

ASME B31.3-2012
(Revision of ASME B31.3-2010)

Process Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Copyright © 2013 by the American Society of Mechanical Engineers.
No reproduction may be made of this material without written consent of ASME.



INTENTIONALLY LEFT BLANK



ASME B31.3-2012
(Revision of ASME B31.3-2010)

Process Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Three Park Avenue • New York, NY • 10016 USA

Copyright © 2013 by the American Society of Mechanical Engineers.
No reproduction may be made of this material without written consent of ASME.



Date of Issuance: January 10, 2013

The next edition of this Code is scheduled for publication in 2014. This Code will become effective 6 months after the Date of Issuance.

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.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at <http://cstools.asme.org/>. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

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 © 2013 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.



CONTENTS

Foreword	xiii
Committee Personnel	xiv
Introduction	xviii
Summary of Changes	xx
Chapter I Scope and Definitions	1
300 General Statements	1
Chapter II Design	10
Part 1 Conditions and Criteria	10
301 Design Conditions	10
302 Design Criteria	12
Part 2 Pressure Design of Piping Components	18
303 General	18
304 Pressure Design of Components	20
Part 3 Fluid Service Requirements for Piping Components	30
305 Pipe	30
306 Fittings, Bends, Miters, Laps, and Branch Connections	30
307 Valves and Specialty Components	32
308 Flanges, Blanks, Flange Facings, and Gaskets	32
309 Bolting	33
Part 4 Fluid Service Requirements for Piping Joints	33
310 General	33
311 Welded Joints	33
312 Flanged Joints	34
313 Expanded Joints	34
314 Threaded Joints	34
315 Tubing Joints	35
316 Caulked Joints	35
317 Soldered and Brazed Joints	35
318 Special Joints	35
Part 5 Flexibility and Support	36
319 Piping Flexibility	36
320 Analysis of Sustained Loads	41
321 Piping Support	42
Part 6 Systems	44
322 Specific Piping Systems	44
Chapter III Materials	46
323 General Requirements	46
325 Materials — Miscellaneous	55
Chapter IV Standards for Piping Components	56
326 Dimensions and Ratings of Components	56
Chapter V Fabrication, Assembly, and Erection	59
327 General	59
328 Welding and Brazing	59
330 Preheating	65
331 Heat Treatment	67
332 Bending and Forming	70



333	Brazing and Soldering	71
335	Assembly and Erection	71
Chapter VI	Inspection, Examination, and Testing	73
340	Inspection	73
341	Examination	73
342	Examination Personnel	80
343	Examination Procedures	80
344	Types of Examination	80
345	Testing	82
346	Records	85
Chapter VII	Nonmetallic Piping and Piping Lined With Nonmetals	86
A300	General Statements	86
Part 1	Conditions and Criteria	86
A301	Design Conditions	86
A302	Design Criteria	86
Part 2	Pressure Design of Piping Components	88
A303	General	88
A304	Pressure Design of Piping Components	88
Part 3	Fluid Service Requirements for Piping Components	89
A305	Pipe	89
A306	Fittings, Bends, Miters, Laps, and Branch Connections	89
A307	Valves and Specialty Components	90
A308	Flanges, Blanks, Flange Facings, and Gaskets	90
A309	Bolting	90
Part 4	Fluid Service Requirements for Piping Joints	90
A310	General	90
A311	Bonded Joints in Plastics	90
A312	Flanged Joints	91
A313	Expanded Joints	91
A314	Threaded Joints	91
A315	Tubing Joints	91
A316	Caulked Joints	91
A318	Special Joints	91
Part 5	Flexibility and Support	92
A319	Flexibility of Nonmetallic Piping	92
A321	Piping Support	93
Part 6	Systems	93
A322	Specific Piping Systems	93
Part 7	Materials	94
A323	General Requirements	94
A325	Materials — Miscellaneous	96
Part 8	Standards for Piping Components	96
A326	Dimensions and Ratings of Components	96
Part 9	Fabrication, Assembly, and Erection	99
A327	General	99
A328	Bonding of Plastics	99
A329	Fabrication of Piping Lined With Nonmetals	101
A332	Bending and Forming	103
A334	Joining Nonplastic Piping	103
A335	Assembly and Erection	103
Part 10	Inspection, Examination, and Testing	104
A340	Inspection	104
A341	Examination	104
A342	Examination Personnel	104



A343	Examination Procedures	104
A344	Types of Examination	105
A345	Testing	105
A346	Records	106
Chapter VIII	Piping for Category M Fluid Service	107
M300	General Statements	107
Part 1	Conditions and Criteria	107
M301	Design Conditions	107
M302	Design Criteria	107
Part 2	Pressure Design of Metallic Piping Components	108
M303	General	108
M304	Pressure Design of Metallic Components	108
Part 3	Fluid Service Requirements for Metallic Piping Components	108
M305	Pipe	108
M306	Metallic Fittings, Bends, Miters, Laps, and Branch Connections	108
M307	Metallic Valves and Specialty Components	108
M308	Flanges, Blanks, Flange Facings, and Gaskets	109
M309	Bolting	109
Part 4	Fluid Service Requirements for Metallic Piping Joints	109
M310	Metallic Piping, General	109
M311	Welded Joints in Metallic Piping	109
M312	Flanged Joints in Metallic Piping	109
M313	Expanded Joints in Metallic Piping	109
M314	Threaded Joints in Metallic Piping	109
M315	Tubing Joints in Metallic Piping	109
M316	Caulked Joints	109
M317	Soldered and Brazed Joints	109
M318	Special Joints in Metallic Piping	109
Part 5	Flexibility and Support of Metallic Piping	110
M319	Flexibility of Metallic Piping	110
M321	Piping Support	110
Part 6	Systems	110
M322	Specific Piping Systems	110
Part 7	Metallic Materials	110
M323	General Requirements	110
M325	Materials — Miscellaneous	110
Part 8	Standards for Piping Components	110
M326	Dimensions and Ratings of Components	110
Part 9	Fabrication, Assembly, and Erection of Metallic Piping	111
M327	General	111
M328	Welding of Metals	111
M330	Preheating of Metals	111
M331	Heat Treatment of Metals	111
M332	Bending and Forming of Metals	111
M335	Assembly and Erection of Metallic Piping	111
Part 10	Inspection, Examination, Testing, and Records of Metallic Piping	111
M340	Inspection	111
M341	Examination	111
M342	Examination Personnel	112
M343	Examination Procedures	112
M344	Types of Examination	112
M345	Testing	112
M346	Records	112



Parts 11 Through 20, Corresponding to Chapter VII	112
MA300 General Statements	112
Part 11 Conditions and Criteria	112
MA301 Design Conditions	112
MA302 Design Criteria	112
Part 12 Pressure Design of Nonmetallic Piping Components	112
MA303 General	112
MA304 Pressure Design of Nonmetallic Components	112
Part 13 Fluid Service Requirements for Nonmetallic Piping Components	112
MA305 Pipe	112
MA306 Nonmetallic Fittings, Bends, Miters, Laps, and Branch Connections	112
MA307 Valves and Specialty Components	112
MA308 Flanges, Blanks, Flange Facings, and Gaskets	113
MA309 Bolting	113
Part 14 Fluid Service Requirements for Nonmetallic Piping Joints	113
MA310 General	113
MA311 Bonded Joints	113
MA312 Flanged Joints	113
MA313 Expanded Joints	113
MA314 Threaded Joints	113
MA315 Tubing Joints in Nonmetallic Piping	113
MA316 Caulked Joints	113
MA318 Special Joints	113
Part 15 Flexibility and Support of Nonmetallic Piping	113
MA319 Piping Flexibility	113
MA321 Piping Support	113
Part 16 Nonmetallic and Nonmetallic Lined Systems	113
MA322 Specific Piping Systems	113
Part 17 Nonmetallic Materials	113
MA323 General Requirements	113
Part 18 Standards for Nonmetallic and Nonmetallic Lined Piping Components	113
MA326 Dimensions and Ratings of Components	113
Part 19 Fabrication, Assembly, and Erection of Nonmetallic and Nonmetallic Lined Piping	113
MA327 General	113
MA328 Bonding of Plastics	114
MA329 Fabrication of Piping Lined With Nonmetals	114
MA332 Bending and Forming	114
MA334 Joining Nonplastic Piping	114
MA335 Assembly and Erection	114
Part 20 Inspection, Examination, Testing, and Records of Nonmetallic and Nonmetallic Lined Piping	114
MA340 Inspection	114
MA341 Examination	114
MA342 Examination Personnel	114
MA343 Examination Procedures	114
MA344 Types of Examination	114
MA345 Testing	114
MA346 Records	114
Chapter IX High Pressure Piping	115
K300 General Statements	115
Part 1 Conditions and Criteria	115
K301 Design Conditions	115
K302 Design Criteria	116



Part 2	Pressure Design of Piping Components	118
K303	General	118
K304	Pressure Design of High Pressure Components	118
Part 3	Fluid Service Requirements for Piping Components	122
K305	Pipe	122
K306	Fittings, Bends, and Branch Connections	122
K307	Valves and Specialty Components	122
K308	Flanges, Blanks, Flange Facings, and Gaskets	122
K309	Bolting	123
Part 4	Fluid Service Requirements for Piping Joints	123
K310	General	123
K311	Welded Joints	123
K312	Flanged Joints	123
K313	Expanded Joints	123
K314	Threaded Joints	123
K315	Tubing Joints	124
K316	Caulked Joints	124
K317	Soldered and Brazed Joints	124
K318	Special Joints	124
Part 5	Flexibility and Support	124
K319	Flexibility	124
K321	Piping Support	124
Part 6	Systems	125
K322	Specific Piping Systems	125
Part 7	Materials	125
K323	General Requirements	125
K325	Miscellaneous Materials	130
Part 8	Standards for Piping Components	130
K326	Requirements for Components	130
Part 9	Fabrication, Assembly, and Erection	130
K327	General	130
K328	Welding	130
K330	Preheating	133
K331	Heat Treatment	134
K332	Bending and Forming	134
K333	Brazing and Soldering	135
K335	Assembly and Erection	135
Part 10	Inspection, Examination, and Testing	135
K340	Inspection	135
K341	Examination	135
K342	Examination Personnel	137
K343	Examination Procedures	137
K344	Types of Examination	137
K345	Leak Testing	138
K346	Records	139
Chapter X	High Purity Piping	140
U300	General Statements	140
Part 1	Conditions and Criteria	140
Part 2	Pressure Design of Piping Components	140
Part 3	Fluid Service Requirements for Piping Components	140
U308	Flanges, Blanks, Flange Facings, and Gaskets	140
Part 4	Fluid Service Requirements for Piping Joints	140
U311	Welded Joints	140
U314	Threaded Joints	141
U315	Tubing Joints	141



Part 5	Flexibility and Support	141
Part 6	Systems	141
Part 7	Metallic Materials	141
Part 8	Standards for Piping Components	141
Part 9	Fabrication, Assembly, and Erection	141
U327	General	141
U328	Welding	142
U330	Preheating	142
U331	Heat Treatment	142
U332	Bending and Forming	142
U333	Brazing and Soldering	142
U335	Assembly and Erection	142
Part 10	Inspection, Examination, and Testing	142
U340	Inspection	142
U341	Examination	142
U342	Examination Personnel	142
U343	Examination Procedures	142
U344	Types of Examination	144
U345	Testing	144
U346	Records	144
Part 11	High Purity Piping in Category M Fluid Service	144
UM300	General Statements	144
UM307	Metallic Valves and Specialty Components	145
UM322	Specific Piping Systems	145
UM328	Welding of Materials	145
UM335	Assembly and Erection of Metallic Piping	145
UM341	Examination	145
UM345	Testing	145
Figures		
300.1.1	Diagram Illustrating Application of B31.3 Piping at Equipment	3
302.3.5	Stress Range Factor, f	17
304.2.1	Nomenclature for Pipe Bends	21
304.2.3	Nomenclature for Miter Bends	21
304.3.3	Branch Connection Nomenclature	23
304.3.4	Extruded Outlet Header Nomenclature	25
304.5.3	Blanks	29
319.4.4A	Moments in Bends	40
319.4.4B	Moments in Branch Connections	40
323.2.2A	Minimum Temperatures Without Impact Testing for Carbon Steel Materials	49
323.2.2B	Reduction in Minimum Design Metal Temperature Without Impact Testing	51
328.3.2	Typical Backing Rings and Consumable Inserts	61
328.4.2	Typical Butt Weld End Preparation	61
328.4.3	Trimming and Permitted Misalignment	61
328.4.4	Preparation for Branch Connections	62
328.5.2A	Fillet Weld Size	63
328.5.2B	Typical Details for Double-Welded Slip-On and Socket Welding Flange Attachment Welds	63
328.5.2C	Minimum Welding Dimensions for Socket Welding Components Other Than Flanges	63
328.5.4A	Typical Welded Branch Connections	64
328.5.4B	Typical Welded Branch Connections	64
328.5.4C	Typical Welded Branch Connections	64
328.5.4D	Acceptable Details for Branch Attachment Welds	64



328.5.4E	Acceptable Details for Branch Attachment Suitable for 100% Radiography	64
328.5.5	Typical Fabricated Laps	65
335.3.3	Typical Threaded Joints Using Straight Threads	72
341.3.2	Typical Weld Imperfections	78
A328.5	Typical Plastic Piping Joints	102
K323.3.3	Example of an Acceptable Impact Test Specimen	128
K328.4.3	Pipe Bored for Alignment: Trimming and Permitted Misalignment	133
K328.5.4	Some Acceptable Welded Branch Connections Suitable for 100% Radiography	133
U304.5.3	Blanks	141
U335.7.1	Face Seal Joints	143
U335.8	Hygienic Clamp	143
Tables		
300.4	Status of Appendices in B31.3	9
302.3.3C	Increased Casting Quality Factors, E_c	15
302.3.3D	Acceptance Levels for Castings	15
302.3.4	Longitudinal Weld Joint Quality Factor, E_j	16
302.3.5	Weld Joint Strength Reduction Factor, W	19
304.1.1	Values of Coefficient Y for $t < D/6$	20
304.4.1	BPV Code References for Closures	27
308.2.1	Permissible Sizes/Rating Classes for Slip-On Flanges Used as Lapped Flanges	32
314.2.1	Minimum Thickness of External Threaded Components	35
323.2.2	Requirements for Low Temperature Toughness Tests for Metals	47
323.2.2A	Tabular Values for Minimum Temperatures Without Impact Testing for Carbon Steel Materials	50
323.3.1	Impact Testing Requirements for Metals	52
323.3.4	Charpy Impact Test Temperature Reduction	53
323.3.5	Minimum Required Charpy V-Notch Impact Values	54
326.1	Component Standards	57
330.1.1	Preheat Temperatures	66
331.1.1	Requirements for Heat Treatment	68
341.3.2	Acceptance Criteria for Welds and Examination Methods for Evaluating Weld Imperfections	75
A323.2.2	Requirements for Low Temperature Toughness Tests for Nonmetals	95
A323.4.2C	Recommended Temperature Limits for Reinforced Thermosetting Resin Pipe	95
A323.4.3	Recommended Temperature Limits for Thermoplastics Used as Linings	96
A326.1	Component Standards	97
A341.3.2	Acceptance Criteria for Bonds	105
K302.3.3D	Acceptable Severity Levels for Steel Castings	118
K305.1.2	Required Ultrasonic or Eddy Current Examination of Pipe and Tubing for Longitudinal Defects	122
K323.3.1	Impact Testing Requirements	127
K323.3.5	Minimum Required Charpy V-Notch Impact Values	129
K326.1	Component Standards	131
K341.3.2	Acceptance Criteria for Welds	136
Appendices		
A	Allowable Stresses and Quality Factors for Metallic Piping and Bolting Materials	147
	Specification Index for Appendix A	148
	Notes for Tables A-1, A-1A, A-1B, A-1M, A-2, and A-2M	151
	Table A-1 Basic Allowable Stresses in Tension for Metals	155
	Iron Castings	155



Carbon Steel	
Pipes and Tubes	156
Pipes (Structural Grade)	160
Plates, Bars, Shapes, and Sheets	160
Plates, Bars, Shapes, and Sheets (Structural)	162
Forgings and Fittings	162
Castings	162
Low and Intermediate Alloy Steel	
Pipes	164
Plates	166
Forgings and Fittings	168
Castings	170
Stainless Steel	
Pipes and Tubes	172
Plates and Sheets	176
Forgings and Fittings	178
Bar	182
Castings	182
Copper and Copper Alloy	
Pipes and Tubes	184
Plates and Sheets	184
Forgings	186
Castings	186
Rod	186
Nickel and Nickel Alloy	
Pipes and Tubes	188
Plates and Sheets	190
Forgings and Fittings	192
Rod and Bar	196
Castings	196
Titanium and Titanium Alloy	
Pipes and Tubes	198
Plates and Sheets	198
Forgings	198
Zirconium and Zirconium Alloy	
Pipes and Tubes	198
Plates and Sheets	198
Forgings and Bar	198
Aluminum Alloy	
Seamless Pipes and Tubes	200
Welded Pipes and Tubes	202
Structural Tubes	202
Plates and Sheets	203
Forgings and Fittings	204
Castings	205
Table A-1M Basic Allowable Stresses in Tension for Metals (Metric)	206
Fe	206
Carbon Steel	208
Low and Intermediate Alloy Steel	228
Stainless Steel	248
Copper and Copper Alloy	276
Nickel and Nickel Alloy	282
Titanium and Titanium Alloy	310
Zirconium and Zirconium Alloy	312
Aluminum Alloy	314
Table A-1A Basic Casting Quality Factors, E_c	332



	Table A-1B Basic Quality Factors for Longitudinal Weld Joints in Pipes, Tubes, and Fittings, E_j	333
	Carbon Steel	333
	Low and Intermediate Alloy Steel	333
	Stainless Steel	334
	Copper and Copper Alloy	334
	Nickel and Nickel Alloy	335
	Titanium and Titanium Alloy	335
	Zirconium and Zirconium Alloy	335
	Aluminum Alloy	335
	Table A-2 Design Stress Values for Bolting Materials	336
	Carbon Steel	336
	Alloy Steel	336
	Stainless Steel	336
	Copper and Copper Alloy	342
	Nickel and Nickel Alloy	342
	Aluminum Alloy	344
	Table A-2M Design Stress Values for Bolting Materials (Metric)	346
B	Stress Tables and Allowable Pressure Tables for Nonmetals	362
C	Physical Properties of Piping Materials	369
D	Flexibility and Stress Intensification Factors	384
E	Reference Standards	388
F	Precautionary Considerations	394
G	Safeguarding	399
H	Sample Calculations for Branch Reinforcement	400
J	Nomenclature	409
K	Allowable Stresses for High Pressure Piping	422
L	Aluminum Alloy Pipe Flanges	436
M	Guide to Classifying Fluid Services	439
N	Application of ASME B31.3 Internationally	441
P	Alternative Rules for Evaluating Stress Range	442
Q	Quality System Program	444
S	Piping System Stress Analysis Examples	445
V	Allowable Variations in Elevated Temperature Service	458
X	Metallic Bellows Expansion Joints	461
Z	Preparation of Technical Inquiries	466
Index	467



FOREWORD

Responding to evident need and at the request of The American Society of Mechanical Engineers, the American Standards Association initiated Project B31 in March 1926, with ASME as sole administrative sponsor. The breadth of the field involved required that membership of the Sectional Committee be drawn from some 40 engineering societies, industries, government bureaus, institutes, and trade associations.

Initial publication in 1935 was as the American Tentative Standard Code for Pressure Piping. Revisions from 1942 through 1955 were published as American Standard Code for Pressure Piping, ASA B31.1. It was then decided to publish as separate documents the various industry Sections, beginning with ASA B31.8-1955, Gas Transmission and Distribution Piping Systems. The first Petroleum Refinery Piping Code Section was designated ASA B31.3-1959. ASA B31.3 revisions were published in 1962 and 1966.

In 1967–1969, the American Standards Association became first the United States of America Standards Institute, then the American National Standards Institute. The Sectional Committee became American National Standards Committee B31 and the Code was renamed the American National Standard Code for Pressure Piping. The next B31.3 revision was designated ANSI B31.3-1973. Addenda were published through 1975.

A draft Code Section for Chemical Plant Piping, prepared by Section Committee B31.6, was ready for approval in 1974. It was decided, rather than have two closely related Code Sections, to merge the Section Committees and develop a joint Code Section, titled Chemical Plant and Petroleum Refinery Piping. The first edition was published as ANSI B31.3-1976.

In this Code, responsibility for piping design was conceptually integrated with that for the overall processing facility, with safeguarding recognized as an effective safety measure. Three categories of Fluid Service were identified, with a separate Chapter for Category M Fluid Service. Coverage for nonmetallic piping was introduced. New concepts were better defined in five Addenda, the fourth of which added Appendix M, a graphic aid to selection of the proper Fluid Service category.

The Standards Committee was reorganized in 1978 as a Committee operating under ASME procedures with ANSI accreditation. It is now the ASME Code for Pressure Piping, B31 Committee. Section committee structure remains essentially unchanged.

The second edition of Chemical Plant and Petroleum Refinery Piping was compiled from the 1976 Edition and its five Addenda, with nonmetal requirements editorially relocated to a separate Chapter. Its new designation was ANSI/ASME B31.3-1980.

Section Committee B31.10 had a draft Code for Cryogenic Piping ready for approval in 1981. Again, it was decided to merge the two Section Committees and develop a more inclusive Code with the same title. The work of consolidation was partially completed in the ANSI/ASME B31.3-1984 Edition.

Significant changes were made in Addenda to the 1984 Edition: integration of cryogenic requirements was completed; a new stand-alone Chapter on high-pressure piping was added; and coverage of fabrication, inspection, testing, and allowable stresses was reorganized. The new Edition was redesignated as ASME/ANSI B31.3-1987 Edition.

Addenda to subsequent Editions, published at three-year intervals, have been primarily to keep the Code up-to-date. New Appendices have been added, however, on requirements for bellows expansion joints, estimating service life, submittal of Inquiries, aluminum flanges, and quality control in the 1990, 1993, 1999, and 2002 Editions, all designated as ASME B31.3.

In a program to clarify the application of all Sections of the Code for Pressure Piping, changes were made in the Introduction and Scope statements of the 1996 Edition, and its title was changed to Process Piping.

Under direction of ASME Codes and Standards management, metric units of measurement are being emphasized. With certain exceptions, SI metric units were listed first in the 1996 Edition and were designated as the standard. Instructions for conversion are given where metric data are not available. U.S. customary units also are given. By agreement, either system may be used.



In this Edition of the Code, SI metric units are given first, with U.S. Customary units in parentheses. Appendices H and X, the table in Appendix K, and Tables C-1, C-3, and C-6 in Appendix C are exceptions. A portion of the allowable design values in Appendix A are given in both SI metric and U.S. Customary units. Except for Appendix A, values in metric units are to be regarded as the standard, unless otherwise agreed between the contracting parties. In Appendix A, the U.S. Customary units are to be regarded as the standard. Instructions are given in those tables for converting tabular data in U.S. Customary units to appropriate SI metric units.

Interpretations, Code Cases, and errata to the B31.3 Code on Process Piping are published on the following ASME web page: <http://cstools.asme.org/csconnect/CommitteePages.cfm?Committee=N10020400>.

ASME B31.3-2012 was approved by the American National Standards Institute on May 9, 2012.



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*
J. E. Meyer, *Vice Chair*
N. Lobo, *Secretary*

STANDARDS COMMITTEE PERSONNEL

R. J. T. Appleby , ExxonMobil Development Co.	N. Lobo , The American Society of Mechanical Engineers
C. Becht IV , Becht Engineering Co.	W. J. Mauro , American Electric Power
A. E. Beyer , Fluor Enterprises	J. E. Meyer , Louis Perry & Associates, Inc.
K. C. Bodenhamer , Enterprise Products Co.	M. L. Nayyar
C. J. Campbell , Air Liquide	R. G. Payne , Alstom Power, Inc.
J. S. Chin , TransCanada Pipeline U.S.	G. R. Petru , EPCO Inc.
D. D. Christian , Victaulic	E. H. Rinaca , Dominion Resources, Inc.
D. L. Coym , Intertek Moody	M. J. Rosenfeld , Kiefner/Applus – RTD
C. J. Melo , <i>Alternate</i> , S&B Engineers and Constructors, Ltd.	R. J. Silvia , Process Engineers & Constructors, Inc.
R. P. Deubler , Fronex Power Systems, LLC	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.	A. Soni , <i>Delegate</i> , Engineers India Ltd.
R. A. Grichuk , Fluor Enterprises, Inc.	L. E. Hayden, Jr. , <i>Ex-Officio Member</i>
R. W. Haupt , Pressure Piping Engineering Associates, Inc.	W. J. Koves , <i>Ex-Officio Member</i> , Pi Engineering Software, Inc.
B. P. Holbrook , Babcock Power, Inc.	A. P. Rangus , <i>Ex-Officio Member</i> , Bechtel
G. A. Jolly , Vogt Valves/Flowsolve Corp.	J. T. Schmitz , <i>Ex-Officio Member</i> , Southwest Gas Corp.
	R. A. Appleton , <i>Contributing Member</i> , Refrigeration Systems Co.

B31.3 PROCESS PIPING SECTION COMMITTEE

J. E. Meyer , <i>Chair</i> , Louis Perry & Associates, Inc.	P. J. Guerrieri, Sr. , Integrated Mechanical Services, Inc.
R. W. Engle , <i>Vice Chair</i> , The Dow Chemical Co.	R. W. Haupt , Pressure Piping Engineering Associates, Inc.
R. Mohamed , <i>Secretary</i> , The American Society of Mechanical Engineers	B. K. Henon , ARC Machines, Inc.
B. L. Agee , General Electric Co.	J. F. Hodgins , Car-Ber Testing Services
C. Becht IV , Becht Engineering Co.	W. J. Koves , Pi Engineering Software, Inc.
R. M. Bojarczuk , ExxonMobil Research & Engineering Co.	R. A. McLeod , Circor Instrumentation Technologies
R. D. Campbell , Bechtel Construction Operations, Inc.	R. J. Medvick , Consultant
D. D. Christian , Victaulic	C. J. Melo , S&B Engineers and Constructors, Ltd.
D. L. Coym , Intertek Moody	V. B. Molina III , Air Products & Chemicals, Inc.
J. A. D'Avanzo , DuPont Engineering	C. A. Moore , Smith Fibercast
C. E. Davila , Crane Energy	A. D. Nalbandian , Thielsch Engineering, Inc.
D. W. Diehl , Intergraph Corp.	K. A. Nisly-Nagele , Archer Daniels Midland Co.
D. R. Edwards , ConocoPhillips	C. D. Pham , SBM Offshore, Inc.
J. P. Ellenberger	J. M. Prawdzik
C. H. Eskridge, Jr. , Jacobs Engineering	D. W. Raho , CCM 2000
D. J. Fetzner , BP Exploration Alaska, Inc.	A. P. Rangus , Bechtel
P. D. Flenner , Flenner Engineering Services	R. K. Reamey , Turner Industries Group, LLC
D. R. Fraser , NASA Ames Research Center	G. C. Reinhardt II , Team Industries, Inc.
D. R. Frikken , Becht Engineering Co.	P. E. Robinson , Parker Hannifin Corp.
O. R. Greulich , NASA	K. S. Shipley , The Equity Engineering Group, Inc.
R. A. Grichuk , Fluor Enterprises, Inc.	C. Y. Shyu , ExxonMobil Development Co.
	R. J. Silvia , Process Engineers & Constructors, Inc.



J. L. Smith, Jacobs Engineering Group
F. W. Tatar, FM Global
Q. N. Truong, Refinery Technology, Inc.
C. T. Widder, Tessengerlo Kerley Services, Inc.
G. E. Woods, GCS Consulting Services, Inc.
C. G. Ziu, Orion Fittings, Inc.

S. Biyuan, *Delegate*, PetroChina Pipeline Co.
F. Zhang, *Delegate*, SINOPEC Engineering Incorporation
G. C. Glover, *Contributing Member*, KBR
J. C. Luf, *Contributing Member*, Jacobs Engineering
J. T. Wier, *Honorary Member*

B31.3 INTERNATIONAL REVIEW GROUP

R. W. Engle, *Chair*, The Dow Chemical Co.
A. Ali, AES Arabia Ltd.
A. T. Balloch, Proteus EPCM Engineers
D. W. Bikker, DuPont de Nemours
G. Evans, BP Exploration
S. LaForge, Total France
J. K. Lambert, Welding Consultant
H. W. Lange, Lisega A.G.

J. Langeland, Agent Kielland
M. S. Mokhtar, SBM Offshore, Inc.
T. J. Naughton, Jacobs Engineering
A. Rokhsativand, Pars Oil & Gas Co.
G. Suresh, Dow Chemical International Private Ltd.
H. Van Leengoed, Jacobs Nederland
S. Wei-Yeow, Shell Sarawak Berhad

B31.3 SUBGROUP ON DESIGN

R. M. Bojarczuk, *Chair*, ExxonMobil Research & Engineering Co.
D. Arnett, Fluor Enterprises Inc.
J. P. Breen, Becht Engineering Co.
S. Butler, Shell Global Solutions
D. W. Diehl, Intergraph Corp.
D. R. Edwards, ConocoPhillips Co.
J. P. Ellenberger
R. W. Haupt, Pressure Piping Engineering Associates, Inc.
D. L. Ianiro, Mainthia Technologies, Inc.
W. J. Koves, Pi Engineering Software, Inc.
E. M. Kvarda, Swagelok

R. A. Leishear, Savannah River National Laboratory
C. Nath, DuPont Engineering
K. A. Nisly-Nagele, Archer Daniels Midland Co.
C. D. Pham, SBM Offshore, Inc.
M. S. Sandacz, UOP LLC
T. C. Scrivner, ExxonMobil
K. S. Shipley, The Equity Engineering Group, Inc.
S. B. Tewell, WFI International, Inc.
B. K. Walker, B&W Y-12 LLC
G. E. Woods, GCS Consulting Services, Inc.
J. C. Luf, *Contributing Member*, Jacobs Engineering

B31.3 SUBGROUP ON EDIT

D. J. Fetzner, *Chair*, BP Exploration Alaska, Inc.
C. Becht IV, Becht Engineering Co.
R. W. Engle, The Dow Chemical Co.

D. R. Frikken, Becht Engineering Co.
J. E. Meyer, Louis Perry & Associates, Inc.

B31.3 SUBGROUP ON FABRICATION, EXAMINATION, AND TESTING

C. H. Eskridge, Jr., *Chair*, Jacobs Engineering
R. D. Campbell, Bechtel Construction Operations, Inc.
K. J. Chizen, Metalogic Inspection Services
D. J. Fetzner, BP Exploration Alaska, Inc.
P. D. Flenner, Flenner Engineering Services
B. Gordon, RMF Nooter
J. F. Hodgins, Car-Ber Testing Services
D. H. Markman, Enerpipe Systems, Inc.
M. W. May, Chevron Energy Technology Co., USA
R. A. McLeod, Circor Instrumentation Technologies

A. D. Nalbandian, Thielsch Engineering, Inc.
R. K. Reamey, Turner Industries Group, LLC
G. C. Reinhardt II, Team Industries, Inc.
L. G. Richardson, Hi-Tech Testing Services, Inc.
R. A. Sierra, R. A. Sierra, LLC
R. J. Silvia, Process Engineers & Constructors, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
J. P. Swezy, Jr., UT-Battelle
S. W. Vail, Bechtel National, Inc.
L. S. Varone, Shaw Group
C. T. Widder, Tessengerlo Kerley Services, Inc.

B31.3 SUBGROUP ON GENERAL REQUIREMENTS

D. D. Christian, *Chair*, Victaulic
D. L. Coym, Intertek Moody
J. A. D'Avanzo, DuPont Engineering
C. E. Davila, Crane Energy

C. J. Melo, S&B Engineers and Constructors, Ltd.
C. Y. Shyu, ExxonMobil Development Co.
K. J. Simko, Victaulic
J. L. Welch, T. D. Williamson, Inc.



B31.3 SUBGROUP ON HIGH PRESSURE PIPING

A. P. Rangus, *Chair*, Bechtel
D. R. Fraser, NASA Ames Research Center
O. R. Greulich, NASA
R. J. Medvick, Consultant
M. H. Nguyen, Lockwood International
F. W. Tatar, FM Global
Q. N. Truong, Refinery Technology, Inc.
W. L. Weeks, Lummus Technology

B31.3 SUBGROUP ON HIGH PURITY SYSTEMS

V. B. Molina III, *Chair*, Air Products & Chemicals, Inc.
G. A. Babuder, Swagelok Co.
D. W. Cobb, ARC Machines, Inc.
P. J. Guerrieri, Sr., Integrated Mechanical Services, Inc.
B. K. Henon, ARC Machines, Inc.
W. M. Huitt, W. M. Huitt Co.
P. E. Robinson, Parker Hannifin Corp.

B31.3 SUBGROUP ON MATERIALS

R. A. Grichuk, *Chair*, Fluor Enterprises, Inc.
B. L. Agee, General Electric Co.
C. Chang, Bechtel National, Inc.
L. K. Hovey, ConocoPhillips
M. Katcher, Haynes International
J. M. Prawdzyk
D. W. Raho, CCM 2000
A. Raza, Pi Engineering, Inc.
J. L. Smith, Jacobs Engineering Group
S. Tang, Swagelok Co.
S. J. Tonkins, BP Exploration Alaska, Inc.
W. Jianyu, *Contributing Member*, SINOPEC Shanghai Engineering Corp.
K. Songlin, *Contributing Member*, SINOPEC Engineering, Inc.

B31.3 SUBGROUP ON NON-METALLIC PIPING

C. A. Moore, *Chair*, Smith Fibercast
M. A. Clark, Nibco, Inc.
J. D. Eisenman, Maverick Applied Science, Inc.
J. B. Immel, Spears Manufacturing Co.
J. M. Kalnins, Crane ChemPharma Flow Solutions — Resistoflex
D. A. McGriff, ISCO Industries, LLC
T. R. McPherson, IPS Corp.
J. R. Paschal, Paschal Engineering & Forensic Consulting, Inc.
J. D. Roach, IPS Corp.
N. J. Rollins, Harrington Industrial Plastics
F. R. Volgstadt, Volgstadt & Associates, Inc.
D. Yanik, Crane Resistoflex
C. G. Ziu, Orion Fittings, Inc.

B31.3 PROCESS PIPING, INDIA INTERNATIONAL WORKING GROUP

R. P. Singh, *Chair*, CB&I Lummus Private Ltd.
A. Kumar, *Vice Chair*, Larsen & Toubro Ltd.
R. Mohamed, *Secretary*, The American Society of Mechanical Engineers
S. Biswas, CH2M Hill
S. Garg, Punj Lloyd Ltd.
R. Goel, Bechtel India Ltd.
P. Govindaraj, Dow Chemical International Private Ltd.
R. Hariharan, L&T Chiyoda
A. Jettley, Bechtel India Private Ltd.
R. K. Mittal, GAIL (India) Ltd.
R. Murugantham, Larsen & Toubro Ltd.
R. Nanda, Engineers India Ltd.
P. Pravin Buddhadeo, Bechtel India Private Ltd.
P. Sanyal, Bechtel India Private Ltd.
C. N. Trivedi, GAIL (India) Ltd.
R. K. Srivastava, *Alternate*, Larsen & Toubro Ltd.

B31 FABRICATION AND EXAMINATION COMMITTEE

A. P. Rangus, *Chair*, Bechtel
F. Huang, *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, Consultant
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.
J. P. Swezy, Jr., UT-Battelle
P. L. Vaughan, ONEOK Partners



B31 MATERIALS TECHNICAL COMMITTEE

- R. A. Grichuk**, *Chair*, Fluor Enterprises, Inc.
N. Lobo, *Secretary*, The American Society of Mechanical Engineers
R. P. Deubler, Fronex Power Systems, LLC
C. H. Eskridge, Jr., Jacobs Engineering
G. A. Jolly, Vogt Valves/Flowserve Corp.
C. J. Melo, S&B Engineers & Constructors, Ltd.
M. L. Nayyar
- M. B. Pickell**, Willbros Engineers, Inc.
D. W. Raho, CCM 2000
R. A. Schmidt, Canadoil
H. R. Simpson, Stantec
J. L. Smith, Jacobs Engineering Group
Z. Djilali, *Contributing Member*, BEREP

B31 MECHANICAL DESIGN TECHNICAL COMMITTEE

- W. J. Koves**, *Chair*, Pi Engineering Software, Inc.
G. A. Antaki, *Vice Chair*, Becht Engineering Co., Inc.
C. E. O'Brien, *Secretary*, The American Society of Mechanical Engineers
D. Arnett, Fluor Enterprises, Inc.
C. Becht IV, Becht Engineering Co.
R. Bethea, Huntington Ingalls Industries — Newport News Shipbuilding
J. P. Breen, Becht Engineering Co.
P. Cakir-Kavcar, Bechtel Corp. — Oil, Gas & Chemicals
N. F. Consumo, Sr., Nuclear Engineer
J. P. Ellenberger
D. J. Fetzner, BP Exploration Alaska, Inc.
J. A. Graziano, Consultant
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
J. F. McCabe, General Dynamics Electric Boat
T. Q. McCawley, TQM Engineering PC
R. J. Medvick, Consultant
J. C. Minichiello, Bechtel National, Inc.
A. W. Paulin, Paulin Resource Group
R. A. Robleto, KBR
M. J. Rosenfeld, Kiefner/Applus — RTD
T. Sato, Japan Power Engineering and Inspection Corp.
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

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, Régie du Bâtiment du Québec
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 Boiler and Pressure Vessel 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. Sturmsma, 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



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 reflect the kinds of piping installations considered during its development, as follows:

- 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 Liquids and Slurries: 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 Transmission and Distribution Piping Systems: piping transporting products that are predominately gas between sources and terminals, including compressor, regulating, and metering stations; 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
- B31.11¹ Slurry Transportation Piping Systems: piping transporting aqueous slurries between facilities, plants, and terminals, and within terminals and 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 B31.3 Process Piping Code Section. Hereafter, in this Introduction and in the text of this Code Section B31.3, 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 Code 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

- 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 chemicals, and wet chemicals
- NFPA 99 Health Care Facilities: medical and laboratory gas systems
- building and plumbing codes, as applicable, for potable hot and cold water, and for sewer and drain systems

¹ Incorporated into B31.4-2012.



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 installation. 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.

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 piping 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

ASME Committee B31 is organized and operates under procedures of The American Society of Mechanical Engineers that 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 years.

Code users will note that paragraphs in the Code are not necessarily numbered consecutively. Such discontinuities result from following a common outline, insofar as practical, 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.

It is intended that this edition of Code Section B31.3 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 mo prior to the original contract date for the first phase of activity covering a piping installation 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 Code revisions without assurance that they are acceptable to the proper authorities in the jurisdiction where the piping is to be installed.

The B31 Committee has established an orderly procedure to consider requests for interpretation and revision of Code requirements. To receive consideration, such request must be in writing and must give full particulars in accordance with Appendix Z.

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.

A Case is the prescribed form of reply 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.

Code Cases remain available for use until annulled by the ASME B31 Standards Committee.

A request for revision of the Code will be placed on the Committee's agenda. Further information or active participation on the part of the proponent may be requested during consideration of a proposed revision.

Materials ordinarily are listed in the stress tables only when sufficient usage in piping within the scope of the Code has been shown. 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. (To develop usage and gain experience, unlisted materials may be used in accordance with para. 323.1.2.)



ASME B31.3-2012 SUMMARY OF CHANGES

Following approval by the B31 Committee and ASME, and after public review, ASME B31.3-2012 was approved by the American National Standards Institute on May 9, 2012.

Changes given below are identified on the pages by a margin note, **(12)**, placed next to the affected area.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xix, xx	Introduction	Ninth-to-last and third-to-last paragraphs revised
1–7	300	(1) Subparagraph (b)(1) revised (2) Subparagraph (d) revised (3) Subparagraph (e) deleted (4) Subparagraph (f) redesignated as (e) and new subparagraph (f) added
	300.2	(1) Definition of <i>autogenous weld</i> added (2) Under <i>fluid service</i> , definitions of <i>Category D Fluid Service</i> , <i>Elevated Temperature Fluid Service</i> , and <i>Normal Fluid Service</i> revised, and all definitions alphabetized (3) Definition of <i>orbital welding</i> revised (4) Under <i>pipe</i> , definition of <i>spiral welded pipe</i> revised (5) Definition of <i>room temperature</i> added
9	Table 300.4	Entry for Appendix N added
10	301.1	Subparagraph (a) revised
12	302.2.2	Revised
13, 14	302.3.2	In subparagraph (d), last paragraph revised
15–20	Table 302.3.3C	General Note revised
	302.3.4	Subparagraph (a) revised
	302.3.5	Subparagraphs (d) and (e) revised
	Table 302.3.4	(1) Entries in fourth column revised (2) Last row revised
	302.5	Paragraph 302.4.1 redesignated as 302.5 and revised
	303	Revised
	Table 302.3.5	(1) General Note (b) and Notes (1), (2), and (9) revised (2) General Note (e) added
22	304.3.2	Subparagraphs (a) and (b) revised
29	304.7.2	First paragraph revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
30	305.2.4	Revised
34	311.2.3	Revised
37	319.2.3	Subparagraph (c) deleted
38, 39	319.3.6	Revised
	319.4.4	Revised
46	323.2	Revised
49	Fig. 323.2.2A	Note (3) revised
56	326.1.2	Cross-reference revised
57, 58	Table 326.1	(1) Under Metallic Fittings, Valves, and Flanges, ASME B16.50 and MSS SP-78 added (2) Under Miscellaneous, MSS SP-73 deleted
59	328	Revised
	328.1	Revised
	328.2	Revised in its entirety
65	330.1	Revised
	330.1.1	Revised
66	Table 330.1.1	Revised in its entirety
67	331.1.1	Subparagraph (e) revised
68, 69	Table 331.1.1	First column head and Note (1) revised
71	333	Revised in its entirety
73	340.4	Subparagraph (b) revised
74	341.3.4	Subparagraph (a) revised
	341.4.1	Subparagraph (b)(1) revised
77	Table 341.3.2	Note (3) revised
79	341.4.4	First paragraph and subparagraph (b)(1) revised
80	344.1.3	Footnote 2 revised
82	345.1	Subparagraphs (c)(1) and (c)(2) revised
84	345.5.1	Revised
	345.7.3	Revised
	345.8	Revised
	345.9.1	Subparagraph (a) revised
91	A314.2.1	Revised
97, 98	Table A326.1	(1) ASTM F2389 added in two places (2) ASTM D2104 deleted
99	A328.2.5	Subparagraphs (a)(1) and (a)(2) revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
117	K302.3.2	Previous footnote 1 deleted and remaining footnotes renumbered
	K302.3.3	In subparagraph (c), cross-reference revised
	K302.3.4	Revised
118	K302.5	Paragraph K302.4.1 redesignated as K302.5 and revised
122	K305.1.1	Revised
	K306.1.1	Revised
126	K323.2	Revised
130	K326	Revised in its entirety
131	K328.2.1	Subparagraph (h) deleted
137	K344.6.2	Revised
139	K346.2	Subparagraphs (d) and (g) revised
142	U328	Revised
	U328.2.1	Subparagraph (h) added
	U341.4.1	Revised in its entirety
144	U344.8.1	First paragraph revised
	U344.8.2	Revised
148–150	Specification Index for Appendix A	ASTM A213, A1010, A1053, and B371 added
151, 152	Notes for Tables A-1, A-1A, A-1B, A-1M, A-2, and A-2M	(1) Title revised (2) General Notes (a) through (c) revised (3) Notes (5) and (35) revised
155	Table A-1	UNS Nos. added
156, 158	Table A-1	Seventh column heading revised and all S-Nos. replaced by P-Nos.
160	Table A-1	(1) Seventh column heading revised and all S-Nos. replaced by P-Nos. (2) Under Carbon Steel, Pipes (Structural Grade), in Material column, A570 replaced by A1011 in six rows
162, 163	Table A-1	(1) Under Plates, Bars, Shapes, and Sheets (Structural), in Spec. No. column, A570 replaced by A1011 in six rows (2) Under Castings, A352 Grade LCC added
164, 166, 168, 170	Table A-1	Under Low and Intermediate Alloy Steel, UNS Nos. added
172, 173	Table A-1	Under Stainless Steel, Pipes and Tubes, A213 Grades TP304L and TP316L added



<i>Page</i>	<i>Location</i>	<i>Change</i>
174, 175	Table A-1	A213 Grade TP316 added
176, 177	Table A-1	(1) A213 Grade TP304 added (2) A1053 Grade 50 added (3) A790 and A789 S32003 added (4) For A789 and A790 S32750, stress value in Min. Temp. to 100°F column revised (5) Under Plates and Sheets, A1010 Grades 40 and 50 added
178, 179	Table A-1	Two A240 S32003 rows added
182, 183	Table A-1	Under Bar, A479 Grades 321, 321H, 347, 347H, and XM-19 added
186, 187	Table A-1	Under new body heading Copper and Copper Alloy, Rod, three B371 C69300 rows added
188, 189	Table A-1	(1) Under Nickel and Nickel Alloy, Pipes and Tubes, for B407 N08811, stress values for 1,550°F through 1,650°F revised (2) B619, B622, and B626 N06030 added
190, 191	Table A-1	(1) For B619 N10276, stress values for 850°F through 1,250°F added (2) For B622 N10276, stress values for 850°F and higher changed to boldface or regular type (3) B626 N10276 added (4) B619, B622, and B626 N06230 added
192, 193	Table A-1	(1) Under Plates and Sheets, B582 N06030 added (2) For B575 N10276, stress values for 850°F and higher changed to boldface or regular type (3) B435 N06230 added
194, 195	Table A-1	(1) Under Forgings and Fittings, B366 and B462 N06030 added (2) For B366 and B564 N10276, stress values for 500°F and higher changed to boldface or regular type (3) B564 and B366 N06230 added
196, 197	Table A-1	(1) Under Rod and Bar, B408 N08810, N08811, and N08800 relocated from pages for Pipes and Tubes (2) B581 N06030 added (3) B574 N10276 added (4) B572 N06230 added



<i>Page</i>	<i>Location</i>	<i>Change</i>
198, 199	Table A-1	(1) Under Titanium and Titanium Alloy, Pipes and Tubes, for B861 and B862 R50250, Notes, Min. Yield Strength, and stress values revised (2) For B861 and B862 R50400, R52400, and R50550, Notes revised
200–205	Table A-1	(1) Sixth column heading revised and all S-Nos. replaced by P-Nos. (2) UNS Nos. added (3) Under Aluminum Alloy, stress values revised (4) Under Plates and Sheets, for last B209 A95456, Temper revised (5) Under Forgings and Fittings, for three B247 A95083 rows, Min. Tensile Strength revised
206–331	Table A-1M	Added
333	Table A-1B	(1) Under Carbon Steel, for API 5L, second row added (2) For fourth API 5L row, A134, and A139, Description revised (3) For first A381 row, Appendix A Notes revised
336–345	Table A-2	Revised in its entirety
346–361	Table A-2M	Added
363	Specification Index for Appendix B	(1) ASTM D2104 deleted (2) ASTM F2389 added
365, 366	Table B-1	(1) All six ASTM D2104 rows deleted (2) ASTM F2389 added
378	Table C-5	(1) For polyethylene, all previous entries deleted and PE2606 through PE4710 added (2) Polypropylene PP0210B44002 and PP0210G07G11030 added
380, 381	Table C-6	Under Copper and Copper Alloys, second Material entry revised
383	Table C-8	(1) Previous PE entries deleted (2) PE2606 through PE4710 added
387	Table D300	Note (2) revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
388–392	Appendix E	<ul style="list-style-type: none"> (1) ASTM A193, A194, A307, A320, A354, A370, A437, A453, A563, A675, A723, B21, B150, B160, B166, B187, B211, B366, B564, B574, B575, B619, B622, B626, B813, B828, E112, E114, E186, E272, E280, E310, and E446 updated (2) ASTM A213, A1010, A1011, A1053, B32, B371, B572, and F2389 added (3) ASTM A570 and D2104 deleted (4) ASME B16.50 and PCC-2 added (5) API 526, 594, 600, and 609 updated (6) API 570 added (7) All three ASNT standards updated (8) AWS A3.0, A5.11, and A5.22 updated (9) AWS A5.8, A5.31, and QC1 added (10) CDA Copper Tube Handbook deleted (11) CEN/TR 14549 added (12) CGA G-4.1 updated (13) ISO 15649 added (14) MSS SP-73 deleted (15) MSS SP-78 added (16) MSS SP-55 updated (17) PFI ES-48 added (18) In list of organizations, CDA deleted, and CEN and ISO added
398	F345.5	Added
	FA323.4	Revised
	FU315	Added
400–408	Appendix H	Revised in its entirety
409–418	Appendix J	Revised
423	Notes for Appendix K Table	General Note (a), Note (7), and Note (12) revised
424, 426, 428, 430, 432, 434	Table K-1	Third column heading revised and all S-Nos. replaced by P-Nos.
440	Fig. M300	Columns 4 and 5 revised
441	Appendix N	Added
459	V304	Values of W for girth weld corrected by errata to read 0.80 or 0.77 in six places and used to correct values for S_{L1}/W , S_{L2}/W , and S_{L3}/W to read 3.75, 3.90, and 4.81 in equations for S_1 , S_2 , and S_3 , respectively

NOTES:

- (1) The interpretations to ASME B31.3 issued between April 23, 2010 and September 27, 2011 follow the last page of this edition as a separate supplement, Interpretations Volume 23.
- (2) After the interpretations, a separate supplement containing Cases 180, 181, and 185 follows.



INTENTIONALLY LEFT BLANK



PROCESS PIPING

Chapter I

Scope and Definitions

(12) 300 GENERAL STATEMENTS

(a) *Identification.* This Process Piping Code is a Section of the American Society of Mechanical Engineers Code for Pressure Piping, ASME B31, an American National Standard. It is published as a separate document for convenience of Code users.

(b) *Responsibilities*

(1) *Owner.* The owner of a piping installation shall have overall responsibility for compliance with this Code, and for establishing the requirements for design, construction, examination, inspection, and testing that will govern the entire fluid handling or process installation of which the piping is a part. The owner is also responsible for designating piping in Category D, Category M, High Pressure, and High Purity Fluid Services, and for determining if a specific Quality System is to be employed. [See paras. 300(d)(4) through (7) and Appendix Q.]

(2) *Designer.* The designer is responsible to the owner for assurance that the engineering design of piping complies with the requirements of this Code and with any additional requirements established by the owner.

(3) *Manufacturer, Fabricator, and Erector.* The manufacturer, fabricator, and erector of piping are responsible for providing materials, components, and workmanship in compliance with the requirements of this Code and of the engineering design.

(4) *Owner's Inspector.* The owner's Inspector (see para. 340) is responsible to the owner for ensuring that the requirements of this Code for inspection, examination, and testing are met. If a Quality System is specified by the owner to be employed, the owner's Inspector is responsible for verifying that it is implemented.

(c) *Intent of the Code*

(1) It is the intent of this Code to set forth engineering requirements deemed necessary for safe design and construction of piping installations.

(2) This Code is not intended to apply to the operation, examination, inspection, testing, maintenance, or repair of piping that has been placed in service. The provisions of this Code may optionally be applied for

those purposes, although other considerations may also be necessary.

(3) Engineering requirements of this Code, while considered necessary and adequate for safe design, generally employ a simplified approach to the subject. A designer capable of applying a more rigorous analysis shall have the latitude to do so; however, the approach must be documented in the engineering design and its validity accepted by the owner. The approach used shall provide details of design, construction, examination, inspection, and testing for the design conditions of para. 301, with calculations consistent with the design criteria of this Code.

(4) Piping elements should, insofar as practicable, conform to the specifications and standards listed in this Code. Piping elements neither specifically approved nor specifically prohibited by this Code may be used provided they are qualified for use as set forth in applicable Chapters of this Code.

(5) The engineering design shall specify any unusual requirements for a particular service. Where service requirements necessitate measures beyond those required by this Code, such measures shall be specified by the engineering design. Where so specified, the Code requires that they be accomplished.

(6) Compatibility of materials with the service and hazards from instability of contained fluids are not within the scope of this Code. See para. F323.

(d) *Determining Code Requirements*

(1) Code requirements for design and construction include fluid service requirements, which affect selection and application of materials, components, and joints. Fluid service requirements include prohibitions, limitations, and conditions, such as temperature limits or a requirement for safeguarding (see Appendix G). Code requirements for a piping system are the most restrictive of those that apply to any of its elements.

(2) For metallic piping not designated by the owner as Category M, High Pressure, or High Purity Fluid Service (see para. 300.2 and Appendix M), Code requirements are found in Chapters I through VI (the base Code) and fluid service requirements are found in

