

ASME B31.1-2010
(Revision of ASME B31.1-2007)

Power Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



Copyright © 2010 by the American Society of Mechanical Engineers.
No reproduction may be made of this material without written consent of ASME.



INTENTIONALLY LEFT BLANK



ASME B31.1-2010
(Revision of ASME B31.1-2007)

Power Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



Three Park Avenue • New York, NY • 10016 USA

Copyright © 2010 by the American Society of Mechanical Engineers.
No reproduction may be made of this material without written consent of ASME.



Date of Issuance: December 31, 2010

The next edition of this Code is scheduled for publication in 2012. This Code will become effective 6 months after the Date of Issuance. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. Interpretations, Code Cases, and errata are published on the ASME Web site under the Committee Pages at <http://cstools.asme.org> as they are issued. Interpretations and code cases are also included with each edition.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. 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,” “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.

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.

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

Copyright © 2010 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.



CONTENTS

Foreword	vi	
Committee Roster	vii	
Introduction	xi	
Summary of Changes	xiii	
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	33
105	Pipe	33
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	37
113	Expanded or Rolled Joints	37
114	Threaded Joints	42
115	Flared, Flareless, and Compression Joints, and Unions	42
116	Bell End Joints	43
117	Brazed and Soldered Joints	43
118	Sleeve Coupled and Other Proprietary Joints	43
Part 5	Expansion, Flexibility, and Pipe Supporting Element	43
119	Expansion and Flexibility	43
120	Loads on Pipe Supporting Elements	46
121	Design of Pipe Supporting Elements	47
Part 6	Systems	50
122	Design Requirements Pertaining to Specific Piping Systems	50
Chapter III	Materials	65
123	General Requirements	65
124	Limitations on Materials	66
125	Materials Applied to Miscellaneous Parts	68
Chapter IV	Dimensional Requirements	69
126	Material Specifications and Standards for Standard and Nonstandard Piping Components	69
Chapter V	Fabrication, Assembly, and Erection	77
127	Welding	77
128	Brazing and Soldering	88
129	Bending and Forming	89
130	Requirements for Fabricating and Attaching Pipe Supports	90
131	Welding Preheat	90



132	Postweld Heat Treatment	91
133	Stamping	99
135	Assembly	99
Chapter VI	Inspection, Examination, and Testing	101
136	Inspection and Examination	101
137	Pressure Tests	105
Chapter VII	Operation and Maintenance	108
138	General	108
139	Operation and Maintenance Procedures	108
140	Condition Assessment of CPS	108
141	CPS Records	109
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	78
127.4.2	Welding End Transition — Maximum Envelope	79
127.4.4(A)	Fillet Weld Size	82
127.4.4(B)	Welding Details for Slip-On and Socket-Welding Flanges; Some Acceptable Types of Flange Attachment Welds	83
127.4.4(C)	Minimum Welding Dimensions Required for Socket Welding Components Other Than Flanges	83
127.4.8(A)	Typical Welded Branch Connection Without Additional Reinforcement	83
127.4.8(B)	Typical Welded Branch Connection With Additional Reinforcement	83
127.4.8(C)	Typical Welded Angular Branch Connection Without Additional Reinforcement	83
127.4.8(D)	Some Acceptable Types of Welded Branch Attachment Details Showing Minimum Acceptable Welds	84
127.4.8(E)	Some Acceptable Details for Integrally Reinforced Outlet Fittings	85
127.4.8(F)	Typical Full Penetration Weld Branch Connections for NPS 3 and Smaller Half Couplings or Adapters	86
127.4.8(G)	Typical Partial Penetration Weld Branch Connection for NPS 2 and Smaller Fittings	87
135.5.3	Typical Threaded Joints Using Straight Threads	100
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	38
114.2.1	Threaded Joints Limitations	42
121.5	Suggested Pipe Support Spacing	48
121.7.2(A)	Carrying Capacity of Threaded ASTM A 36, A 575, and A 576 Hot-Rolled Carbon Steel	49
122.2	Design Pressure for Blowoff/Blowdown Piping Downstream of BEP Valves	55
122.8.2(B)	Minimum Wall Thickness Requirements for Toxic Fluid Piping	62
126.1	Specifications and Standards	70
127.4.2	Reinforcement of Girth and Longitudinal Butt Welds	81
129.3.1	Approximate Lower Critical Temperatures	89
132	Postweld Heat Treatment	92
132.1	Alternate Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels	97
136.4	Mandatory Minimum Nondestructive Examinations for Pressure Welds or Welds to Pressure-Retaining Components	103
136.4.1	Weld Imperfections Indicated by Various Types of Examination	104
Mandatory Appendices		
A	Table A-1, Carbon Steel	112
	Table A-2, Low and Intermediate Alloy Steel	124
	Table A-3, Stainless Steels	134
	Table A-4, Nickel and High Nickel Alloys	164
	Table A-5, Cast Iron	176
	Table A-6, Copper and Copper Alloys	178
	Table A-7, Aluminum and Aluminum Alloys	182
	Table A-8, Temperatures 1,200°F and Above	190
	Table A-9, Titanium and Titanium Alloys	196
	Table A-10, Bolts, Nuts, and Studs	200
B	Table B-1, Thermal Expansion Data	206
	Table B-1 (SI), Thermal Expansion Data	210
C	Table C-1, Moduli of Elasticity for Ferrous Material	214
	Table C-1 (SI), Moduli of Elasticity for Ferrous Material	215
	Table C-2, Moduli of Elasticity for Nonferrous Material	216
	Table C-2 (SI), Moduli of Elasticity for Nonferrous Material	218
D	Table D-1, Flexibility and Stress Intensification Factors	220
	Chart D-1, Flexibility Factor, k , and Stress Intensification Factor, i	224
	Chart D-2, Correction Factor, c	225
	Fig. D-1, Branch Connection Dimensions	226
F	Referenced Standards	227
G	Nomenclature	231
H	Preparation of Technical Inquiries	237
J	Quality Control Requirements for Boiler External Piping (BEP)	238
Nonmandatory Appendices		
II	Rules for the Design of Safety Valve Installations	240
III	Rules for Nonmetallic Piping and Piping Lined With Nonmetals	260
IV	Corrosion Control for ASME B31.1 Power Piping Systems	280
V	Recommended Practice for Operation, Maintenance, and Modification of Power Piping Systems	284
VI	Approval of New Materials	294
VII	Procedures for the Design of Restrained Underground Piping	295
Index	306



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.



ASME B31 COMMITTEE

Code for Pressure Piping

(The following is the roster of the Committee at the time of approval of this Code.)

STANDARDS COMMITTEE OFFICERS

M. L. Nayyar, *Chair*
K. C. Bodenhamer, *Vice Chair*
N. Lobo, *Secretary*

STANDARDS COMMITTEE PERSONNEL

R. J. T. Appleby , Pipeline Experts, LLC	G. A. Jolly , Vogt Valves/Flowserve Corp.
C. Becht IV , Becht Engineering Co.	N. Lobo , The American Society of Mechanical Engineers
A. E. Beyer , Fluor Enterprises	W. J. Mauro , American Electric Power
K. C. Bodenhamer , Enterprise Products Co.	J. E. Meyer , Louis Perry & Associates, Inc.
C. J. Campbell , Air Liquide	M. L. Nayyar , Bechtel Power Corp.
J. S. Chin , TransCanada Pipeline U.S.	R. G. Payne , Alstom Power, Inc.
D. D. Christian , Victaulic	G. R. Petru , Engineering Products Co.
D. L. Coym , WorleyParsons	E. H. Rinaca , Dominion Resources, Inc.
C. J. Melo , <i>Alternate</i> , WorleyParsons	M. J. Rosenfeld , Kiefner & Associates, Inc.
R. P. Deubler , Fronек Power Systems, LLC	R. J. Silvia , Process Engineers and Constructors, Inc.
J. A. Drake , Spectra Energy Transmission	W. J. Sperko , Sperko Engineering Services, Inc.
P. D. Flenner , Flenner Engineering Services	F. W. Tatar , FM Global
J. W. Frey , Stress Engineering Services, Inc.	K. A. Vilminot , Black & Veatch
D. R. Frikken , Becht Engineering Co.	K. H. Wooten , ConocoPhillips Pipe Line Co.
R. A. Grichuk , Fluor Corp.	A. Soni , <i>Delegate</i> , Engineers India Ltd.
R. W. Haupt , Pressure Piping Engineering Associates, Inc.	W. J. Koves , <i>Ex-Officio</i>
L. E. Hayden, Jr. , Consultant	A. P. Rangus , <i>Ex-Officio</i> , Bechtel
B. P. Holbrook , Babcock Power, Inc.	R. A. Appleton , <i>Contributing Member</i> , Refrigeration Systems Co.

B31.1 POWER PIPING SECTION COMMITTEE

J. W. Frey , <i>Chair</i> , Stress Engineering Services, Inc.	J. Kaliyadan , Dominion
W. J. Mauro , <i>Vice Chair</i> , American Electric Power	R. J. Kennedy , Detroit Edison Co.
C. E. O'Brien , <i>Secretary</i> , The American Society of Mechanical Engineers	D. J. Leininger , WorleyParsons
H. A. Ainsworth , Consultant	S. P. Licud , Weirich Consulting Services, Inc.
D. D. Christian , Victaulic	W. M. Lundy , U.S. Coast Guard
M. J. Cohn , Intertek–Aptech	D. C. Moore , Southern Co. Services, Inc.
D. H. Creates , Ontario Power Generation, Inc.	M. L. Nayyar , Bechtel Power Corp.
G. J. Delude , Penpower	R. G. Payne , Alstom Power, Inc.
R. P. Deubler , Fronек Power Systems, LLC	D. W. Raho , CCM 2000
A. S. Drake , Constellation Energy Group	K. I. Rapkin , FPL
S. J. Findlan , Electric Power Research Institute	R. K. Reamey , Turner Industries Group, LLC
P. D. Flenner , Flenner Engineering Services	E. H. Rinaca , Dominion Resources, Inc.
E. C. Goodling, Jr. , WorleyParsons	R. D. Schueler, Jr. , The National Board of Boiler and Pressure Vessel Inspectors
J. W. Goodwin , Southern Co.	J. P. Scott , Dominion
T. E. Hansen , American Electric Power	J. J. Sekely , Welding Services, Inc.
R. W. Haupt , Pressure Piping Engineering Associates, Inc.	H. R. Simpson , Industry and Energy Associates, LLC
C. L. Henley , Black & Veatch	S. K. Sinha , Lucius Pitkin, Inc.
B. P. Holbrook , Babcock Power, Inc.	K. A. Vilminot , Black & Veatch
	A. L. Watkins , First Energy Corp.



B31.1 SUBGROUP ON DESIGN

K. A. Vilminot, *Chair*, Black & Veatch
D. H. Creates, Ontario Power Generation, Inc.
S. D. Cross, Zachry Engineering
M. K. Engelkemier, Stanley Consultants, Inc.
J. W. Goodwin, Southern Co.
R. W. Haupt, Pressure Piping Engineering Associates, Inc.
B. P. Holbrook, Babcock Power, Inc.
M. W. Johnson, RRI Energy
R. J. Kennedy, Detroit Edison Co.

W. M. Lundy, U.S. Coast Guard
D. C. Moore, Southern Co. Services, Inc.
A. D. Nance, Consultant
R. D. Patel, GE Energy Nuclear
R. G. Payne, Alstom Power, Inc.
D. D. Pierce, Puget Sound Naval Shipyard
K. I. Rapkin, FPL
T. Sato, Japan Power Engineering and Inspection Corp.
A. L. Watkins, First Energy Corp.
R. B. Wilson, TWD Technologies Ltd.

B31.1 SUBGROUP ON FABRICATION AND EXAMINATION

R. K. Reamey, *Chair*, Turner Industries Group, LLC
R. B. Corbit, Exelon Nuclear
P. M. Davis, Foster Wheeler North America Corp.
C. Emslander
S. J. Findlan, Electric Power Research Institute
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Services, Inc.
S. E. Gingrich, URS Corp.

J. Hainsworth, The Babcock & Wilcox Co.
T. E. Hansen, American Electric Power
D. J. Leininger, WorleyParsons
S. P. Licud, Weirich Consulting Services, Inc.
T. Monday, Team Industries, Inc.
J. J. Sekely, Welding Services, Inc.
E. F. Summers, Jr., Babcock & Wilcox Construction Co.
E. F. Gerwin, *Honorary Member*

B31.1 SUBGROUP ON GENERAL REQUIREMENTS

W. J. Mauro, *Chair*, American Electric Power
H. A. Ainsworth, Consultant
D. D. Christian, Victaulic
G. J. Delude, Penpower
J. Kaliyadan, Dominion

J. W. Power, Alstom Power, Inc.
R. D. Schueler, Jr., The National Board of Boiler and Pressure Vessel Inspectors
M. A. Treat, Associated Electric Cooperative, Inc.

B31.1 SUBGROUP ON MATERIALS

D. W. Rahoi, *Chair*, CCM 2000
M. G. Barkan
R. P. Deubler, Fronex Power Systems, LLC
P. J. Dobson, Electricity de France
A. S. Drake, Constellation Energy Group
C. L. Henley, Black & Veatch

S. L. McCracken, Electric Power Research Institute
L. C. McDonald, Structural Integrity Associates, Inc.
M. L. Nayyar, Bechtel Power Corp.
W. M. Sherman, Swagelok Co.
N. S. Tambat, Bechtel Corp.

B31.1 SUBGROUP ON OPERATION AND MAINTENANCE

R. J. Kennedy, *Chair*, Detroit Edison Co.
C. E. O'Brien, *Secretary*, The American Society of Mechanical Engineers
M. J. Cohn, Intertek–Aptech
D. H. Creates, Ontario Power Generation, Inc.
P. M. Davis, Foster Wheeler North America Corp.
M. K. Engelkemier, Stanley Consultants, Inc.
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Services, Inc.
E. C. Goodling, Jr., WorleyParsons
J. W. Goodwin, Southern Co.
T. E. Hansen, American Electric Power

R. W. Haupt, Pressure Piping Engineering Associates, Inc.
B. P. Holbrook, Babcock Power, Inc.
M. W. Johnson, RRI Energy
L. C. McDonald, Structural Integrity Associates, Inc.
D. C. Moore, Southern Co. Services, Inc.
M. L. Nayyar, Bechtel Power Corp.
R. G. Payne, Alstom Power, Inc.
K. I. Rapkin, FPL
R. K. Reamey, Turner Industries Group, LLC
E. H. Rinaca, Dominion Resources, Inc.
J. P. Scott, Dominion
A. L. Watkins, First Energy Corp.



B31.1 SUBGROUP ON SPECIAL ASSIGNMENTS

E. H. Rinaca, *Chair*, Dominion Resources, Inc.
M. J. Cohn, Intertek–Aptech
E. C. Goodling, Jr., WorleyParsons
J. P. Scott, Dominion

H. R. Simpson, Industry and Energy Associates, LLC
S. K. Sinha, Lucius Pitkin, Inc.
D. A. Yoder, WorleyParsons

B31 EXECUTIVE COMMITTEE

N. Lobo, *Secretary*, The American Society of Mechanical Engineers
C. Becht IV, Becht Engineering Co.
K. C. Bodenhamer, Enterprise Products Co.
D. D. Christian, Victaulic
J. A. Drake, Spectra Energy Transmission
P. D. Flenner, Flenner Engineering Services
D. R. Frikken, Becht Engineering Co.
R. W. Haupt, Pressure Piping Engineering Associates, Inc.
L. E. Hayden, Jr., Consultant

B. P. Holbrook, Babcock Power, Inc.
G. A. Jolly, Vogt Valves/Flowserve Corp.
W. J. Koves
M. L. Nayyar, Bechtel Power Corp.
R. G. Payne, Alstom Power, Inc.
A. P. Rangus, Bechtel
W. J. Sperko, Sperko Engineering Services, Inc.
K. H. Wooten, ConocoPhillips Pipe Line Co.
R. A. Appleton, *Contributing Member*, Refrigeration Systems Co.

B31 CONFERENCE GROUP

A. Bell, Bonneville Power Administration
R. A. Coomes, Commonwealth of Kentucky, Department of Housing/Boiler Section
D. H. Hanrath
C. J. Harvey, Alabama Public Service Commission
D. T. Jagger, Ohio Department of Commerce
M. Kotb, Regie du Batiment du Quebec
K. T. Lau, Alberta Boilers Safety Association
R. G. Marini, New Hampshire Public Utilities Commission
I. W. Mault, Manitoba Department of Labour
A. W. Meiring, Fire and Building Safety Division/Indiana

R. F. Mullaney, Boiler and Pressure Vessel Safety Branch/
Vancouver
P. Sher, State of Connecticut
M. E. Skarda, Arkansas Department of Labor
D. A. Starr, Nebraska Department of Labor
D. J. Stursma, Iowa Utilities Board
R. P. Sullivan, The National Board of Boiler and Pressure Vessel Inspectors
J. E. Troppman, Division of Labor/State of Colorado Boiler Inspections
W. A. M. West, Lighthouse Assistance, Inc.
T. F. Wickham, Rhode Island Department of Labor

B31 FABRICATION AND EXAMINATION COMMITTEE

A. P. Rangus, *Chair*, Bechtel
R. J. Horvath, Jr., *Secretary*, The American Society of Mechanical Engineers
J. P. Ellenberger
R. J. Ferguson, Metallurgist
D. J. Fetzner, BP Exploration Alaska, Inc.
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Services, Inc.
W. W. Lewis, E. I. DuPont

S. P. Licud, Weirich Consulting Services, Inc.
T. Monday, Team Industries, Inc.
A. D. Nalbandian, Thielsch Engineering, Inc.
R. I. Seals, Consultant
R. J. Silvia, Process Engineers & Constructors, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
E. F. Summers, Jr., Babcock & Wilcox Construction Co.
P. L. Vaughan, ONEOK Partners

B31 MATERIALS TECHNICAL COMMITTEE

R. A. Grichuk, *Chair*, Fluor Corp.
N. Lobo, *Secretary*, The American Society of Mechanical Engineers
M. H. Barnes, Scantec, Inc.
R. P. Deubler, Fronex Power Systems, LLC
W. H. Eskridge, Jr., Aker Solutions Engineering & Construction
C. L. Henley, Black & Veatch
M. L. Nayyar, Bechtel Power Corp.

M. B. Pickell, Willbros Engineers, Inc.
D. W. Rahoi, CCM 2000
R. A. Schmidt, Hackney Ladish, Inc.
H. R. Simpson, Industry and Energy Associates, LLC
J. L. Smith, Jacobs Engineering Group
Z. Djilali, *Contributing Member*, BEREP



B31 MECHANICAL DESIGN TECHNICAL COMMITTEE

W. J. Koves, *Chair*

G. A. Antaki, *Vice Chair*, Becht Engineering Co., Inc.

C. E. O'Brien, *Secretary*, The American Society of Mechanical Engineers

C. Becht IV, Becht Engineering Co.

J. P. Breen, Becht Engineering Co.

N. F. Consumo, Sr., GE Energy

J. P. Ellenberger

D. J. Fetzner, BP Exploration Alaska, Inc.

J. A. Graziano, Tennessee Valley Authority

R. W. Haupt, Pressure Piping Engineering Associates, Inc.

B. P. Holbrook, Babcock Power, Inc.

R. A. Leishear, Savannah River National Laboratory

G. D. Mayers, Alion Science & Technology

T. Q. McCawley, Zachry Engineering Corp.

R. J. Medvick, Swagelok

J. C. Minichiello, Bechtel National, Inc.

A. W. Paulin, Paulin Research Group

R. A. Robleto, KBR

M. J. Rosenfeld, Kiefner & Associates, Inc.

G. Stevick, Berkeley Engineering and Research, Inc.

E. A. Wais, Wais and Associates, Inc.

H. Kosasayama, *Delegate*, JGC Corp.

E. C. Rodabaugh, *Honorary Member*, Consultant



INTRODUCTION

(10)

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 and Addenda issued at least 6 mo 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. Addenda are

issued periodically. 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.

