

**ASME B31.3-2018**  
(Revision of ASME B31.3-2016)

# Process Piping

**ASME Code for Pressure Piping, B31**

**AN INTERNATIONAL PIPING CODE®**



**The American Society of  
Mechanical Engineers**

**ASME B31.3-2018**  
(Revision of ASME B31.3-2016)

# Process Piping

---

**ASME Code for Pressure Piping, B31**

AN INTERNATIONAL PIPING CODE®



**The American Society of  
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: August 30, 2019

The next edition of this Code is scheduled for publication in 2020. 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 are published on the Committee web page and under <http://go.asme.org/Interpretations>. Periodically certain actions of the ASME B31 Committee may be published as Cases. Cases are published on the ASME website under the B31 Committee page at <http://go.asme.org/B31committee> as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages of the associated codes and standards 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 B31 Committee Page can be found at <http://go.asme.org/B31committee>. The associated B31 Committee Page for each code and standard can be accessed from this main page. 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 international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" an 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, are 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  
Two Park Avenue, New York, NY 10016-5990

Copyright © 2019 by  
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
All rights reserved  
Printed in U.S.A.

# CONTENTS

Foreword .....	xi
Committee Roster .....	vi
Introduction .....	xx
Summary of Changes .....	xxii
<b>Chapter I</b>	
<b>Scope and Definitions</b> .....	1
300 General Statements .....	1
<b>Chapter II</b>	
<b>Design</b> .....	10
<b>Part 1</b>	
<b>Conditions and Criteria</b> .....	10
301 Design Conditions .....	10
302 Design Criteria .....	12
<b>Part 2</b>	
<b>Pressure Design of Piping Components</b> .....	19
303 General .....	19
304 Pressure Design of Components .....	19
<b>Part 3</b>	
<b>Fluid Service Requirements for Piping Components</b> .....	31
305 Pipe .....	31
306 Fittings, Bends, Miters, Laps, and Branch Connections .....	32
307 Valves and Specialty Components .....	33
308 Flanges, Blanks, Flange Facings, and Gaskets .....	33
309 Bolting .....	34
<b>Part 4</b>	
<b>Fluid Service Requirements for Piping Joints</b> .....	35
310 General .....	35
311 Welded Joints .....	35
312 Flanged Joints .....	35
313 Expanded Joints .....	35
314 Threaded Joints .....	36
315 Tubing Joints .....	36
316 Caulked Joints .....	37
317 Soldered and Brazed Joints .....	37
318 Special Joints .....	37
<b>Part 5</b>	
<b>Flexibility and Support</b> .....	37
319 Piping Flexibility .....	37
320 Analysis of Sustained Loads .....	42
321 Piping Support .....	43
<b>Part 6</b>	
<b>Systems</b> .....	45
322 Specific Piping Systems .....	45
<b>Chapter III</b>	
<b>Materials</b> .....	47
323 General Requirements .....	47
325 Materials — Miscellaneous .....	58

<b>Chapter IV</b>	<b>Standards for Piping Components</b> . . . . .	59
326	Dimensions and Ratings of Components . . . . .	59
<b>Chapter V</b>	<b>Fabrication, Assembly, and Erection</b> . . . . .	63
327	General . . . . .	63
328	Welding and Brazing . . . . .	63
330	Preheating . . . . .	71
331	Heat Treatment . . . . .	72
332	Bending and Forming . . . . .	75
333	Brazing and Soldering . . . . .	78
335	Assembly and Erection . . . . .	78
<b>Chapter VI</b>	<b>Inspection, Examination, and Testing</b> . . . . .	81
340	Inspection . . . . .	81
341	Examination . . . . .	81
342	Examination Personnel . . . . .	88
343	Examination Procedures . . . . .	88
344	Types of Examination . . . . .	88
345	Testing . . . . .	90
346	Records . . . . .	94
<b>Chapter VII</b>	<b>Nonmetallic Piping and Piping Lined With Nonmetallic</b> . . . . .	95
A300	General Statements . . . . .	95
<b>Part 1</b>	<b>Conditions and Criteria</b> . . . . .	95
A301	Design Conditions . . . . .	95
A302	Design Criteria . . . . .	95
<b>Part 2</b>	<b>Pressure Design of Piping Components</b> . . . . .	97
A303	General . . . . .	97
A304	Pressure Design of Piping Components . . . . .	97
<b>Part 3</b>	<b>Fluid Service Requirements for Piping Components</b> . . . . .	99
A305	Pipe . . . . .	99
A306	Fittings, Bends, Miters, Laps, and Branch Connections . . . . .	99
A307	Valves and Specialty Components . . . . .	99
A308	Flanges, Blanks, Flange Facings, and Gaskets . . . . .	99
A309	Bolting . . . . .	100
<b>Part 4</b>	<b>Fluid Service Requirements for Piping Joints</b> . . . . .	100
A310	General . . . . .	100
A311	Bonnet Joints in Plastics . . . . .	100
A312	Flanged joints . . . . .	100
A313	Expanded Joints . . . . .	100
A314	Threaded Joints . . . . .	100
A315	Tubing Joints . . . . .	101
A316	Caulked Joints . . . . .	101
A318	Special Joints . . . . .	101
<b>Part 5</b>	<b>Flexibility and Support</b> . . . . .	101
A319	Flexibility of Nonmetallic Piping . . . . .	101
A321	Piping Support . . . . .	103
<b>Part 6</b>	<b>Systems</b> . . . . .	103

A322	Specific Piping Systems .....	103
<b>Part 7</b>	<b>Materials</b> .....	103
A323	General Requirements .....	103
<b>Part 8</b>	<b>Standards for Piping Components</b> .....	104
A326	Dimensions and Ratings of Components .....	104
<b>Part 9</b>	<b>Fabrication, Assembly, and Erection</b> .....	106
A327	General .....	106
A328	Bonding of Plastics .....	106
A329	Fabrication of Piping Lined With Nonmetals .....	111
A332	Bending and Forming .....	112
A334	Joining Nonplastic Piping .....	112
A335	Assembly and Erection .....	112
<b>Part 10</b>	<b>Inspection, Examination, and Testing</b> .....	113
A340	Inspection .....	113
A341	Examination .....	113
A342	Examination Personnel .....	114
A343	Examination Procedures .....	114
A344	Types of Examination .....	114
A345	Testing .....	114
A346	Records .....	115
<b>Chapter VIII</b>	<b>Piping for Category M Fluid Service</b> .....	116
M300	General Statements .....	116
<b>Part 1</b>	<b>Conditions and Criteria</b> .....	116
M301	Design Conditions .....	116
M302	Design Criteria .....	116
<b>Part 2</b>	<b>Pressure Design of Metallic Piping Components</b> .....	116
M303	General .....	116
M304	Pressure Design of Metallic Components .....	116
<b>Part 3</b>	<b>Fluid Service Requirements for Metallic Piping Components</b> .....	116
M305	Pipe .....	116
M306	Metallic Fittings, Bends, Miters, Laps, and Branch Connections .....	117
M307	Metallic Valves and Specialty Components .....	117
M308	Flange, Boloms, Flange Facings, and Gaskets .....	117
M309	Bolting .....	118
<b>Part 4</b>	<b>Fluid Service Requirements for Metallic Piping Joints</b> .....	118
M310	Metallic Piping, General .....	118
M311	Welded Joints in Metallic Piping .....	118
M312	Flanged Joints in Metallic Piping .....	118
M313	Expanded Joints in Metallic Piping .....	118
M314	Threaded Joints in Metallic Piping .....	118
M315	Tubing Joints in Metallic Piping .....	118
M316	Caulked Joints .....	118
M317	Soldered and Brazed Joints .....	118
M318	Special Joints in Metallic Piping .....	118
<b>Part 5</b>	<b>Flexibility and Support of Metallic Piping</b> .....	118

M319	Flexibility of Metallic Piping .....	118
M320	Analysis of Sustained Loads .....	118
M321	Piping Support .....	118
<b>Part 6</b>	<b>Systems</b> .....	<b>119</b>
M322	Specific Piping Systems .....	119
<b>Part 7</b>	<b>Metallic Materials</b> .....	<b>119</b>
M323	General Requirements .....	119
M325	Materials — Miscellaneous .....	119
<b>Part 8</b>	<b>Standards for Piping Components</b> .....	<b>119</b>
M326	Dimensions and Ratings of Components .....	119
<b>Part 9</b>	<b>Fabrication, Assembly, and Erection of Metallic Piping</b> .....	<b>120</b>
M327	General .....	120
M328	Welding of Metals .....	120
M330	Preheating of Metals .....	120
M331	Heat Treatment of Metals .....	120
M332	Bending and Forming of Metals .....	120
M335	Assembly and Erection of Metallic Piping .....	120
<b>Part 10</b>	<b>Inspection, Examination, Testing, and Records of Metallic Piping</b> .....	<b>120</b>
M340	Inspection .....	120
M341	Examination .....	120
M342	Examination Personnel .....	121
M343	Examination Procedures .....	121
M344	Types of Examination .....	121
M345	Testing .....	121
M346	Records .....	121
	<b>Parts 11 Through 20, Correspondence to Chapter VII</b> .....	<b>121</b>
MA300	General Statements .....	121
<b>Part 11</b>	<b>Conditions and Criteria</b> .....	<b>121</b>
MA301	Design Conditions .....	121
MA302	Design Criteria .....	121
<b>Part 12</b>	<b>Pressure Design of Nonmetallic Piping Components</b> .....	<b>121</b>
MA303	General .....	121
MA304	Pressure Design of Nonmetallic Components .....	121
<b>Part 13</b>	<b>Fluid Service Requirements for Nonmetallic Piping Components</b> .....	<b>121</b>
MA305	Pipes .....	121
MA306	Nonmetallic Fittings, Bends, Miters, Laps, and Branch Connections .....	121
MA307	Valves and Specialty Components .....	122
MA308	Flanges, Blanks, Flange Facings, and Gaskets .....	122
MA309	Bolting .....	122
<b>Part 14</b>	<b>Fluid Service Requirements for Nonmetallic Piping Joints</b> .....	<b>122</b>
MA310	General .....	122
MA311	Bonded Joints .....	122
MA312	Flanged Joints .....	122
MA313	Expanded Joints .....	122
MA314	Threaded Joints .....	122

MA315	Tubing Joints in Nonmetallic Piping . . . . .	122
MA316	Caulked Joints . . . . .	122
MA318	Special Joints . . . . .	122
<b>Part 15</b>	<b>Flexibility and Support of Nonmetallic Piping . . . . .</b>	<b>122</b>
MA319	Piping Flexibility . . . . .	122
MA321	Piping Support . . . . .	122
<b>Part 16</b>	<b>Nonmetallic and Nonmetallic-Lined Systems . . . . .</b>	<b>122</b>
MA322	Specific Piping Systems . . . . .	122
<b>Part 17</b>	<b>Nonmetallic Materials . . . . .</b>	<b>122</b>
MA323	General Requirements . . . . .	122
<b>Part 18</b>	<b>Standards for Nonmetallic and Nonmetallic-Lined Piping Components . . . . .</b>	<b>123</b>
MA326	Dimensions and Ratings of Components . . . . .	123
<b>Part 19</b>	<b>Fabrication, Assembly, and Erection of Nonmetallic and Nonmetallic-Lined Piping . . . . .</b>	<b>123</b>
MA327	General . . . . .	123
MA328	Bonding of Plastics . . . . .	123
MA329	Fabrication of Piping Lined With Nonmetals . . . . .	123
MA332	Bending and Forming . . . . .	123
MA334	Joining Nonplastic Piping . . . . .	123
MA335	Assembly and Erection . . . . .	123
<b>Part 20</b>	<b>Inspection, Examination, Testing, and Records of Nonmetallic and Nonmetallic-Lined Piping . . . . .</b>	<b>123</b>
MA340	Inspection . . . . .	123
MA341	Examination . . . . .	123
MA342	Examination Personnel . . . . .	123
MA343	Examination Procedures . . . . .	123
MA344	Types of Examination . . . . .	123
MA345	Testing . . . . .	123
MA346	Records . . . . .	123
<b>Chapter IX</b>	<b>High Pressure Piping . . . . .</b>	<b>124</b>
K300	General Statements . . . . .	124
<b>Part 1</b>	<b>Conditions and Criteria . . . . .</b>	<b>124</b>
K301	Design Conditions . . . . .	124
K302	Design Criteria . . . . .	125
<b>Part 2</b>	<b>Pressure Design of Piping Components . . . . .</b>	<b>127</b>
K303	General . . . . .	127
K304	Pressure Design of High Pressure Components . . . . .	127
<b>Part 3</b>	<b>Fluid Service Requirements for Piping Components . . . . .</b>	<b>131</b>
K305	Pipe . . . . .	131
K306	Fittings, Bends, and Branch Connections . . . . .	131
K307	Valves and Specialty Components . . . . .	132
K308	Flanges, Blanks, Flange Facings, and Gaskets . . . . .	132
K309	Bolting . . . . .	132
<b>Part 4</b>	<b>Fluid Service Requirements for Piping Joints . . . . .</b>	<b>132</b>
K310	General . . . . .	132
K311	Welded Joints . . . . .	132

K312	Flanged Joints . . . . .	133
K313	Expanded Joints . . . . .	133
K314	Threaded Pipe Joints . . . . .	133
K315	Tubing Joints . . . . .	133
K316	Caulked Joints . . . . .	133
K317	Soldered and Brazed Joints . . . . .	133
K318	Special Joints . . . . .	134
<b>Part 5</b>	<b>Flexibility and Support . . . . .</b>	<b>134</b>
K319	Flexibility . . . . .	134
K320	Analysis of Sustained Loads . . . . .	134
K321	Piping Support . . . . .	134
<b>Part 6</b>	<b>Systems . . . . .</b>	<b>134</b>
K322	Specific Piping Systems . . . . .	134
<b>Part 7</b>	<b>Materials . . . . .</b>	<b>135</b>
K323	General Requirements . . . . .	135
K325	Miscellaneous Materials . . . . .	138
<b>Part 8</b>	<b>Standards for Piping Components . . . . .</b>	<b>138</b>
K326	Requirements for Components . . . . .	138
<b>Part 9</b>	<b>Fabrication, Assembly, and Erection . . . . .</b>	<b>139</b>
K327	General . . . . .	139
K328	Welding . . . . .	139
K330	Preheating . . . . .	142
K331	Heat Treatment . . . . .	142
K332	Bending and Forming . . . . .	143
K333	Brazing and Soldering . . . . .	143
K335	Assembly and Erection . . . . .	144
<b>Part 10</b>	<b>Inspection, Examination, and Testing . . . . .</b>	<b>144</b>
K340	Inspection . . . . .	144
K341	Examination . . . . .	144
K342	Examination Personnel . . . . .	146
K343	Examination Procedures . . . . .	146
K344	Types of Examination . . . . .	146
K345	Leak Testing . . . . .	147
K346	Records . . . . .	148
<b>Chapter X</b>	<b>High-Purity Piping . . . . .</b>	<b>149</b>
U300	General statements . . . . .	149
<b>Part 1</b>	<b>Conditions and Criteria . . . . .</b>	<b>149</b>
U301	Design Conditions . . . . .	149
<b>Part 2</b>	<b>Pressure Design of Piping Components . . . . .</b>	<b>149</b>
<b>Part 3</b>	<b>Fluid Service Requirements for Piping Components . . . . .</b>	<b>149</b>
U306	Fittings, Bends, Miters, Laps, and Branch Connections . . . . .	149
U307	Valves and Specialty Components . . . . .	149
U308	Flanges, Blanks, Flange Facings, and Gaskets . . . . .	149
<b>Part 4</b>	<b>Fluid Service Requirements for Piping Joints . . . . .</b>	<b>150</b>
U311	Welded Joints . . . . .	150

U314	Threaded Joints . . . . .	150
U315	Tubing Joints . . . . .	150
<b>Part 5</b>	<b>Flexibility and Support . . . . .</b>	<b>150</b>
U319	Piping Flexibility . . . . .	150
<b>Part 6</b>	<b>Systems . . . . .</b>	<b>150</b>
<b>Part 7</b>	<b>Metallic Materials . . . . .</b>	<b>151</b>
<b>Part 8</b>	<b>Standards for Piping Components . . . . .</b>	<b>151</b>
<b>Part 9</b>	<b>Fabrication, Assembly, and Erection . . . . .</b>	<b>151</b>
U327	General . . . . .	151
U328	Welding . . . . .	151
U330	Preheating . . . . .	151
U331	Heat Treatment . . . . .	151
U332	Bending and Forming . . . . .	151
U333	Brazing and Soldering . . . . .	151
U335	Assembly and Erection . . . . .	151
<b>Part 10</b>	<b>Inspection, Examination, and Testing . . . . .</b>	<b>152</b>
U340	Inspection . . . . .	152
U341	Examination . . . . .	152
U342	Examination Personnel . . . . .	153
U343	Examination Procedures . . . . .	153
U344	Types of Examination . . . . .	153
U345	Testing . . . . .	154
U346	Records . . . . .	154
<b>Part 11</b>	<b>High Purity Piping in Category M Fluid Service . . . . .</b>	<b>154</b>
UM300	General Statements . . . . .	154
UM307	Metallic Valves and Specialty Components . . . . .	154
UM322	Specific Piping Systems . . . . .	155
UM328	Welding of Materials . . . . .	155
UM335	Assembly and Erection of Metallic Piping . . . . .	155
UM341	Examination . . . . .	155
UM345	Testing . . . . .	155
<b>Appendices</b>		
A	Allowable Stresses and Quality Factors for Metallic Piping and Bolting Materials . . . . .	156
B	Stress Tables and Allowable Pressure Tables for Nonmetals . . . . .	382
C	Physical Properties of Piping Materials . . . . .	391
D	Flexibility and Stress Intensification Factors . . . . .	412
E	Reference Standards . . . . .	417
F	Guidance and Precautionary Considerations . . . . .	423
G	Safeguarding . . . . .	429
H	Sample Calculations for Branch Reinforcement . . . . .	431
J	Nomenclature . . . . .	439
K	Allowable Stresses for High Pressure Piping . . . . .	455
L	Aluminum Alloy Pipe Flanges . . . . .	470
M	Guide to Classifying Fluid Services . . . . .	473

N	Application of ASME B31.3 Internationally . . . . .	475
Q	Quality System Program . . . . .	476
R	Use of Alternative Ultrasonic Acceptance Criteria . . . . .	477
S	Piping System Stress Analysis Examples . . . . .	480
V	Allowable Variations in Elevated Temperature Service . . . . .	492
W	High-Cycle Fatigue Assessment of Piping Systems . . . . .	495
X	Metallic Bellows Expansion Joints . . . . .	500
Z	Preparation of Technical Inquiries . . . . .	504

**Figures**

300.1.1	Diagram Illustrating Application of B31.3 Piping at Equipment . . . . .	3
302.3.5	Stress Range Factor, $f$ . . . . .	18
304.2.1	Nomenclature for Pipe Bends . . . . .	22
304.2.3	Nomenclature for Miter Bends . . . . .	22
304.3.3	Branch Connection Nomenclature . . . . .	26
304.3.4	Extruded Outlet Header Nomenclature . . . . .	28
304.5.3	Blanks . . . . .	30
319.4.4A	Moments in Bends . . . . .	41
319.4.4B	Moments in Branch Connections . . . . .	42
323.2.2A	Minimum Temperatures Without Impact Testing for Carbon Steel Materials . . . . .	50
323.2.2B	Reduction in Lowest Exemption Temperature for Steels Without Impact Testing . . . . .	52
328.3.2	Typical Backing Rings and Consumable Inserts . . . . .	65
328.4.2	Typical Butt Weld End Preparation . . . . .	65
328.4.3	Trimming and Permitted Misalignment . . . . .	66
328.4.4	Preparation for Branch Connections . . . . .	67
328.5.2A	Fillet Weld Size . . . . .	67
328.5.2B	Typical Details for Double-Welded Slip-On and Socket Welding Flange Attachment Welds . . . . .	67
328.5.2C	Minimum Welding Dimensions for Socket Welding Components Other Than Flanges . . . . .	68
328.5.4A, B, C	Typical Welded Branch Connections . . . . .	68
328.5.4D	Acceptable Details for Branch Attachment Welds . . . . .	69
328.5.4E	Acceptable Details for Branch Attachment Suitable for 100% Radiography . . . . .	69
328.5.4F	Acceptable Details for Integrally Reinforced Branch Connections . . . . .	70
328.5.5	Typical Fabricated Laps . . . . .	71
335.3.3	Typical Threaded Joints Using Straight Threads . . . . .	79
341.3.2	Typical Weld Imperfections . . . . .	83
A328.5.3	Thermoplastic Solvent Cemented Joint . . . . .	110
A328.5.4	Thermoplastic Heat Fusion Joints . . . . .	110
A328.5.5	Thermoplastic Electrofusion Joints . . . . .	111
A328.5.6	Fully Tapered Thermosetting Adhesive Joint . . . . .	111
A328.5.7	Thermosetting Wrapped Joints . . . . .	111
K323.3.3	Example of an Acceptable Impact Test Specimen . . . . .	138
K328.4.3	Pipe Bored for Alignment: Trimming and Permitted Misalignment . . . . .	141
K328.5.4	Some Acceptable Welded Branch Connections Suitable for 100% Radiography . . . . .	142
U304.5.3	Blanks . . . . .	150

U335.7.1	Face Seal Joints . . . . .	152
U335.8A	Hygienic Clamp Joint Assembly . . . . .	152
U335.8B	Hygienic Clamp Types . . . . .	153
U335.8C	Hygienic Ferrules . . . . .	153
H301	Illustrations for SI Units Examples in Appendix H . . . . .	432
H311	Illustrations for U.S. Customary Units Examples in Appendix H . . . . .	436
M300	Guide to Classifying Fluid Services . . . . .	474
R307	Surface and Subsurface Flaws . . . . .	478
S301.1	Simple Code Compliant Model . . . . .	480
S302.1	Liftoff Model . . . . .	484
S303.1	Moment Reversal Model . . . . .	487
 <b>Tables</b>		
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 . . . . .	16
302.3.4	Longitudinal Weld Joint Quality Factor, $E_j$ . . . . .	17
302.3.5	Weld Joint Strength Reduction Factor, $W$ . . . . .	20
304.1.1	Values of Coefficient $Y$ for $t < D/6$ . . . . .	22
304.4.1	ASME BPVC References for Closures . . . . .	29
308.2.1	Permissible Sizes/Rating Classes for Slip-On Flanges Used as Lapped Flanges . . . . .	33
314.2.1	Minimum Schedule of Components With External Threads . . . . .	36
323.2.2	Requirements for Low Temperature Toughness Tests for Metals . . . . .	48
323.2.2A	Tabular Values for Minimum Temperatures Without Impact Testing for Carbon Steel Materials . . . . .	51
323.2.2B	Tabular Values for Reduction in Lowest Exemption Temperature for Steels Without Impact Testing . . . . .	53
323.3.1	Impact Testing Requirements for Metals . . . . .	55
323.3.4	Charpy Impact Test Temperature Reduction . . . . .	56
323.3.5	Minimum Required Charpy V-Notch Impact Values . . . . .	57
326.1	Component Standards . . . . .	60
330.1.1	Preheat Temperatures . . . . .	72
331.1.1	Postweld Heat Treatment . . . . .	74
331.1.2	Alternate Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels, P-Nos. 1 and 3 . . . . .	75
331.1.3	Exemptions to Mandatory Postweld Heat Treatment . . . . .	76
341.3.2	Acceptance Criteria for Welds — Visual and Radiographic Examination . . . . .	84
	Criterion Value Notes for Table 341.3.2 . . . . .	85
A323.2.2	Requirements for Low Temperature Toughness Tests for Nonmetals . . . . .	105
A323.4.2C	Recommended Temperature Limits for Reinforced Thermosetting Resin Pipe . . . . .	105
A323.4.3	Recommended Temperature Limits for Thermoplastics Used as Linings . . . . .	105
A326.1	Component Standards . . . . .	107
A341.3.2	Acceptance Criteria for Bonds . . . . .	114
K302.3.3D	Acceptable Severity Levels for Steel Castings . . . . .	127
K305.1.2	Required Ultrasonic or Eddy Current Examination of Pipe and Tubing for Longitudinal Defects . . . . .	131

K323.3.1	Impact Testing Requirements . . . . .	137
K323.3.5	Minimum Required Charpy V-Notch Impact Values . . . . .	139
K326.1	Component Standards . . . . .	140
K341.3.2	Acceptance Criteria for Welds . . . . .	144
	Criterion Value Notes for Table K341.3.2 . . . . .	145
	Specification Index for Appendix A . . . . .	157
A-1	Basic Allowable Stresses in Tension for Metals . . . . .	165
A-1M	Basic Allowable Stresses in Tension for Metals (SI Units) . . . . .	240
A-1A	Basic Casting Quality Factors, $E_c$ . . . . .	350
A-1B	Basic Quality Factors for Longitudinal Weld Joints in Pipes and Tubes, $E_f$ . . . . .	351
A-2	Design Stress Values for Bolting Materials . . . . .	356
A-2M	Design Stress Values for Bolting Materials (SI Units) . . . . .	366
	Specification Index for Appendix B . . . . .	383
B-1	Hydrostatic Design Stresses (HDS) and Recommended Temperature Limits for Thermoplastic Pipe . . . . .	384
B-1M	Hydrostatic Design Stresses (HDS) and Recommended Temperature Limits for Thermoplastic Pipe (SI Units) . . . . .	386
B-2	Listed Specifications for Laminated Reinforced Thermosetting Resin Pipe . . . . .	388
B-3	Listed Specifications for Filament Wound and Centrifugally Cast Reinforced Thermosetting Resin and Reinforced Plastic Mortar Pipe . . . . .	388
B-4	Allowable Pressures and Recommended Temperature Limits for Concrete Pipe . . . . .	389
B-5	Allowable Pressures and Recommended Temperature Limits for Borosilicate Glass Pipe . . . . .	389
B-6	Allowable Pressures and Recommended Temperature Limits for PEX-AL-PEX and PE-AL-PE Pipe . . . . .	390
C-1	Thermal Expansion Data . . . . .	392
C-1M	Thermal Expansion Data (SI Units) . . . . .	396
C-5	Thermal Expansion Coefficients, Nonmetals . . . . .	401
C-6	Moduli of Elasticity for Metals . . . . .	403
C-6M	Moduli of Elasticity for Metals (SI Units) . . . . .	407
C-8	Modulus of Elasticity, Nonmetals . . . . .	411
D300	Flexibility Factor, $k$ , and Stress Intensification Factor, $i$ . . . . .	413
	Specification Index for Appendix K . . . . .	456
K-1	Allowable Stresses in Tension for Metals for Chapter IX . . . . .	458
L301.2M	Pressure–Temperature Ratings (SI Units) . . . . .	471
L301.2U	Pressure–Temperature Ratings (U.S. Customary Units) . . . . .	471
L303.2	Aluminum Bolting Materials . . . . .	472
R308.1	Acceptance Criteria for Surface Flaws . . . . .	479
R308.2	Acceptance Criteria for Subsurface Flaws . . . . .	479
S301.1	Temperature/Pressure Combinations . . . . .	481
S301.3.1	Generic Pipe Stress Model Input . . . . .	481
S301.3.2	Element Connectivity, Type, and Lengths . . . . .	482
S301.5.1	Operating Load Case Results: Internal Loads and Deflections . . . . .	482
S301.5.2	Operating Load Case Results: Reaction Loads on Supports and Anchors . . . . .	483
S301.6	Sustained Forces and Stresses [Allowable $S_h = 130$ MPa (18,900 psi)] . . . . .	483
S301.7	Displacement Stress Range [ $S_A = 205$ MPa (29,725 psi)] . . . . .	484

S302.1	Temperature/Pressure Combinations . . . . .	484
S302.3	Generic Pipe Stress Model Input: Component Connectivity, Type, and Lengths . . . . .	485
S302.5.1	Results for Operating Case 1: Reaction Loads on Support and Anchors . . . . .	485
S302.6.2.1	Sustained Load Condition Listing . . . . .	486
S302.6.3.1	Sustained Forces and Stresses for Sustained Condition 3 With Node 50 Support Removed [Allowable $S_h = 124.5$ MPa (18,100 psi): Fails] . . . . .	487
S303.1	Pressure/Temperature Combinations . . . . .	488
S303.3	Generic Pipe Stress Model Input: Component Connectivity, Type, and Lengths . . . . .	488
S303.7.1	Case 1: Displacement Stress Range [Eq. (1a) Allowable $S_A = 248.2$ MPa (36 ksi): Passes] . . . . .	489
S303.7.2	Case 2: Displacement Stress Range [Eq. (1a) Allowable $S_A = 248.2$ MPa (36 ksi): Passes] . . . . .	490
S303.7.3	Load Combination Considering Cases 1 and 2, Total Strain Based: Displacement Stress Range [Eq. (1b) Allowable $S_A = 379.8$ MPa (55.1 ksi): Fails] . . . . .	491
W301-1	Gamma Function Evaluation . . . . .	496
W302.1-1	Fatigue Material Coefficients ( $-3\sigma$ ) . . . . .	497
W302.1-2	Fatigue Material Coefficients ( $-2\sigma$ ) . . . . .	497
W302.1-3	Optional Fatigue Material Coefficients When $N_{ti} > 10^7$ . . . . .	497
W302.2-1	Environmental Fatigue Factors for Carbon Steel Piping, $T \leq 93^\circ\text{C}$ (200°F) . . . . .	498

# FOREWORD

Responding to evident need and at the request of The American Society of Mechanical Engineers (ASME), 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 (ANSI). 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 designated as ASME/ANSI B31.3-1987 Edition.

Addenda to the subsequent five Editions, published at three-year intervals, were primarily used to keep the Code up to date. New Appendices were 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, SI (metric) units of measurement were emphasized. With certain exceptions, SI units were listed first in the 1996 Edition and were designated as the standard. Instructions for conversion were given where SI units data were not available. U.S. Customary units also were given. By agreement, either system may have been used.

Beginning with the 2004 Edition, the publication cycle of ASME B31.3 was changed to biennial. Other changes made in the 2004 Edition included the introduction of the weld joint strength reduction factor,  $W$ , and the additions of Appendix P, Alternative Rules for Evaluating Stress Range, and Appendix S, Piping System Stress Analysis Examples.

Changes that were made to the 2006 and 2008 Editions of ASME B31.3 included the requirement that valves have blowout-proof stems and the addition of a definition for elevated temperature fluid service, respectively. The most significant change that was made to the 2010 Edition of ASME B31.3 was the addition of Chapter X, High Purity

Piping. In the 2012 Edition, Tables A-1M and A-2M were added to Appendix A that give allowable design values in SI units, and Appendix N, Application of ASME B31.3 Internationally, was also added.

For the 2016 Edition, the allowable design values in SI units as shown in Tables A-1M and A-2M were changed from for information only to values that may be used to meet the requirements of the Code.

In this Edition, SI units are given first, with U.S. Customary units in parentheses. Table K-1 in Appendix K is an exception, containing only U.S. Customary units. The allowable design values in Tables A-1 and A-2 are given in U.S. Customary units, and the SI values are given in Tables A-1M and A-2M. Either the U.S. Customary units or the SI units for these allowable design values may be used. Except for Tables A-1, A-1M, A-2, A-2M, C-1, C-1M, C-6, C-6M, and K-1, values in SI units are to be regarded as the standard, unless otherwise agreed between the contracting parties. Instructions are given in Table K-1 for converting tabular data in U.S. Customary units to appropriate SI units.

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

ASME B31.3-2018 was approved by the American National Standards Institute on August 8, 2018.

# 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

**J. E. Meyer**, *Chair*  
**J. W. Frey**, *Vice Chair*  
**A. Maslowski**, *Secretary*

### STANDARDS COMMITTEE PERSONNEL

<b>R. J. T. Appleby</b> , ExxonMobil Pipeline Co.	<b>J. E. Meyer</b> , Louis Perry Group
<b>C. Becht IV</b> , Becht Engineering Co.	<b>T. Monday</b> , Team Industries, Inc.
<b>K. C. Bodenhamer</b> , TRC Pipeline Services	<b>M. L. Nayyar</b> , NICE
<b>R. Bojarczuk</b> , ExxonMobil Research and Engineering Co.	<b>G. R. Petru</b> , Acapella Engineering Services, LLC
<b>M. R. Braz</b> , MRBraz & Associates, PLLC	<b>D. W. Raho</b> , CCM 2000
<b>J. S. Chin</b> , TransCanada Pipeline U.S.	<b>R. Reamey</b> , Turner Industries Group, LLC
<b>D. D. Christian</b> , Victaulic	<b>M. J. Rosenfeld</b> , Kiefner/Applus — RTD
<b>R. P. Deubler</b> , Becht Engineering Co., Inc.	<b>J. T. Schmitz</b> , Southwest Gas Corp.
<b>C. Eskridge, Jr.</b> , Worley ECR	<b>S. K. Sinha</b> , Lucius Pitkin, Inc.
<b>D. J. Fetzner</b> , BP Exploration Alaska, Inc.	<b>W. J. Sperko</b> , Sperko Engineering Services, Inc.
<b>P. D. Flenner</b> , Flenner Engineering Services	<b>J. P. Swezy, Jr.</b> , Boiler Code Tech, LLC
<b>J. W. Frey</b> , Joe W. Frey Engineering Services, LLC	<b>F. W. Tatar</b> , FM Global
<b>D. R. Frikken</b> , Becht Engineering Co.	<b>K. A. Vilminot</b> , Commonwealth Associates, Inc.
<b>R. A. Grichuk</b> , Fluor Enterprises, Inc.	<b>G. Antaki</b> , <i>Ex-Officio Member</i> , Becht Engineering Co., Inc.
<b>R. W. Haupt</b> , Pressure Piping Engineering Associates, Inc.	<b>L. E. Hayden, Jr.</b> , <i>Ex-Officio Member</i>
<b>G. A. Jolly</b> , Samshin Limited	<b>C. Kolovich</b> , <i>Ex-Officio Member</i>
<b>K. Kaplan</b> , Consultant	<b>A. J. Livingston</b> , <i>Ex-Officio Member</i> , Kinder Morgan
<b>A. Maslowski</b> , The American Society of Mechanical Engineers	<b>J. S. Willis</b> , <i>Ex-Officio Member</i> , Page Southerland Page, Inc.
<b>W. J. Mauro</b> , American Electric Power	

### B31.3 PROCESS PIPING SECTION COMMITTEE

<b>D. W. Diehl</b> , <i>Chair</i> , Hexagon PPM	<b>O. R. Greulich</b> , NASA Headquarters
<b>C. Eskridge, Jr.</b> , <i>Vice Chair</i> , Worley ECR	<b>R. A. Grichuk</b> , Fluor Enterprises, Inc.
<b>R. Mohamed</b> , <i>Secretary</i> , The American Society of Mechanical Engineers	<b>P. J. Guerrieri, Sr.</b> , Integrated Mechanical Services, Inc.
<b>B. L. Agee</b> , GE Energy	<b>R. W. Haupt</b> , Pressure Piping Engineering Associates, Inc.
<b>D. Arnett</b> , Fluor	<b>B. K. Henon</b> , Arc Machines, Inc., Retired
<b>C. Becht IV</b> , Becht Engineering Co.	<b>J. F. Hodgins</b> , Car-Ber Testing Services
<b>R. M. Bojarczuk</b> , ExxonMobil Research and Engineering Co.	<b>W. M. Huitt</b> , W. M. Huitt Co.
<b>B. T. Bounds</b> , Bechtel Corp.	<b>D. L. Ianiro</b> , Mainthia Technologies, Inc.
<b>R. D. Campbell</b> , Bechtel	<b>R. A. Leishear</b> , Leishear Engineering, LLC
<b>D. D. Christian</b> , Victaulic	<b>C. J. Melo</b> , Technip FMC
<b>S. S. Cimorelli</b> , DuPont Advanced Printing	<b>J. E. Meyer</b> , Louis Perry Group
<b>J. A. D'Avanzo</b> , Fluoroseal Valves	<b>V. B. Molina III</b> , Air Products & Chemicals, Inc.
<b>C. E. Davila</b> , Crane Energy	<b>C. A. Moore</b> , NOV Fiberglass Systems
<b>J. Davio</b> , EllisDon Industrial	<b>A. D. Nalbandian</b> , Thielsch Engineering, Inc.
<b>D. R. Edwards</b>	<b>M. Nguyen</b> , S&B Engineers and Constructors, LTD
<b>J. P. Ellenberger</b>	<b>K. A. Nisly-Nagele</b> , Archer Daniels Midland Co.
<b>R. W. Engle</b> , IHI E&C International Corp.	<b>D. W. Raho</b> , CCM 2000
<b>D. J. Fetzner</b> , BP Exploration Alaska, Inc.	<b>R. K. Reamey</b> , Turner Industries Group, LLC
<b>P. D. Flenner</b> , Flenner Engineering Services	<b>G. C. Reinhardt II</b> , Team Industries, Inc.
<b>D. R. Fraser</b> , NASA Ames Research Center	<b>K. S. Shipley</b> , The Equity Engineering Group, Inc.
<b>D. R. Frikken</b> , Becht Engineering Co.	<b>C. Y. Shyu</b> , Atkins
<b>B. S. Gordon</b> , Under Pressure Code Consulting and Training	<b>R. J. Silvia</b> , Process Engineers & Constructors, Inc.
	<b>J. L. Smith</b> , Technical Consultant

J. P. Swezy, Jr., Boiler Code Tech, LLC  
F. W. Tatar, FM Global  
S. J. Tonkins, BP Americas  
S. Vail, Bechtel National, Inc.  
B. K. Walker, Consolidated Nuclear Security, LLC  
W. L. Weeks, Lummus Technology  
T. D. Wills, Jr., Praxair, Inc.

G. E. Woods, GCS Consulting Services, Inc.  
S. Biyuan, *Delegate*, PetroChina Pipeline Co.  
F. Zhang, *Delegate*, SINOPEC Engineering, Inc.  
D. L. Coym, *Contributing Member*, Intertek Moody  
D. C. Glover, *Contributing Member*, KBR  
R. A. McLeod, *Contributing Member*, General Electric Co.  
Q. N. Truong, *Contributing Member*, Consulting Engineer

### B31.3 INTERNATIONAL REVIEW GROUP

R. W. Engle, *Chair*, IHI E&C International Corp.  
A. Bhattacharya, CB&I UK Ltd.  
P. Burt, Fluor  
A. Esmaeili, Origin Energy  
G. Evans, BP Exploration  
S. B. Feder, Apache Energy Limited  
R. Gopalakrishnan, Samsung Saudi Arabia Co. Ltd.  
P. Govindaraj, Dow Benelux B.V.  
Z. Gu, Technip Norge AS  
M. Guidara, Engineering Procurement & Project Management S.A.

J. M. Hamedi, Euromer Consultants  
J. W. Horn, Sasol  
H. W. Lange, Liseaga AG  
J. Langeland, My Piping AS  
T. J. Naughton, Jacobs Engineering  
A. Rokhsativand, Pars Oil & Gas Co.  
W. Y. Sam, Shell Sarawak Berhad — Deepwater Engineering  
R. Sils, Terra Nimbus Pty Ltd.  
S. V. Merwe, Sasol  
R. Verstegen, Dow Benelux B.V.

### B31.3 SUBGROUP ON DESIGN

K. S. Shipley, *Chair*, The Equity Engineering Group, Inc.  
T. C. Scrivner, *Vice Chair*, Engineering Services Canada, Imperial Oil  
F. A. Abd Dzubir, PETRONAS  
D. Arnett, Fluor  
R. M. Bojarczuk, ExxonMobil Research & Engineering Co.  
C. Chang, Bechtel National, Inc.  
D. W. Diehl, Hexagon PPM  
D. R. Edwards  
R. W. Haupt, Pressure Piping Engineering Associates, Inc.  
J. Haynes, WFI International, Inc.  
D. L. Ianiro, Mainthia Technologies, Inc.  
M. Jaouhari, Bechtel Corp.  
J. M. Krance, Swagelok Co.  
E. M. Kvarda, Swagelok  
R. A. Leishear, Leishear Engineering, LLC

R. Maxwell, L-3 Combat Propulsion Systems  
J. C. Mielcarek, SGT, Inc.  
P. D. Moore, Burns & McDonnell  
K. A. Nisly-Nagele, Archer Daniels Midland Co.  
P. Parker, Monsanto Co.  
S. Stelmar, Expansion Joint Manufacturers Association, Inc.  
M. J. Stewart, AECOM  
B. Swartz, Los Alamos National Laboratory  
B. K. Walker, Consolidated Nuclear Security, LLC  
G. E. Woods, GCS Consulting Services, Inc.  
R. P. S. Bindra, *Contributing Member*, CB&I Lummus Private Ltd.  
J. P. Ellenberger, *Contributing Member*  
S. Krishnamurthy, *Contributing Member*, UOP LLC  
S. LaForge, *Contributing Member*, Total France  
H. W. Lange, *Contributing Member*, Liseaga AG

### B31.3 SUBGROUP ON EDIT

D. J. Fetzner, *Chair*, BP Exploration Alaska, Inc.  
C. Becht IV, Becht Engineering Co.  
R. W. Engle, IHI E&C International Corp.

D. R. Frikken, Becht Engineering Co.  
J. E. Meyer, Louis Perry Group  
R. J. Silvia, Process Engineers & Constructors, Inc.

### B31.3 SUBGROUP ON FABRICATION, EXAMINATION, AND TESTING

R. D. Campbell, *Chair*, Bechtel  
J. Davio, *Vice Chair*, EllisDon Industrial  
C. Larsen, *Vice Chair*, Team Industrial Services  
D. A. Bingham, Los Alamos National Labs  
K. J. Chizen, NDE Level III  
A. C. Collins, Keyline Enterprises LLC  
M. G. Collins, ConocoPhillips  
J. Cosentino, Shell Oil  
T. Dang, Chevron Energy Technology Co.  
M. DeLong, IHI E&C  
C. Eskridge, Jr., Worley ECR  
P. D. Flenner, Flenner Engineering Services  
R. S. Gleave, PCL Industrial Management, Inc.  
B. S. Gordon, Under Pressure Code Consulting and Training  
P. T. Hayes, Advanced OEM Solutions

S. Hilliker, Steven Hilliker Consulting, LLC  
J. F. Hodgins, Car-Ber Testing Services  
J. R. Lindlof, Kiewit Engineering Group, Inc.  
D. H. Markman, Summit Mechanical Services, LLC  
V. B. Molina III, Air Products & Chemicals, Inc.  
A. D. Nalbandian, Thielsch Engineering, Inc.  
A. C. Ramirez, Bechtel  
R. K. Reamey, Turner Industries Group, LLC  
G. C. Reinhardt II, Team Industries, Inc.  
L. G. Richardson, Crossbridge Compliance  
W. J. Sperko, Sperko Engineering Services, Inc.  
J. P. Swezy, Jr., Boiler Code Tech, LLC  
R. Taylor, PBF Energy  
S. W. Vail, Bechtel National, Inc.  
D. A. Williams, Fixed Equipment Hess Corp.

**R. A. McLeod**, *Contributing Member*, General Electric Co.

**A. Rokhsativand**, *Contributing Member*, Pars Oil & Gas Co.

### **B31.3 SUBGROUP ON GENERAL REQUIREMENTS**

**C. J. Melo**, *Chair*, Technip FMC  
**D. D. Christian**, Victaulic  
**J. A. D'Avanzo**, Fluoroseal Valves  
**C. E. Davila**, Crane Energy  
**G. Evans**, BP Exploration  
**K. Landreth**, T. D. Williamson  
**C. Y. Shyu**, Atkins  
**G. B. Trinker**, Victaulic Co.

**T. D. Wills, Jr.**, Praxair, Inc.  
**A. Ali**, *Contributing Member*, Arabian Co. and Sasakura for Water & Power  
**S. S. Cimorelli**, *Contributing Member*, DuPont Advanced Printing  
**D. L. Coym**, *Contributing Member*, Intertek Moody  
**J. Langeland**, *Contributing Member*, My Piping AS  
**P. S. Shriwal**, *Contributing Member*, Shriwal Enterprises

### **B31.3 SUBGROUP ON HIGH PRESSURE PIPING**

**B. Bounds**, *Chair*, Bechtel Corp.  
**D. R. Fraser**, NASA Ames Research Center  
**O. R. Greulich**, NASA Headquarters  
**M. H. Nguyen**, S&B Engineers and Constructors, Ltd.  
**A. P. Rangus**, Bechtel  
**F. W. Tatar**, FM Global

**H. Tiwari**, Technip FMC  
**M. C. Warren**, Xcel Energy  
**W. L. Weeks**, Lummus Technology  
**A. Jettley**, *Contributing Member*, Bechtel India Private Ltd.  
**Q. N. Truong**, *Contributing Member*, Consulting Engineer

### **B31.3 SUBGROUP ON HIGH PURITY SYSTEMS**

**W. M. Huitt**, *Chair*, W. M. Huitt Co.  
**W. F. Daprile**, *Vice Chair*, Eli Lilly & Co.  
**R. Foster**, Hose Master, LLC  
**B. K. Henon**, Arc Machines, Inc., Retired

**R. McGregor**, Titan Research Group  
**N. T. Ulsvik**, Aker Solutions  
**T. J. Naughton**, *Contributing Member*, Jacobs Engineering

### **B31.3 SUBGROUP ON MATERIALS**

**B. L. Agee**, *Chair*, GE Energy  
**S. J. Tonkins**, *Vice Chair*, BP Americas  
**D. E. Brown**, SSP  
**R. A. Grichuk**, Fluor Enterprises, Inc.  
**L. Henderson, Jr.**, Chiyoda International Corp.  
**L. K. Hovey**, Fluor Corp.  
**K. Pham**, Fluor Enterprises, Inc.  
**D. W. Rahoji**, CCM 2000  
**A. Raza**, SFRL Consultants Ltd.  
**M. Sindelar**, Lokring Technology  
**J. L. Smith**, Technical Consultant  
**S. Tang**, Swagelok Co.

**D. K. Verma**, Bechtel Oil, Gas and Chemicals  
**A. Yasemi**, Cenovus Energy, Inc.  
**X. Chen**, *Contributing Member*, SINOPEC Engineering, Inc.  
**R. Goel**, *Contributing Member*, CB&I  
**R. Gopalakrishnan**, *Contributing Member*, Samsung Saudi Arabia Co. Ltd.  
**M. Guidara**, *Contributing Member*, Engineering Procurement & Project Management, S.A.  
**W. Y. Sam**, *Contributing Member*, Shell Sarawak Berhad — Deepwater Engineering  
**J. Wang**, *Contributing Member*, SINOPEC Shanghai Engineering Corp.

### **B31.3 SUBGROUP ON NON-METALLIC PIPING**

**J. M. Kalnins**, *Chair*, Crane ResistoFlex  
**M. McDaniel**, *Vice Chair*, The Dow Chemical Co.  
**C. A. Moore**, *Vice Chair*, NOV Fiberglass Systems  
**J. R. Paschal**, *Vice Chair*, Paschal Engineering & Forensic Consulting, Inc.  
**B. Allen**, Crane ResistoFlex  
**J. Becker**, ISCO Industries

**M. A. Clark**, Nibco, Inc.  
**A. M. Kyu**, Bechtel  
**F. R. Volgstadt**, Volgstadt & Associates, Inc.  
**D. Yanik**, Crane ResistoFlex  
**C. Ziu**, Nupi Americas, Inc.  
**R. Sils**, *Contributing Member*, Terra Nimbus Pty Ltd.

### **B31.3 PROCESS PIPING, INDIA INTERNATIONAL WORKING GROUP**

**R. Goel**, *Chair*, CB&I  
**A. Jettley**, *Vice Chair*, Bechtel India Private Ltd.  
**R. Mohamed**, *Secretary*, The American Society of Mechanical Engineers

**R. P. S. Bindra**, CB&I Lummus Private Ltd.  
**S. Biswas**, Technip Noida  
**R. Jiwani**, Intergraph Corp. India  
**N. Khera**, CB&I India Private Ltd.

**A. Kumar**, Larsen & Toubro Ltd.  
**S. Kumar**, CB&I India  
**A. Meghani**, Petroleum & Natural Gas Regulatory Board  
**S. S. Palkar**, CB&I India Private Ltd.  
**V. Pranjali**, Fluor Daniel India Pvt Ltd.  
**R. S. Gururajan**, Petrofac Engineering Services Private Ltd.

**P. S. Shriwal**, Shriwal Enterprises  
**R. Singh**, CB&I  
**H. Toki**, Bechtel India Private Ltd.  
**D. D. Christian**, *Contributing Member*, Victaulic  
**M. Sharma**, *Contributing Member*, ASME India Private Ltd.

### **B31 FABRICATION AND EXAMINATION COMMITTEE**

**J. P. Swezy, Jr.**, *Chair*, Boiler Code Tech, LLC  
**U. D'Urso**, *Secretary*, The American Society of Mechanical Engineers  
**D. Bingham**, Los Alamos National Labs  
**R. D. Campbell**, Bechtel  
**R. D. Couch**, Electric Power Research Institute  
**R. J. Ferguson**, Metallurgist  
**P. D. Flenner**, Flenner Engineering Services  
**J. Frey**, Joe W. Frey Engineering Services, LLC

**S. Gingrich**, AECOM  
**J. Hainsworth**, WR Metallurgical  
**T. Monday**, Team Industries, Inc.  
**A. D. Nalbandian**, Thielsch Engineering, Inc.  
**R. J. Silvia**, Process Engineers & Constructors, Inc.  
**W. J. Sperko**, Sperko Engineering Services, Inc.  
**K. P. Wu**, Stellar Energy Systems

### **B31 MATERIALS TECHNICAL COMMITTEE**

**R. P. Deubler**, *Chair*, Becht Engineering Co., Inc.  
**C. Eskridge, Jr.**, *Vice Chair*, Worley ECR  
**C. E. O'Brien**, *Secretary*, The American Society of Mechanical Engineers  
**B. T. Bounds**, Bechtel Corp.  
**W. P. Collins**, WPC Sol, LLC  
**R. A. Grichuk**, Fluor Enterprises, Inc.  
**J. Gundlach**, Michigan Seamless Tube and Pipe  
**A. A. Hassan**, Power Generation Engineering and Services Co.

**L. Henderson, Jr.**, Chiyoda International Corp.  
**C. Henley**, Kiewit Engineering Group, Inc.  
**G. A. Jolly**, Samshin Limited  
**C. J. Melo**, Technip FMC  
**M. L. Nayyar**, NICE  
**D. W. Raho**, CCM 2000  
**R. A. Schmidt**, Canadoil  
**Z. Djilali**, *Contributing Member*, Sonatrach  
**J. L. Smith**, *Contributing Member*, Technical Consultant

### **B31 MECHANICAL DESIGN TECHNICAL COMMITTEE**

**J. E. Meyer**, *Chair*, Louis Perry Group  
**U. D'Urso**, *Secretary*, The American Society of Mechanical Engineers  
**J. Wu**, *Secretary*, The American Society of Mechanical Engineers  
**G. A. Antaki**, Becht Engineering Co., Inc.  
**D. Arnett**, Fluor  
**C. Becht IV**, Becht Engineering Co.  
**R. Bethea**, Huntington Ingalls Industries — Newport News Shipbuilding  
**N. F. Consumo, Sr.**  
**J. P. Ellenberger**  
**M. Engelkemier**, Cargill  
**D. J. Fetzner**, BP Exploration Alaska, Inc.  
**D. Fraser**, NASA Ames Research Center  
**J. A. Graziano**, Consultant

**J. D. Hart**, SSD, Inc.  
**R. W. Haupt**, Pressure Piping Engineering Associates, Inc.  
**B. P. Holbrook**  
**R. A. Leishear**, Leishear Engineering, LLC  
**G. D. Mayers**, Alion Science & Technology  
**T. Q. McCawley**, TQM Engineering PC  
**J. C. Minichiello**, Bechtel National, Inc.  
**P. Moore**, Burns & McDonnell  
**A. W. Paulin**, Paulin Resource Group  
**R. A. Robleto**, KBR  
**M. J. Rosenfeld**, Kiefner/Applus — RTD  
**T. Sato**, Japan Power Engineering and Inspection Corp.  
**M. Stewart**, AECOM

# 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; onshore and offshore petroleum and natural gas production facilities; chemical, pharmaceutical, textile, paper, ore processing, semiconductor, and cryogenic plants; food and beverage processing facilities; 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 and Heat Transfer Components: 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
- B31.12 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

The Code specifies engineering requirements deemed necessary for safe design and construction of pressure piping. While safety is the primary consideration, this factor alone will not necessarily govern the final specifications for any piping installation. The Code is not a design handbook. Many decisions that must be made to produce a sound piping installation are not specified in detail within this Code. The Code does not serve as a substitute for sound engineering judgments by the owner and the designer.

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.

This edition of Code Section B31.3 is not retroactive. Normally, agreement is made between contracting parties to use a specific edition, considering requirements of the authority having jurisdiction. When specified as the latest edition and when no edition is specified, the specific edition is the one issued at least 6 months prior to the original contract date for the first design activity.

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 B31.3-2018 SUMMARY OF CHANGES

Following approval by the ASME B31 Committee and ASME, and after public review, ASME B31.3-2018 was approved by the American National Standards Institute on August 8, 2018.

ASME B31.3-2018 includes the following changes identified by a margin note, **(18)**.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xx	Introduction	Revised
1	300	Subparagraphs (b)(1) and (c)(4) revised
2	300.1	Revised
2	300.1.3	Footnote 2 revised
2	300.1.4	Revised
3	300.2	(1) Footnote 3 revised (2) <i>indication, linear; indication, rounded; and stress ratio</i> revised (3) <i>owner, readily accessible (for visual examination), and representative</i> added
9	Table 300.4	Entry for W added
11	301.5	First paragraph deleted
11	301.5.1	Revised
11	301.5.4	Revised
12	302.2.3	Revised in its entirety
12	302.2.4	First paragraph and subpara. (c) revised
14	302.3.2	Revised in its entirety
15	302.3.5	Subparagraphs (c), (e), and (f) revised
18	302.3.6	Subparagraph (a) revised
20	Table 302.3.5	(1) Second column head revised (2) First row added (3) General Note (b) and Notes (2), (3), and (9) revised
29	304.5.1	Subparagraph (b) revised
32	306.3.2	Revised
32	306.3.3	Revised
33	306.4.4	Subparagraph (b) revised
33	306.5.2	Revised
33	Table 308.2.1	General Note revised
34	308.3	Revised
34	308.4	Revised
34	309.2.3	First paragraph revised
35	310	Revised
35	311.1	Revised
35	311.2	Paragraphs 311.2.1, 311.2.2, and 311.2.3 deleted, and subsequent paragraphs redesignated

35	312	First paragraph added
36	Table 314.2.1	Revised in its entirety
36	314.2.1	Subparagraphs (a) and (b) revised
36	315.2	Subparagraph (a) revised
36	315.3	Revised
37	318.2.3	Revised
39	319.3.6	Second paragraph revised
40	319.4.4	Subparagraph (c) revised
43	320.2	Second paragraph revised
45	321.3.2	(1) First paragraph revised (2) Last paragraph and footnote 10 added
47	323.2.2	Revised in its entirety
48	Table 323.2.2	(1) Last two column heads revised (2) Under Type of Material, third entry revised (3) Notes (1), (3), (4), (6), and (7) revised
50	Figure 323.2.2A	Previous Note (6) redesignated as (1) and revised; other Notes renumbered
51	Table 323.2.2A	In seventh group of rows, in fourth row, entries under Nominal Thickness revised
52	Figure 323.2.2B	(1) Fahrenheit values corrected by errata and moved to bottom of illustration (2) General Notes replaced by one General Note
54	323.3.5	Subparagraphs (b) and (c) revised
57	Table 323.3.5	In first column, last entry revised
60	Table 326.1	(1) ASME B18.31.2 added (2) Notes (4) and (5) revised
72	Table 330.1.1	For P-No. 5B, first two entries in third row revised
72	331.1.1	Subparagraph (a) revised
79	335.3.1	Revised
81	340.4	Subparagraph (b)(3) revised
82	341.4.1	Subparagraphs (a)(2) and (a)(3) revised
84	Table 341.3.2	(1) Under Weld Imperfection, fifth entry revised (2) For Criteria F and G, main entry under Measure revised
85	Criterion Value Notes for Table 341.3.2	Note (2) [formerly Note (10)] revised
89	344.2.1	Revised
89	344.2.2	Revised
89	344.5.1	Revised
90	344.6.2	Subparagraph (b) corrected by errata
91	345.2.1	Subparagraph (a) revised
91	345.2.5	Revised
93	345.8	(1) Paragraph 345.8.1 added (2) Existing text moved to new para. 345.8.2 and subpara. (a) revised
95	A302.2.3	Revised
96	A302.3.2	Footnote 1 revised

97	A302.3.4	Subparagraph (a) revised
101	A319.2.1	Revised in its entirety
102	A319.2.2	Subparagraph (a) revised
107	Table A326.1	(1) ASTM F1545 and AWWA C900 revised (2) Note (4) added
114	Table A341.3.2	Revised
119	M323.2	Revised
120	M335.1.1	First cross-reference corrected by errata to read 335.1
124	K300	Subparagraphs (a), (b)(1), and (e) revised
124	K300.1	Revised in its entirety
124	K300.4	Revised
124	K301	(1) First paragraph revised (2) Paragraph K301.1 deleted (3) Paragraph K301.2.1 revised (4) Paragraphs K301.4.2 and K301.7.3 added
125	K302.2.3	Revised in its entirety
125	K302.2.4	Revised
126	K302.3.3	First paragraph revised
127	K302.3.5	Subparagraph (c) revised
127	K302.3.6	Subparagraph (a) revised
128	K304.1.2	(1) Equations (34a), (34b), (34c), and (34d) revised (2) Footnote 3 deleted and subsequent footnotes renumbered
130	K304.7.4	Revised
131	K306.1.1	Revised
133	K314	Revised in its entirety
133	K315	Revised in its entirety
134	K318	Revised
134	K319	Revised
134	K320	Added
135	K323.2	Revised
135	K323.2.1	Revised
136	K323.2.4	Subparagraph (a) revised
139	K326.4	Revised in its entirety
144	Table K341.3.2	Under Type of Imperfection, fifth entry revised
145	Criterion Value Notes for Table K341.3.2	For Symbol C, Measure revised
146	K344.6.3	Subparagraph (b) revised
148	K346.2	Subparagraph (d) revised
151	U328.4	Revised
152	U341.3.2	Revised
157	Specification Index for Appendix A	Revised in its entirety
161	Notes for Tables A-1, A-1M, A-1A, A-1B, A-2, and A-2M	(1) General Note (a) and Notes (6), (30), and (65) revised (2) Note (79) added
165	Table A-1	(1) All Note (2) references deleted

- (2) Under Carbon Steel — Forgings and Fittings, A694 F42, F46, F52, F56, F60, F65, and F70; A707 L1, L2, and L3; and A860 WPHY 42, WPHY 46, WPHY 52, WPHY 60, WPHY 65, and WPHY 70 added
- (3) Under Low and Intermediate Alloy Steel — Pipes, for A671 CFB70 and CFE70, Type/Grade revised
- (4) Under Low and Intermediate Alloy Steel — Plates, for A387 9, P-No. revised
- (5) Under Stainless Steel — Pipes and Tubes, A312 TP321, A312 TP321H, A376 TP321, and A376 TP321H revised
- (6) A270 TP304L and TP316L added
- (7) A358 321 and A409 TP321 revised
- (8) A358 321H added
- (9) A270 TP316 added
- (10) A270 TP304 added
- (11) A789 and A790 S82441 added
- (12) A789 and A790 S32003 revised
- (13) For A928 S32003, Size revised
- (14) A789 and A790 S32760 revised
- (15) Under Stainless Steel — Plates and Sheets, A240 321 and 321H revised
- (16) A240 S82441 added
- (17) For A240 S32003, Size revised
- (18) A240 S32760 revised
- (19) Under Stainless Steel — Forgings and Fittings, A182 F321 and F321H revised
- (20) A403 WP321 and WP321H revised
- (21) Under Stainless Steel — Bar, for A479 304, 304H, 304L, 316, 316H, and 316L, Notes revised
- (22) For A479 321 and 321H, stress value for 650°F and font for stress values revised
- (23) A479 S82441 added
- (24) Under Stainless Steel — Castings, for A351 CF8C, Notes and stress values revised
- (25) Under Nickel and Nickel Alloy — Pipes and Tubes, N08825 B163, B474, and B704 added
- (26) For N08825 B423 and B705, fonts for stress values corrected by errata
- (27) N06690 B163 and B167 added
- (28) N08120 B163, B407, B514, and B515 added
- (29) Under Nickel and Nickel Alloy — Plates and Sheets, for N08825 B424, fonts for stress values corrected by errata
- (30) N06690 B168 added
- (31) N08120 B409 added
- (32) Under Nickel and Nickel Alloy — Forgings and Fittings, for N02200 B366, stress value revised
- (33) N02200 B564 deleted

- (34) For N08825 B366 and B564, fonts for stress values corrected by errata
- (35) N06690 B564 added
- (36) N08120 B366 and B564 added
- (37) Under Nickel and Nickel Alloy — Rod and Bar, for N08825 B425, fonts for stress values corrected by errata
- (38) N06690 B166 added
- (39) N08120 B408 added
- (40) For the titanium and titanium alloys, Product Form and Class/Condition/Temper entries added, and stress values revised
- (41) Under Titanium and Titanium Alloy — Pipes and Tubes, R50250, R50400, R50550, R52400, and R53400 B338 added
- (42) R53400 B861 and B862 added
- (43) Under Titanium and Titanium Alloy — Plates, Sheet, and Strips (formerly Plates and Sheets), for R50250 B265, Specified Min. Yield Strength revised
- (44) R52400 and R53400 B265 added
- (45) Under Titanium and Titanium Alloy — Forgings and Fittings (formerly Forgings), R50250, R50400, R50550, R52400, and R53400 B363 added
- (46) For R50250 B381, Type/Grade and Specified Min. Yield Strength revised
- (47) For R50400 and R50550 B381, Type/Grade revised
- (48) R52400 and R53400 B381 added
- (49) Under Titanium and Titanium Alloy — Bars, R50250, R50400, R50550, R52400, and R53400 B348 added
- (50) Under Titanium and Titanium Alloy — Castings, R52550 and R52700 B367 added
- (51) Under Aluminum Alloy — Seamless Pipes and Tubes, A83003, A91060, A93003, A95083, A95086, A96061, and A96063 B345 deleted
- (52) Under Aluminum Alloy — Castings, for A03560 B26, P-Nos. added
- (1) All Note (2) references deleted
- (2) A694 F42, F46, F52, F56, F60, F65, and F70; A707 L1, L2, and L3; and A860 WPHY 42, WPHY 46, WPHY 52, WPHY 60, WPHY 65, and WPHY 70 added
- (3) For A671 CFB70 and CFE70, Type/Grade revised
- (4) For A387 9, P-No. revised
- (5) A270 TP304L and TP316L added
- (6) A312 TP321, A312 TP321H, A358 321, A376 TP321, A376 TP321H, and A409 TP321 revised
- (7) A358 321H added
- (8) A270 TP304, TP304L, TP316, and TP316L added
- (9) A789 and A790 S82441 added
- (10) A789 and A790 S32003 revised
- (11) For A928 S32003, Size revised
- (12) A789 and A790 S32760 revised

- (13) A358 S34565 revised
- (14) A240 321 and 321H revised
- (15) A240 S82441 added
- (16) For A240 S32003, Size revised
- (17) A240 S32760 revised
- (18) A182 F321 and F321H revised
- (19) A403 WP321 and WP321H revised
- (20) A182 and A815 S32760 revised
- (21) For A479 304, 304H, 304L, 316, 316H, and 316L, Notes revised
- (22) A479 321 and 321H revised
- (23) A479 S82441 added
- (24) A351 CF8C revised
- (25) N08825 B163 added
- (26) For N08825 B423, Notes revised
- (27) N08825 B474 and B704 added
- (28) N08825 B705 revised
- (29) N06690 B163 and B167 added
- (30) N08120 B163, B407, B514, and B515 added
- (31) For N06230 B619, B622, and B626, font for stress values revised
- (32) N06690 B168 added
- (33) N08120 B409 added
- (34) For N06230 B435, font for stress values revised
- (35) N06230 B435 added
- (36) For N02200 B366, stress values revised
- (37) N02200 B564 deleted
- (38) N06690 B564 added
- (39) N08120 B366 and B564 added
- (40) For N06230 B366, font for stress values revised
- (41) N06690 B166 added
- (42) N08120 B408 added
- (43) For N06230 B572, font for stress values revised
- (44) For titanium and titanium alloy materials, Product Form and Class/Condition/Temper entries added; and Min. Tensile Strength, Min. Yield Strength, and stress values revised
- (45) R50250, R50400, R50550, R52400, and R53400 B338 added
- (46) R53400 B861 and B862 added
- (47) R52400 and R53400 B265 added
- (48) R50250, R50400, R50550, R52400, and R53400 B363 and B381 added
- (49) R50250, R50400, R50550, R52400, and R53400 B348 added
- (50) R52550 and R52700 B367 added
- (51) A83003, A91060, A93003, A95083, A95086, A96061, and A96063 B345 deleted
- (52) For A03560 B26, P-Nos. added

350	Table A-1A	B367 added
351	Table A-1B	(1) A105, A181, A350, A182, A487, B160, B164, B564, B247, and B345 deleted (2) A813, A814, B517, and B862 revised (3) A270, B163, B515, B704, and B338 added
356	Table A-2	(1) A325 deleted (2) F3125 A325 added (3) A354 BC and BD lines revised and new BC line added (4) For last B150 HR50, Size Range corrected by errata
366	Table A-2M	(1) For A307 B, Min. Yield Strength deleted by errata (2) A325 deleted (3) F3125 A325 added (4) A354 BC and BD lines revised and new BC line added (5) For last B150 HR50, Size Range corrected by errata
396	Table C-1M	Table C-2 redesignated as Table C-1M
403	Table C-6	Revised in its entirety
407	Table C-6M	Added
413	Table D300	General Note (b) added
417	Appendix E	Revised in its entirety
423	F300.1.4	Added
423	F301	(1) Paragraph F301.5.1 added (2) Paragraph F301.11 deleted
424	F308.4	Revised
425	F312.1	Subparagraph (b) revised
426	F323.2.2	Revised
426	F323.4	Subparagraphs (a) and (c)(4) revised
428	FK300	Added
439	Appendix J	(1) Entry for <i>X</i> deleted by errata (2) Appendix revised
455	Appendix K	ASTM A789, A790, and A815 added to Specification Index
457	Notes for Table K-1	(1) General Note (b) revised (2) Notes (9) and (10) deleted (3) Notes (19) and (20) added
458	Table K-1	(1) Under Carbon Steel — Pipes and Tubes, API 5L lines revised (2) Under Carbon Steel — Forgings and Fittings, for A694 F42 through F70, stress values for highest temperatures deleted (3) For Stainless Steel entries, UNS Nos. added (4) Under Stainless Steel — Pipes and Tubes, A789 and A790 S32750 added (5) Under Stainless Steel — Forgings and Fittings, A182 and A815 S32750 added (6) Titanium and Titanium Alloy entries revised, and entries in columns for 350°C, 450°F, and 550°F added
474	Figure M300	Cross-references in Col. 1 revised
476	Appendix Q	Footnote 1 revised
477	R300	Subparagraph (a) corrected by errata

480	Appendix S	Footnote 1 added
482	S301.6	First paragraph revised
492	V303.1.1	Subparagraph (b) revised
493	V303.1.3	Revised
495	Appendix W	Added
502	X302.2.1	In subparagraph (d), last cross-reference corrected by errata to read Table 331.1.1
502	X302.2.3	Subparagraph (a) revised
504	Appendix Z	Revised in its entirety

NOTES:

- (1) The ASME B31.3 Interpretations Volume will no longer be published with the Code.
- (2) The B31.3 Code Cases will no longer be published with the Code.

INTENTIONALLY LEFT BLANK

# Chapter I

## Scope and Definitions

### (18) 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](#).] Where applicable, the owner shall consider requirements imposed by the authority having jurisdiction regarding the piping installation. The owner may designate a representative to carry out selected responsibilities required by this Code, but the owner retains ultimate responsibility for the actions of the representative.

(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. See

[para. F300.1](#) for examples of standards that may apply in these situations. The provisions of this Code may optionally be applied for those purposes, although other considerations may also be necessary.

(3) The Code generally specifies a simplified approach for many of its requirements. A designer may choose to use a more rigorous analysis to develop design and construction requirements. When the designer decides to take this approach, the designer shall provide to the owner details and calculations demonstrating that design, construction, examination, and testing are consistent with the design criteria of this Code. These details shall be adequate for the owner to verify the validity and shall be approved by the owner. The details shall be documented in the engineering design.

(4) Piping elements shall conform to the specifications and standards listed in this Code or, if not prohibited by this Code, shall be 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

(-a) [Chapter III](#) for materials

(-b) [Chapter II, Part 3](#), for components

(-c) [Chapter II, Part 4](#), for joints