptable to the proper authorities in the jurisdiction where the piping is to be installed.

Code users will note that clauses in the Code are not necessarily numbered consecutively. Such discontinuities result from following a common outline, insofar as practicable, for all Code Sections. In this way, corresponding material is correspondingly numbered in most Code Sections, thus facilitating reference by those who have occasion to use more than one Section.

The Code is under the direction of ASME Committee B31, Code for Pressure Piping, which is organized and operates under procedures of The American Society of Mechanical Engineers which have been accredited by the American National Standards Institute. The Committee is a continuing one, and keeps all Code Sections current with new developments in materials, construction, and industrial practice. New editions are published at intervals of two to five years.

When no Section of the ASME Code for Pressure Piping, specifically covers a piping system, at the user's discretion, he/she may select any Section determined to be generally applicable. However, it is cautioned that supplementary requirements to the Section chosen may be necessary to provide for a safe piping system for the intended application. Technical limitations of the various Sections, legal requirements, and possible applicability of other codes or standards are some of the factors to be considered by the user in determining the applicability of any Section of this Code.

The Committee has established an orderly procedure to consider requests for interpretation and revision of Code requirements. To receive consideration, inquiries must be in writing and must give full particulars (see Mandatory Appendix H covering preparation of technical inquiries). The Committee will not respond to inquiries requesting assignment of a Code Section to a piping installation.

The approved reply to an inquiry will be sent directly to the inquirer. In addition, the question and reply will be published as part of an Interpretation Supplement issued to the applicable Code Section.

A Case is the prescribed form of reply to an inquiry when study indicates that the Code wording needs clarification or when the reply modifies existing requirements of the Code or grants permission to use new materials or alternative constructions. The Case will be published as part of a Case Supplement issued to the applicable Code Section.

The ASME B31 Standards Committee took action to eliminate Code Case expiration dates effective September 21, 2007. This means that all Code Cases in effect as of this date will remain available for use until annulled by the ASME B31 Standards Committee.

Materials are listed in the Stress Tables only when sufficient usage in piping within the scope of the Code has been shown. Materials may be covered by a Case. Requests for listing shall include evidence of satisfactory usage and specific data to permit establishment of allowable stresses, maximum and minimum temperature limits, and other restrictions. Additional criteria can be found in the guidelines for addition of new materials in the ASME Boiler and Pressure Vessel Code, Section II and Section VIII, Division 1, Appendix B. (To develop usage and gain experience, unlisted materials may be used in accordance with para. 123.1.)

Requests for interpretation and suggestions for revision should be addressed to the Secretary, ASME B31 Committee, Three Park Avenue, New York, NY 10016-5990.



POWER PIPING

Chapter I Scope and Definitions

100 GENERAL

This Power Piping Code is one of several Sections of the American Society of Mechanical Engineers Code for Pressure Piping, B31. This Section is published as a separate document for convenience.

Standards and specifications specifically incorporated by reference into this Code are shown in Table 126.1. It is not considered practical to refer to a dated edition of each of the standards and specifications in this Code. Instead, the dated edition references are included in an Addenda and will be revised yearly.

100.1 Scope

Rules for this Code Section have been developed considering the needs for applications that include piping typically found in electric power generating stations, in industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems.

- (12) **100.1.1** This Code prescribes requirements for the design, materials, fabrication, erection, test, inspection, operation, and maintenance of piping systems.

Piping as used in this Code includes pipe, flanges, bolting, gaskets, valves, pressure-relieving valves/devices, fittings, and the pressure containing portions of other piping components, whether manufactured in accordance with Standards listed in Table 126.1 or specially designed. It also includes hangers and supports and other equipment items necessary to prevent overstressing the pressure containing components.

Rules governing piping for miscellaneous appurtenances, such as water columns, remote water level indicators, pressure gages, gage glasses, etc., are included within the scope of this Code, but the requirements for boiler appurtenances shall be in accordance with Section I of the ASME Boiler and Pressure Vessel Code, PG-60.

The users of this Code are advised that in some areas legislation may establish governmental jurisdiction over the subject matter covered by this Code. However, any such legal requirement shall not relieve the owner of his inspection responsibilities specified in para. 136.1.

100.1.2 Power piping systems as covered by this Code apply to all piping and their component parts except as excluded in para. 100.1.3. They include but are not limited to steam, water, oil, gas, and air services.

(A) This Code covers boiler external piping as defined below for power boilers and high temperature, high pressure water boilers in which steam or vapor is generated at a pressure of more than 15 psig [100 kPa (gage)]; and high temperature water is generated at pressures exceeding 160 psig [1 103 kPa (gage)] and/or temperatures exceeding 250°F (120°C).

Boiler external piping shall be considered as piping that begins where the boiler proper terminates at

- (1) the first circumferential joint for welding end connections; or
- (2) the face of the first flange in bolted flanged connections; or
- (3) the first threaded joint in that type of connection; and that extends up to and including the valve or valves required by para. 122.1.

The terminal points themselves are considered part of the boiler external piping. The terminal points and piping external to power boilers are illustrated by Figs. 100.1.2(A.1), 100.1.2(A.2), 100.1.2(B), and 100.1.2(C).

Piping between the terminal points and the valve or valves required by para. 122.1 shall be provided with Data Reports, inspection, and stamping as required by Section I of the ASME Boiler and Pressure Vessel Code. All welding and brazing of this piping shall be performed by manufacturers or contractors authorized to use the appropriate symbol shown in Figs. PG-105.1 through PG-105.3 of Section I of the ASME Boiler and Pressure Vessel Code. The installation of boiler external piping by mechanical means may be performed by an organization not holding a Code symbol stamp. However, the holder of a valid S, A, or PP Certificate of Authorization shall be responsible for the documentation and hydrostatic test, regardless of the method of assembly. The quality control system requirements of Section I of the ASME Boiler and Pressure Vessel Code shall apply. These requirements are shown in Mandatory Appendix J of this Code.

