

SECTION VIII

Rules for Construction of Pressure Vessels

2017 ASME Boiler and Pressure Vessel Code
An International Code

Division 1

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AN INTERNATIONAL CODE

2017 ASME Boiler & Pressure Vessel Code

2017 Edition

July 1, 2017

VIII RULES FOR CONSTRUCTION OF PRESSURE VESSELS

Division 1

ASME Boiler and Pressure Vessel Committee
on Pressure Vessels



The American Society of
Mechanical Engineers

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TABLE OF CONTENTS

List of Sections		xxxi
Foreword		xv
Statement of Policy on the Use of the Certification Mark and Code Authorization in Advertising		xvi
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items		xxxvii
Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees		xxxviii
Personnel		xli
Summary of Changes		lx
List of Changes in Record Number Order		lxviii
Cross-Referencing and Stylistic Changes in the Boiler and Pressure Vessel Code		lxxii
Introduction		1
U-1	Scope	1
U-2	General	3
U-3	Standards Referenced by This Division	4
U-4	Units of Measurement	4
U-5	Tolerances	4
Subsection A	General Requirements	7
Part UG	General Requirements for All Methods of Construction and All Materials	7
UG-1	Scope	7
	Materials	7
UG-4	General	7
UG-5	Plate	8
UG-6	Forgings	8
UG-7	Castings	8
UG-8	Pipes and Tubes	8
UG-9	Welding Materials	9
UG-10	Material Identified With or Produced to a Specification Not Permitted by This Division, and Material Not Fully Identified	9
UG-11	Prefabricated or Preformed Pressure Parts Furnished Without a Certification Mark	10
UG-12	Bolts and Studs	12
UG-13	Nuts and Washers	12
UG-14	Rods and Bars	12
UG-15	Product Specification	13
	Design	13
UG-16	General	13
UG-17	Methods of Fabrication in Combination	14
UG-18	Materials in Combination	14
UG-19	Special Constructions	14
UG-20	Design Temperature	14
UG-21	Design Pressure	15
UG-22	Loadings	15
UG-23	Maximum Allowable Stress Values	15
UG-24	Castings	17
UG-25	Corrosion	18
UG-26	Linings	18
UG-27	Thickness of Shells Under Internal Pressure	18
UG-28	Thickness of Shells and Tubes Under External Pressure	19

UG-29	Stiffening Rings for Cylindrical Shells Under External Pressure ..	22
UG-30	Attachment of Stiffening Rings	24
UG-31	Tubes, and Pipe When Used as Tubes or Shells	28
UG-32	Formed Heads, and Sections, Pressure on Concave Side	28
UG-33	Formed Heads, Pressure on Convex Side	29
UG-34	Unstayed Flat Heads and Covers	32
UG-35	Other Types of Closures	36
	Openings and Reinforcements	37
UG-36	Openings in Pressure Vessels	37
UG-37	Reinforcement Required for Openings in Shells and Formed Heads	40
UG-38	Flued Openings in Shells and Formed Heads	43
UG-39	Reinforcement Required for Openings in Flat Heads	43
UG-40	Limits of Reinforcement	46
UG-41	Strength of Reinforcement	46
UG-42	Reinforcement of Multiple Openings	49
UG-43	Methods of Attachment of Pipe and Nozzle Necks to Vessel Walls	49
UG-44	Flanges and Pipe Fittings	53
UG-45	Nozzle Neck Thickness	53
UG-46	Inspection Openings	54
	Braced and Stayed Surfaces	55
UG-47	Braced and Stayed Surfaces	55
UG-48	Staybolts	56
UG-49	Location of Staybolts	56
UG-50	Dimensions of Staybolts	56
	Ligaments	56
UG-53	Ligaments	56
UG-54	Supports	58
UG-55	Lugs for Platforms, Ladders, and Other Attachments to Vessel Walls	58
	Fabrication	58
UG-75	General	58
UG-76	Cutting Planes and Other Stock	59
UG-77	Material Identification (see UG-85)	59
UG-78	Repair of Defects in Materials	59
UG-79	Forming Pressure Parts	59
UG-80	Permissible Out-of-Roundness of Cylindrical, Conical, and Spheri- cal Shells	62
UG-81	Tolerance for Formed Heads	64
UG-82	Lugs and Fitting Attachments	64
UG-83	Holes for Screw Stays	64
UG-84	Charpy Impact Tests	64
UG-85	Heat Treatment	71
	Inspection and Tests	71
UG-90	General	71
UG-91	The Inspector	72
UG-92	Access for Inspector	73
UG-93	Inspection of Materials	73
UG-94	Marking on Materials	74
UG-95	Examination of Surfaces During Fabrication	74
UG-96	Dimensional Check of Component Parts	74
UG-97	Inspection During Fabrication	74
UG-98	Maximum Allowable Working Pressure	74
UG-99	Standard Hydrostatic Test	75
UG-100	Pneumatic Test (see UW-50)	76
UG-101	Proof Tests to Establish Maximum Allowable Working Pressure ..	77

UG-102	Test Gages	82
UG-103	Nondestructive Testing	82
	Marking and Reports	82
UG-115	General	82
UG-116	Required Marking	82
UG-117	Certificates of Authorization and Certification Marks	84
UG-118	Methods of Marking	85
UG-119	Nameplates	86
UG-120	Data Reports	86
	Overpressure Protection	89
UG-125	General	89
UG-126	Pressure Relief Valves	90
UG-127	Nonreclosing Pressure Relief Devices	90
UG-128	Liquid Pressure Relief Valves	92
UG-129	Marking	92
UG-130	Certification Mark	95
UG-131	Certification of Capacity of Pressure Relief Devices	95
UG-132	Certification of Capacity of Pressure Relief Valves in Combination With Nonreclosing Pressure Relief Devices	98
UG-133	Determination of Pressure-Relieving Requirements	99
UG-134	Pressure Settings and Performance Requirements	100
UG-135	Installation	100
UG-136	Minimum Requirements for Pressure Relief Valves	101
UG-137	Minimum Requirements for Relief Disk Devices	105
UG-138	Minimum Requirements for Air Devices	106
UG-140	Overpressure Protection by System Design	108
Subsection B	Requirements Pertaining to Methods of Fabrication of Pressure Vessels	110
Part UW	Requirements for Pressure Vessels Fabricated by Welding ..	110
	General	110
UW-1	Scope	110
UW-2	Service Restrictions	110
UW-3	Welded Joint Category	111
	Materials	112
UW-5	General	112
UW-6	Nonmandatory Guidelines for Welding Material Selections	113
	Design	113
UW-8	General	113
UW-9	Design of Welded Joints	113
UW-10	Postweld Heat Treatment	115
UW-11	Radiographic and Ultrasonic Examination	115
UW-12	Joint Efficiencies	116
UW-13	Attachment Details	116
UW-14	Openings in or Adjacent to Welds	125
UW-15	Welded Connections	127
UW-16	Minimum Requirements for Attachment Welds at Openings	127
UW-17	Plug Welds	136
UW-18	Fillet Welds	137
UW-19	Welded Stayed Construction	137
UW-20	Tube-to-Tubesheet Welds	138
UW-21	ASME B16.5 Socket and Slip-on Flange Welds	141
	Fabrication	141
UW-26	General	141
UW-27	Welding Processes	142
UW-28	Qualification of Welding Procedure	142

UW-29	Tests of Welders and Welding Operators	142
UW-30	Lowest Permissible Temperatures for Welding	143
UW-31	Cutting, Fitting, and Alignment	143
UW-32	Cleaning of Surfaces to Be Welded	143
UW-33	Alignment Tolerance	143
UW-34	Spin-Holes	143
UW-35	Finished Longitudinal and Circumferential Joints	144
UW-36	Fillet Welds	144
UW-37	Miscellaneous Welding Requirements	144
UW-38	Repair of Weld Defects	145
UW-39	Peening	145
UW-40	Procedures for Postweld Heat Treatment	146
UW-41	Sectioning of Welded Joints	147
UW-42	Surface Weld Metal Buildup	147
	Inspection and Tests	148
UW-46	General	148
UW-47	Check of Welding Procedure	148
UW-48	Check of Welder and Welding Operator Qualification	148
UW-49	Check of Postweld Heat Treatment Practice	148
UW-50	Nondestructive Examination of Welds on Pneumatically Tested Vessels	148
UW-51	Radiographic Examination of Welded Joints	148
UW-52	Spot Examination of Welded Joints	149
UW-53	Ultrasonic Examination of Welded Joints	150
UW-54	Qualification of Nondestructive Examination Personnel	150
	Marking and Reports	150
UW-60	General	150
Part UF	Requirements for Pressure Vessels Fabricated by Forging ..	151
	General	151
UF-1	Scope	151
	Materials	151
UF-5	General	151
UF-6	Forgings	151
UF-7	Forge Steel Rolls Used for Corrugating Paper Machinery	151
	Design	151
UF-12	General	151
UF-13	Head Design	152
UF-25	Corrosion Allowance	152
	Fabrication	152
UF-26	General	152
UF-27	Tolerances on Body Forgings	152
UF-28	Methods of Forming Forged Heads	152
UF-29	Tolerance on Forged Heads	152
UF-30	Localized Thin Areas	152
UF-31	Heat Treatment	152
UF-32	Welding for Fabrication	153
UF-37	Repair of Defects in Material	154
UF-38	Repair of Weld Defects	154
UF-39	Attachment of Threaded Nozzles to Integrally Forged Necks and Thickened Heads on Vessels	155
	Inspection and Tests	155
UF-45	General	155
UF-46	Acceptance by Inspector	155
UF-47	Parts Forging	155
UF-52	Check of Heat Treatment and Postweld Heat Treatment	155
UF-53	Test Specimens	155

UF-54	Tests and Retests	155
UF-55	Ultrasonic Examination	155
	Marking and Reports	156
UF-115	General	156
Part UB	Requirements for Pressure Vessels Fabricated by Brazing ..	157
	General	157
UB-1	Scope	157
UB-2	Elevated Temperature	157
UB-3	Service Restrictions	157
	Materials	157
UB-5	General	157
UB-6	Brazing Filler Metals	158
UB-7	Fluxes and Atmospheres	158
	Design	158
UB-9	General	158
UB-10	Strength of Brazed Joints	158
UB-11	Qualification of Brazed Joints for Design Temperatures Up to the Maximum Shown in Column 1 of Table UB-2	158
UB-12	Qualification of Brazed Joints for Design Temperatures in the Range Shown in Column 2 of Table UB-2	158
UB-13	Corrosion	158
UB-14	Joint Efficiency Factors	158
UB-15	Application of Brazing Filler Metal	158
UB-16	Permissible Types of Joints	159
UB-17	Joint Clearance	159
UB-18	Joint Brazing Procedure	160
UB-19	Openings	160
UB-20	Nozzles	160
UB-21	Brazed Connections	160
UB-22	Low Temperature Operation	161
	Fabrication	161
UB-30	General	161
UB-31	Qualification of Brazing Procedure	161
UB-32	Qualification of Brazers and Brazing Operators	161
UB-33	Outgassing	162
UB-34	Cleaning of Surfaces to Be Brazed	162
UB-35	Clearance Between Surfaces to Be Brazed	162
UB-36	Postbrazing Operations	162
UB-37	Repair of Defective Brazing	162
	Inspection and Tests	162
UB-40	General	162
UB-41	Inspection During Fabrication	162
UB-42	Procedure	162
UB-43	Brazer and Brazing Operator	162
UB-44	Visual Examination	163
UB-50	Exemptions	163
	Marking and Reports	163
UB-55	General	163
Subsection C	Requirements Pertaining to Classes of Materials	164
Part UCS	Requirements for Pressure Vessels Constructed of Carbon and Low Alloy Steels	164
	General	164
UCS-1	Scope	164
	Materials	164
UCS-5	General	164

UCS-6	Steel Plates	164
UCS-7	Steel Forgings	165
UCS-8	Steel Castings	165
UCS-9	Steel Pipe and Tubes	165
UCS-10	Bolt Materials	165
UCS-11	Nuts and Washers	165
UCS-12	Bars and Shapes	165
	Design	165
UCS-16	General	165
UCS-19	Welded Joints	166
UCS-23	Maximum Allowable Stress Values	166
UCS-27	Shells Made From Pipe	166
UCS-28	Thickness of Shells Under External Pressure	167
UCS-29	Stiffening Rings for Shells Under External Pressure	167
UCS-30	Attachment of Stiffening Rings to Shell	167
UCS-33	Formed Heads, Pressure on Convex Side	167
UCS-56	Requirements for Postweld Heat Treatment	167
UCS-57	Radiographic Examination	168
	Low Temperature Operation	178
UCS-65	Scope	178
UCS-66	Materials	178
UCS-67	Impact Tests of Welding Procedures	193
UCS-68	Design	194
	Fabrication	194
UCS-75	General	194
UCS-79	Forming Pressure Parts	194
UCS-85	Heat Treatment of Test Specimens	195
	Inspection and Tests	196
UCS-90	General	196
	Marking and Reports	196
UCS-115	General	196
Nonmandatory Appendix UCS-A		197
UCS-A-1	General	197
UCS-A-2	Creep Rupture Properties of Carbon Steels	197
UCS-A-3	Vessels Operating at Temperatures Colder Than the MDMT Stamped on the Nameplate	197
Part UNF	Requirements for Pressure Vessels Constructed of Nonferrous Materials	198
	General	198
UNF-1	Scope	198
UNF-3	Uses	198
UNF-4	Conditions of Service	198
	Materials	198
UNF-5	General	198
UNF-6	Nonferrous Plate	198
UNF-7	Forgings	198
UNF-8	Castings	198
UNF-12	Bolt Materials	198
UNF-13	Nuts and Washers	199
UNF-14	Rods, Bars, and Shapes	199
UNF-15	Other Materials	199
	Design	199
UNF-16	General	199
UNF-19	Welded Joints	199
UNF-23	Maximum Allowable Stress Values	199

UNF-28	Thickness of Shells Under External Pressure	202
UNF-30	Stiffening Rings	202
UNF-33	Formed Heads, Pressure on Convex Side	202
UNF-56	Postweld Heat Treatment	202
UNF-57	Radiographic Examination	203
UNF-58	Liquid Penetrant Examination	203
UNF-65	Low Temperature Operation	203
	Fabrication	203
UNF-75	General	203
UNF-77	Forming Shell Sections and Heads	204
UNF-78	Welding	204
UNF-79	Requirements for Postfabrication Heat Treatment Due to Straining	204
	Inspection and Tests	204
UNF-90	General	204
UNF-91	Requirements for Penetrameter	204
UNF-95	Welding Test Plates	204
	Marking and Reports	204
UNF-115	General	204
Nonmandatory Appendix UNF-A	Characteristics of the Nonferrous Materials	206
UNF-A-1	Purpose	206
UNF-A-2	General	206
UNF-A-3	Properties	206
UNF-A-4	Magnetic Properties	206
UNF-A-5	Elevated Temperature Effects	206
UNF-A-6	Low Temperature Behavior	206
UNF-A-7	Thermal Cutting	206
UNF-A-8	Machining	206
UNF-A-9	Gas Welding	206
UNF-A-10	Metal Arc Welding	207
UNF-A-11	Inert Gas Metal Arc Welding	207
UNF-A-12	Resistance Welding	207
UNF-A-13	Corrosion	207
UNF-A-14	Special Comments	207
Part UHA	Requirements for Pressure Vessels Constructed of High Alloy Steel	208
	General	208
UHA-1	Scope	208
UHA-5	Uses	208
UHA-6	Conditions of Service	208
UHA-8	Material	208
	Materials	208
UHA-11	General	208
UHA-12	Bolt Materials	208
UHA-13	Nuts and Washers	208
	Design	209
UHA-20	General	209
UHA-21	Welded Joints	209
UHA-23	Maximum Allowable Stress Values	209
UHA-28	Thickness of Shells Under External Pressure	209
UHA-29	Stiffening Rings for Shells Under External Pressure	209
UHA-30	Attachment of Stiffening Rings to Shell	209
UHA-31	Formed Heads, Pressure on Convex Side	209
UHA-32	Requirements for Postweld Heat Treatment	209
UHA-33	Radiographic Examination	213

UHA-34	Liquid Penetrant Examination	213
	Fabrication	213
UHA-40	General	213
UHA-42	Weld Metal Composition	213
UHA-44	Requirements for Postfabrication Heat Treatment Due to Straining	214
	Inspection and Tests	215
UHA-50	General	215
UHA-51	Impact Tests	215
UHA-52	Welded Test Plates	219
	Marking and Reports	220
UHA-60	General	220
Nonmandatory Appendix UHA-A	Suggestions on the Selection and Treatment of Austenitic Chromium–Nickel and Ferritic and Martensitic High Chro- mium Steels	221
UHA-A-1	General	221
UHA-A-2	Structure	221
UHA-A-3	Intergranular Corrosion	221
UHA-A-4	Stress Corrosion Cracking	221
UHA-A-5	Sigma Phase Embrittlement	221
UHA-A-6	Heat Treatment of Austenitic Chromium–Nickel Steels	221
UHA-A-7	Dissimilar Weld Metal	221
UHA-A-8	Fabrication	221
UHA-A-9	885°F (475°C) Embrittlement	221
UHA-A-10	Relaxation Cracking	222
Part UCI	Requirements for Pressure Vessels Constructed of Cast Iron	223
	General	223
UCI-1	Scope	223
UCI-2	Service Restrictions	223
UCI-3	Pressure–Temperature Limitations	223
	Materials	223
UCI-5	General	223
UCI-12	Bolt Materials	223
	Design	223
UCI-16	General	223
UCI-23	Maximum Allowable Stress Values	223
UCI-28	Thickness of Shells Under External Pressure	224
UCI-29	Dual Metal Cylinders	224
UCI-32	Heads With Pressure on Concave Side	224
UCI-33	Heads With Pressure on Convex Side	224
UCI-35	Spherically Shaped Covers (Heads)	224
UCI-36	Openings and Reinforcements	224
UCI-37	Corners and Fillets	225
	Fabrication	225
UCI-75	General	225
UCI-78	Repairs in Cast Iron Materials	225
	Inspection and Tests	226
UCI-90	General	226
UCI-99	Standard Hydrostatic Test	226
UCI-101	Hydrostatic Test to Destruction	226
	Marking and Reports	226
UCI-115	General	226

Part UCL	Requirements for Welded Pressure Vessels Constructed of Material With Corrosion Resistant Integral Cladding, Weld Metal Overlay Cladding, or Applied Linings	227
	General	227
UCL-1	Scope	227
UCL-2	Methods of Fabrication	227
UCL-3	Conditions of Service	227
	Materials	227
UCL-10	General	227
UCL-11	Integral and Weld Metal Overlay Clad Material	227
UCL-12	Lining	228
	Design	228
UCL-20	General	228
UCL-23	Maximum Allowable Stress Values	228
UCL-24	Maximum Allowable Working Temperature	229
UCL-25	Corrosion of Cladding or Lining Material	229
UCL-26	Thickness of Shells and Heads Under External Pressure	229
UCL-27	Low Temperature Operations	229
	Fabrication	229
UCL-30	General	229
UCL-31	Joints in Integral or Weld Metal Overlay Cladding and Applied Linings	229
UCL-32	Weld Metal Composition	229
UCL-33	Inserted Strips in Clad Material	229
UCL-34	Postweld Heat Treatment	230
UCL-35	Radiographic Examination	230
UCL-36	Examination of Chromium Stainless Steel Cladding or Lining	230
UCL-40	Welding Procedures	230
UCL-42	Alloy Welds in Base Metal	230
UCL-46	Fillet Welds	230
	Inspection and Tests	231
UCL-50	General	231
UCL-51	Tightness of Applied Lining	231
UCL-52	Hydrostatic Test	231
	Marking and Reports	231
UCL-55	General	231
Part UCD	Requirements for Pressure Vessels Constructed of Cast Ductile Iron	232
	General	232
UCD-1	Scope	232
UCD-2	Service Restrictions	232
UCD-3	Pressure-Temperature Limitations	232
	Materials	232
UCD-5	General	232
UCD-12	Bolt Materials	232
	Design	232
UCD-16	General	232
UCD-23	Maximum Allowable Stress Values	232
UCD-28	Thickness of Shells Under External Pressure	232
UCD-32	Heads With Pressure on Concave Side	233
UCD-33	Heads With Pressure on Convex Side	233
UCD-35	Spherically Shaped Covers (Heads)	233
UCD-36	Openings and Reinforcements	233
UCD-37	Corners and Fillets	233
	Fabrication	233

UCD-75	General	233
UCD-78	Repairs in Cast Ductile Iron Material	233
	Inspection and Tests	234
UCD-90	General	234
UCD-99	Standard Hydrostatic Test	234
UCD-101	Hydrostatic Test to Destruction	235
	Marking and Reports	235
UCD-115	General	235
Part UHT	Requirements for Pressure Vessels Constructed of Ferritic Steels With Tensile Properties Enhanced by Heat Treatment	236
	General	236
UHT-1	Scope	236
	Materials	236
UHT-5	General	236
UHT-6	Test Requirements	236
	Design	237
UHT-16	General	237
UHT-17	Welded Joints	237
UHT-18	Nozzles	238
UHT-19	Conical Sections	238
UHT-20	Joint Alignment	238
UHT-23	Maximum Allowable Stress Values	238
UHT-25	Corrosion Allowance	238
UHT-27	Thickness of Shells Under External Pressure	241
UHT-28	Structural Attachments and Stiffening Rings	241
UHT-29	Stiffening Rings for Shells Under External Pressure	241
UHT-30	Attachment of Stiffening Rings to Shells	241
UHT-32	Formed Heads, Pressure on Concave Side	241
UHT-33	Formed Heads, Pressure on Convex Side	242
UHT-34	Hemispherical Heads	242
UHT-40	Materials Having Different Coefficients of Expansion	242
UHT-56	Postweld Heat Treatment	242
UHT-57	Examination	242
	Fabrication	243
UHT-75	General	243
UHT-79	Forming Pressure Parts	243
UHT-80	Heat Treatment	244
UHT-81	Heat Treatment Verification Tests	244
UHT-82	Welding	244
UHT-83	Methods of Metal Removal	246
UHT-84	Weld Finish	246
UHT-85	Structural and Temporary Welds	246
UHT-86	Marking on Plates and Other Materials	246
	Inspection and Tests	246
UHT-90	General	246
	Marking and Reports	246
UHT-115	General	246
Part ULW	Requirements for Pressure Vessels Fabricated by Layered Construction	247
	Introduction	247
ULW-1	Scope	247
ULW-2	Nomenclature	247
	Material	247
ULW-5	General	247

	Design	247
ULW-16	General	247
ULW-17	Design of Welded Joints	250
ULW-18	Nozzle Attachments and Opening Reinforcement	250
ULW-20	Welded Joint Efficiency	258
ULW-22	Attachments	258
ULW-26	Postweld Heat Treatment	258
	Welding	258
ULW-31	Welded Joints	258
ULW-32	Welding Procedure Qualification	262
ULW-33	Performance Qualification	262
	Nondestructive Examination of Welded Joints	262
ULW-50	General	262
ULW-51	Inner Shells and Inner Heads	262
ULW-52	Layers — Welded Joints	262
ULW-53	Layers — Step Welded Girth Joints	264
ULW-54	Butt Joints	264
ULW-55	Flat Head and Tubesheet Weld Joints	265
ULW-56	Nozzle and Communicating Chambers Weld Joints	265
ULW-57	Random Spot Examination and Repairs of Weld	265
	Fabrication	266
ULW-75	General	266
ULW-76	Vent Holes	266
ULW-77	Contact Between Layers	268
ULW-78	Alternative to Measuring Contact Between Layers During Construction	268
	Inspection and Testing	269
ULW-90	General	269
	Marking and Reports	269
ULW-115	General	269
Part ULT	Alternative Rules for Pressure Vessels Constructed of Materials Having Higher Allowable Stresses at Low Temperature	270
	General	270
ULT-1	Scope	270
ULT-2	Conditions of Service	270
ULT-5	General	270
	Design	271
ULT-16	General	271
ULT-17	Welded Joints	271
ULT-18	Nozzles and Other Connections	271
ULT-23	Maximum Allowable Stress Values	271
ULT-27	Thickness of Shells	271
ULT-28	Thickness of Shells Under External Pressure	271
ULT-29	Stiffening Rings for Shells Under External Pressure	271
ULT-30	Structural Attachments	271
ULT-56	Postweld Heat Treatment	274
ULT-57	Examination	274
	Fabrication	274
ULT-75	General	274
ULT-79	Forming Shell Sections and Heads	274
ULT-82	Welding	274
ULT-86	Marking on Plate and Other Materials	274
	Inspection and Tests	274
ULT-90	General	274
ULT-99	Hydrostatic Test	274

ULT-100	Pneumatic Test	275
	Marking and Reports	276
ULT-115	General	276
	Overpressure Protection	277
ULT-125	General	277
Part UHX	Rules for Shell-and-Tube Heat Exchangers	278
UHX-1	Scope	278
UHX-2	Materials and Methods of Fabrication	278
UHX-3	Terminology	278
UHX-4	Design	278
UHX-8	Tubesheet Effective Bolt Load, W^*	278
UHX-9	Tubesheet Extension	280
UHX-10	General Conditions of Applicability for Tubesheets	281
UHX-11	Tubesheet Characteristics	282
UHX-12	Rules for the Design of U-Tube Tubesheets	288
UHX-13	Rules for the Design of Fixed Tubesheets	294
UHX-14	Rules for the Design of Floating Tubesheets	313
UHX-16	Bellows Expansion Joints	324
UHX-17	Flexible Shell Element Expansion Joints	324
UHX-18	Pressure Test Requirements	325
UHX-19	Heat Exchanger Marking and Reports	325
UHX-20	Examples	327
Part UIG	Requirements for Pressure Vessels Constructed of Impreg-	
	nated Graphite	328
	Nonmandatory Introduction	328
	General	328
UIG-1	Scope	328
UIG-2	Equipment and Service Limitations	328
UIG-3	Terminology	329
	Materials	329
UIG-5	Raw Material Control	329
UIG-6	Certified Material Control	329
UIG-7	Additional Properties	330
UIG-8	Tolerances for Impregnated Graphite Tubes	330
	Design	330
UIG-22	Loadings	330
UIG-23	Maximum Allowable Stress Values for Certified Material	330
UIG-27	Thickness of Cylindrical Shells Made of Certified Materials Under	
	Internal Pressure	330
	External Pressure	331
UIG-28	External Pressure	331
UIG-29	Euler Buckling of Extruded Graphite Tubes	331
UIG-34	Calculating Flat Heads, Covers, and Tubesheets	331
UIG-36	Openings and Reinforcements	333
UIG-45	Nozzle Neck Thickness	333
UIG-60	Lethal Service	333
	Fabrication	338
UIG-75	General Requirements	338
UIG-76	Procedure and Personnel Qualification	339
UIG-77	Certified Material Specification	339
UIG-78	Certified Cement Specification	339
UIG-79	Certified Cementing Procedure Specification	339
UIG-80	Cementing Technician Qualification	340
UIG-81	Repair of Materials	341
UIG-84	Required Tests	341
	Inspection and Tests	344

UIG-90	General	344
UIG-95	Visual Examination	344
UIG-96	Qualification of Visual Examination Personnel	345
UIG-97	Acceptance Standards and Documentation	345
UIG-99	Pressure Tests	346
UIG-112	Quality Control Requirements	346
UIG-115	Markings and Reports	346
UIG-116	Required Markings	346
UIG-120	Data Reports	346
UIG-121	Records	346
Mandatory Appendix 1	Supplementary Design Formulas	359
1-1	Thickness of Cylindrical and Spherical Shells	359
1-2	Cylindrical Shells	359
1-3	Spherical Shells	359
1-4	Formulas for the Design of Formed Heads Under Internal Pressure	360
1-5	Rules for Conical Reducer Sections and Conical Heads Under Internal Pressure	363
1-6	Dished Covers (Bolted Heads)	365
1-7	Large Openings in Cylindrical and Conical Shells	368
1-8	Rules for Reinforcement of Cones and Conical Reducers Under External Pressure	369
Mandatory Appendix 2	Rules for Bolted Flange Connections With Ring Type Gaskets	375
2-1	Scope	375
2-2	Materials	375
2-3	Notation	376
2-4	Circular Flange Types	377
2-5	Bolt Loads	378
2-6	Flange Moments	384
2-7	Calculation of Flange Stresses	386
2-8	Allowable Flange Design Stresses	387
2-9	Split Loose Flanges	388
2-10	Noncircular Shaped Flanges With Circular Bore	388
2-11	Flanges Subject to External Pressures	389
2-12	Flanges With Nut-Stops	389
2-13	Reverse Flanges	393
2-14	Flange Rigidity	395
2-15	Qualification of Assembly Procedures and Assemblers	395
Mandatory Appendix 3	Definitions	397
3-1	Introduction	397
3-2	Definitions of Terms	397
Mandatory Appendix 4	Rounded Indications Charts Acceptance Standard for Radiographically Determined Rounded Indications in Welds ...	400
4-1	Applicability of These Standards	400
4-2	Terminology	400
4-3	Acceptance Criteria	400
Mandatory Appendix 5	Flexible Shell Element Expansion Joints	408
5-1	General	408
5-2	Materials	408
5-3	Design	408
5-4	Fabrication	409
5-5	Inspection and Tests	411
5-6	Marking and Reports	411

Mandatory Appendix 6	Methods for Magnetic Particle Examination (MT)	412
6-1	Scope	412
6-2	Certification of Competency for Nondestructive Examination Personnel	412
6-3	Evaluation of Indications	412
6-4	Acceptance Standards	412
6-5	Repair Requirements	412
Mandatory Appendix 7	Examination of Steel Castings	414
7-1	Scope	414
7-2	Examination Techniques	414
7-3	Examination Requirements	414
7-4	Repairs	415
7-5	Identification and Marking	416
Mandatory Appendix 8	Methods for Liquid Penetrant Examination (PT)	417
8-1	Scope	417
8-2	Certification of Competency of Nondestructive Examination Personnel	417
8-3	Evaluation of Indications	417
8-4	Acceptance Standards	417
8-5	Repair Requirements	417
Mandatory Appendix 9	Jacketed Vessels	419
9-1	Scope	419
9-2	Types of Jacketed Vessels	419
9-3	Materials	419
9-4	Design of Jacket Shells and Jacket Heads	419
9-5	Design of Closure Member of Jacket to Vessel	419
9-6	Design of Penetrations Through Jackets	425
9-7	Design of Partial Jackets	425
9-8	Fabrication	427
9-10	Inspection	427
Mandatory Appendix 10	Quality Control System	428
10-1	General	428
10-2	Outline of Features to Be Included in the Written Description of the Quality Control System	428
10-3	Authority and Responsibility	428
10-4	Organization	428
10-5	Drawings, Design Calculations, and Specification Control	428
10-6	Material Control	429
10-7	Examination and Inspection Program	429
10-8	Correction of Nonconformities	429
10-9	Welding	429
10-10	Nondestructive Examination	429
10-11	Heat Treatment	429
10-12	Calibration of Measurement and Test Equipment	429
10-13	Records Retention	429
10-14	Sample Forms	430
10-15	Inspection of Vessels and Vessel Parts	430
10-16	Inspection of Pressure Relief Valves	430
10-17	Certifications	430
Mandatory Appendix 11	Capacity Conversions for Safety Valves	431
11-1	.....	431
11-2	.....	434

Mandatory Appendix 12	Ultrasonic Examination of Welds (UT)	435
12-1	Scope	435
12-2	Certification of Competence of Nondestructive Examiner	435
12-3	Acceptance–Rejection Standards	435
12-4	Report of Examination	435
Mandatory Appendix 13	Vessels of Noncircular Cross Section	436
13-1	Scope	436
13-2	Types of Vessels	436
13-3	Materials	436
13-4	Design of Vessels of Noncircular Cross Section	440
13-5	Nomenclature	443
13-6	Ligament Efficiency of Multidiameter Holes in Plates	445
13-7	Unreinforced Vessels of Rectangular Cross Section	446
13-8	Reinforced Vessels of Rectangular Cross Section	448
13-9	Stayed Vessels of Rectangular Cross Section [Figure 13-2(a) Sketches (7) and (8)]	453
13-10	Unreinforced Vessels Having an Obround Cross Section [Figure 13-2(b) Sketch (1)]	456
13-11	Reinforced Vessels of Obround Cross Section [Figure 13-2(b) Sketch (2)]	456
13-12	Stayed Vessels of Obround Cross Section [Figure 13-2(b) Sketch (3)]	457
13-13	Vessels of Circular Cross Section Having a Single Diametral Staying Member [Figure 13-2(c)]	458
13-14	Vessels of Noncircular Cross Section Subject to External Pressure	459
13-15	Fabrication	461
13-16	Inspection	461
13-17	Examples	461
13-18	Special Calculations	461
Mandatory Appendix 14	Integral Flat Heads With a Large, Single, Circular, Centrally Located Opening	465
14-1	Scope	465
14-2	Nomenclature	465
14-3	Design Procedure	465
14-4	Data Reports	467
Mandatory Appendix 17	Dimpled or Embossed Assemblies	468
17-1	Scope	468
17-2	Service Restrictions	468
17-3	Materials	468
17-4	Thickness Limitations	469
17-5	Maximum Allowable Working Pressure (MAWP)	469
17-6	Design Limitations	469
17-7	Welding Control	469
17-8	Quality Control	471
17-9	Records	471
17-10	Data Reports	472
Mandatory Appendix 18	Adhesive Attachment of Nameplates	480
18-1	Scope	480
18-2	Nameplate Application Procedure Qualification	480
Mandatory Appendix 19	Electrically Heated or Gas-Fired Jacketed Steam Kettles	481
19-1	Scope	481
19-2	Service Restrictions	481
19-3	Materials	481

19-4	Design	481
19-5	Inspection and Stamping	481
19-6	Pressure Relief	481
19-7	Appurtenances and Controls	481
19-8	Data Reports	481
Mandatory Appendix 20	Hubs Machined From Plate	482
20-1	Scope	482
20-2	Material	482
20-3	Examination Requirements	482
20-4	Data Reports	482
Mandatory Appendix 21	Jacketed Vessels Constructed of Work-Hardened Nickel	483
21-1	Scope	483
21-2	Design Requirements	483
21-3	Fabrication	483
21-4	Data Reports	483
Mandatory Appendix 22	Integrally Forged Vessels	484
22-1	Scope	484
22-2	Material	484
22-3	Design	484
22-4	Heat Treatment	485
22-5	Marking	485
22-6	Data Reports	485
Mandatory Appendix 23	External Pressure Design of Copper, Copper Alloy, and Titanium Alloy Condenser and Heat Exchanger Tubes With Integral Fins	486
23-1	Scope	486
23-2	Materials	486
23-3	Test Procedure	486
23-4	Criteria	486
23-5	Data Reports	487
Mandatory Appendix 24	Design Rules for Clamp Connections	488
24-1	Scope	488
24-2	Materials	488
24-3	Notation	488
24-4	Bolt Loads	492
24-5	Hub Moments	493
24-6	Calculation of Hub Stresses	493
24-7	Calculation of Clamp Stresses	493
24-8	Allowable Design Stresses for Clamp Connections	493
Mandatory Appendix 26	Bellows Expansion Joints	495
26-1	Scope	495
26-2	Conditions of Applicability	495
26-3	Nomenclature	495
26-4	Design Considerations	499
26-5	Materials	501
26-6	Design of U-Shaped Unreinforced Bellows	501
26-7	Design of U-Shaped Reinforced Bellows	505
26-8	Design of Toroidal Bellows	509
26-9	Bellows Subjected to Axial, Lateral, or Angular Displacements ...	511
26-10	Fabrication	513
26-11	Examination	513
26-12	Pressure Test Requirements	514
26-13	Marking and Reports	515

26-14	Examples	515
26-15	Polynomial Approximation for Coefficients C_p , C_f , C_d	515
Mandatory Appendix 27	Alternative Requirements for Glass-Lined Vessels	521
27-1	Scope	521
27-2	Permissible Out-of-Roundness of Cylindrical Shells Under Internal Pressure	521
27-3	Permissible Tolerance for Hemispherical or 2:1 Ellipsoidal Heads	521
27-4	Hydrostatic Test	521
27-5	Heat Treatment of Test Specimens	522
27-6	Low Temperature Operation	522
27-7	Postweld Heat Treatment	522
27-8	Data Reports	522
Mandatory Appendix 28	Alternative Corner Weld Joint Detail for Box Headers for Air-Cooled Heat Exchangers	523
Mandatory Appendix 30	Rules for Drilled Holes Not Penetrating Through Vessel Wall	524
30-1	Scope	524
30-2	Supplementary Requirements	524
30-3	Nomenclature	525
Mandatory Appendix 31	Rules for Cr-Mo Steels With Additional Requirements for Welding and Heat Treatment	526
31-1	Scope	526
31-2	Postweld Heat Treatment	526
31-3	Test Specimen Heat Treatment	527
31-4	Welding Procedure Qualification and Welding Consumables Testing	528
31-5	Toughness Requirements	528
Mandatory Appendix 32	Local Thin Areas in Cylindrical Shells and in Spherical Segments of Shells	529
32-1	Scope	529
32-2	General Requirements	529
32-3	Nomenclature	529
32-4	Allowable Locations for Local Thin Areas	530
32-5	Blend Grinding Requirements for Local Thin Areas	531
32-6	Single Local Thin Areas in Cylindrical Shells	531
32-7	Multiple Local Thin Areas in Cylindrical Shells	532
32-8	Single Local Thin Areas in Spherical Segments of Shells	532
32-9	Multiple Local Thin Areas in Spherical Segments of Shells	532
32-10	Data Reports	532
Mandatory Appendix 33	Standard Units for Use in Equations	533
Mandatory Appendix 34	Requirements for Use of High Silicon Stainless Steels for Pressure Vessels	534
34-1	Scope	534
34-2	Heat Treatment	534
34-3	Weld Procedure Qualification	534
34-4	Toughness Requirements	535
34-5	Additional Requirements	535
Mandatory Appendix 35	Rules for Mass Production of Pressure Vessels	536
35-1	Introduction	536
35-2	Scope	536
35-3	General	536
35-4	Quality Control Procedures	536
35-5	Data Reports	537

35-6	Pneumatic Testing	537
35-7	Hydrostatic Testing	538
Mandatory Appendix 36	Standard Test Method for Determining the Flexural Strength of Certified Materials Using Three-Point Loading	539
36-1	Scope	539
36-2	Terminology	539
36-3	Apparatus	539
36-4	Test Specimen	539
36-5	Procedure	539
36-6	Test Data Record	539
36-7	Calculation	539
36-8	Report	539
Mandatory Appendix 37	Standard Test Method for Determining the Tensile Strength of Certified Impregnated Graphite Materials	541
37-1	Scope	541
37-2	Terminology	541
37-3	Apparatus	541
37-4	Test Specimens	541
37-5	Procedure	541
37-6	Test Data Record	541
37-7	Calculations	541
37-8	Reports	542
Mandatory Appendix 38	Standard Test Method for Compressive Strength of Impregnated Graphite	543
38-1	Scope	543
38-2	Referenced Documents	543
38-3	Terminology	543
38-4	Significance and Use	543
38-5	Apparatus	543
38-6	Sampling	543
38-7	Test Specimen	543
38-8	Procedure	543
38-9	Calculation	544
38-10	Report	544
38-11	Precision and Bias	544
Mandatory Appendix 39	Testing the Coefficient of Permeability of Impregnated Graphite	545
39-1	Scope and Field of Application	545
39-2	Concept	545
39-3	Principle	545
39-4	Apparatus	545
39-5	Specimens	546
39-6	Procedure	546
39-7	Test Report	546
39-8	Precision	546
Mandatory Appendix 40	Thermal Expansion Test Method for Graphite and Impregnated Graphite	547
40-1	Scope	547
40-2	Test Method	547
40-3	Equipment	547
40-4	Test Specimen	547
40-5	Testing Process	548
40-6	Thermal Expansion Factor	548

Mandatory Appendix 41	Electric Immersion Heater Element Support Plates	550
41-1	Scope	550
41-2	Materials and Methods of Fabrication	550
41-3	Terminology	550
41-4	Conditions of Applicability for EIH Support Plates	550
41-5	Nomenclature	550
41-6	Design Considerations	552
41-7	Calculation Procedure	552
41-8	Pressure Test Requirement	553
41-9	Data Reports	553
41-10	Example	553
Mandatory Appendix 42	Diffusion Bonding	555
42-1	General	555
42-2	Diffusion Bonding Procedure Specification (DBPS)	555
42-3	Diffusion Bonding Procedure Qualification Record (PQR)	555
42-4	Diffusion Bonding Performance Qualification (DBPQ)	555
42-5	Diffusion Bonding Variables	555
42-6	Mechanical Testing of DBPQ and DBPS Diffusion Bonded Blocks .	555
42-7	Production Diffusion Bond Examination	556
42-8	Design	556
Mandatory Appendix 43	Establishing Governing Code Editions and Cases for Pressure Vessels and Parts	557
43-1	General	557
43-2	Construction	557
43-3	Materials	557
Mandatory Appendix 44	Cold Stretching of Austenitic Stainless Steel Pressure Vessels	558
44-1	Scope	558
44-2	General Requirements	558
44-3	Nomenclature	558
44-4	Materials and Allowable Design Stress	558
44-5	Design	558
44-6	Fabrication Process	559
44-7	Stamping and Certification	560
Mandatory Appendix 45	Plate Heat Exchangers	561
45-1	Scope	561
45-2	Materials of Construction	561
45-3	Terminology	561
45-4	Conditions of Applicability	562
45-5	Design Considerations	562
45-6	Calculation Procedure	562
45-7	Pressure Test Requirements	563
45-8	Manufacturer's Data Reports	563
Nonmandatory Appendix A	Basis for Establishing Allowable Loads for Tube-to-Tubesheet Joints	564
A-1	General	564
A-2	Maximum Axial Loadings	565
A-3	Shear Load Test	566
A-4	Acceptance Standards for f_r Determined by Test	569
A-5	Acceptance Standards for Proposed Operating Temperatures Determined by Test	569
Nonmandatory Appendix C	Suggested Methods for Obtaining the Operating Temperature of Vessel Walls in Service	570
C-1	Thermocouple Installation	570

C-2	Alternative Thermocouple Installation	570
Nonmandatory Appendix D	Suggested Good Practice Regarding Internal Structures	571
D-1	Introduction	571
D-2	Internal Structures Support	571
D-3	Internal Structures Support Guidelines	571
Nonmandatory Appendix E	Suggested Good Practice Regarding Corrosion Allowance ...	572
E-1	General	572
E-2	Predictable Corrosion Rate	572
E-3	Indeterminate Corrosion Rate	572
E-4	Negligible Corrosion Rate	572
E-5	Corrosive Service	572
E-6	External Attachment Corrosion Rate	572
Nonmandatory Appendix F	Suggested Good Practice Regarding Linings	573
F-1	General	573
F-2	Metal Linings	573
F-3	Paint	573
F-4	Hydrotest Considerations for Metal Linings	573
Nonmandatory Appendix G	Suggested Good Practice Regarding Piping Reactions and Design of Supports and Attachments	574
G-1	General	574
G-2	Supports Considerations	574
G-3	Vertical Vessels, Post Supported	574
G-4	Vertical Vessels Supported at Shell	574
G-5	Vertical Vessels, Skirt Supported	574
G-6	Horizontal Vessel Supports	575
G-7	Horizontal Gas Storage Tank Supports	575
G-8	Attachments Subject to Cyclic Loading	575
G-9	Additional References	575
Nonmandatory Appendix H	Guidance to Accommodate Loadings Produced by Deflagration	576
H-1	Scope	576
H-2	General	576
H-3	Design Limitations	576
H-4	Design Criteria	576
H-5	References	577
Nonmandatory Appendix K	Sectioning of Welded Joints	578
K-1	Etch Tests	578
K-2	Closure of Openings Resulting From Sectioning	578
K-3	Preheating	579
Nonmandatory Appendix L	Application of Rules for Joint Efficiency in Shells and Heads of Vessels With Welded Joints	580
L-1	Vessels Under Internal Pressure	580
Nonmandatory Appendix M	Installation and Operation	586
M-1	Introduction	586
M-2	Corrosion	586
M-3	Marking on the Vessel	586
M-4	Pressure-Relieving Devices	586
M-5	Stop Valves Located in the Relief Path	586
M-6	Inlet Pressure Drop for High Lift, Top-Guided Safety, Safety Relief, and Pilot-Operated Pressure Relief Valves in Compressible Fluid Service	588
M-7	Discharge Lines From Pressure Relief Devices	589

M-8	Pressure Drop, Nonreclosing Pressure Relief Devices	589
M-9	General Advisory Information on the Characteristics of Pressure Relief Devices Discharging Into a Common Header	589
M-10	Pressure Differentials for Pressure Relief Valves	589
M-11	Installation of Safety and Safety Relief Valves	590
M-12	Reaction Forces and Externally Applied Loads	590
M-13	Sizing of Pressure Relief Devices for Fire Conditions	591
M-14	Pressure-Indicating Device	591
Nonmandatory Appendix P	Basis for Establishing Allowable Stress Values for UCI, UCD, and ULT Materials	592
P-1		592
Nonmandatory Appendix R	Preheating	594
R-1	Introduction	594
R-2	P-No. 1 Group Nos. 1, 2, and 3	594
R-3	P-No. 3 Group Nos. 1, 2, and 3	594
R-4	P-No. 4 Group Nos. 1 and 2	594
R-5	P-Nos. 5A and 5B Group No. 1	594
R-6	P-No. 6 Group Nos. 1, 2, and 3	594
R-7	P-No. 7 Group Nos. 1 and 2	594
R-8	P-No. 8 Group Nos. 1 and 2	594
R-9	P-No. 9 Groups	594
R-10	P-No. 10 Groups	594
R-11	P-No. 11 Groups	594
	P-No. 15E Group No. 1	595
Nonmandatory Appendix S	Design Considerations for Bolted Flange Connections	596
S-1	Bolting	596
Nonmandatory Appendix T	Temperature Protection	598
Nonmandatory Appendix W	Guide for Preparing Manufacturer's Data Reports	599
W-1	Guide for Preparing Manufacturer's Data Reports	599
W-2	Guide for Preparing Supplemental Data Reports for Parts Constructed of Graphite	599
Nonmandatory Appendix Y	Flat Face Flanges With Metal-to-Metal Contact Outside the Bolt Circle	632
Y-1	General	632
Y-2	Materials	633
Y-3	Notation	633
Y-4	Bolt Loads	637
Y-5	Classification of Assemblies and Categorization of Individual Flanges	637
Y-6	Flange Analysis	639
Y-7	Allowable Flange Design Stresses	643
Y-8	Prestressing the Bolts	643
Y-9	Estimating Flange Thicknesses and Bolting	643
Y-10		644
Nonmandatory Appendix DD	Guide to Information Appearing on Certificate of Authorization	646
Nonmandatory Appendix EE	Half-Pipe Jackets	649
EE-1	General	649
EE-2	Half-Pipe Jackets	649
EE-3	Jackets With Other Geometries	649

Nonmandatory Appendix FF	Guide for the Design and Operation of Quick-Actuating and Quick-Opening Closures	654
FF-1	Introduction	654
FF-2	Responsibilities	654
FF-3	Design	654
FF-4	Installation	655
FF-5	Maintenance	655
FF-6	Inspection	655
FF-7	Training	655
FF-8	Administrative Controls	656
Nonmandatory Appendix GG	Guidance for the Use of U.S. Customary and SI Units in the ASME Boiler and Pressure Vessel Code	657
GG-1	Use of Units in Equations	657
GG-2	Guidelines Used to Develop SI Equivalents	657
GG-3	Soft Conversion Factors	659
Nonmandatory Appendix HH	Tube Expanding Procedures and Qualification	660
HH-1	General	660
HH-2	Scope	660
HH-3	Terms and Definitions	660
HH-4	Tube Expanding Procedure Specification (TEPS)	661
HH-5	Tube Expanding Procedure Qualification	661
HH-6	Tube Expanding Performance Qualification (TEPQ)	661
HH-7	Tube Expanding Variables	661
Nonmandatory Appendix JJ	Flowcharts Illustrating Toughness Testing Requirements and Exemptions From Toughness Testing by the Rules of UHA-51	670
JJ-1	UHA-51 Toughness Test Requirements for High Alloy Vessels ...	670
Nonmandatory Appendix KK	Guide for Preparing User's Design Requirements	676
KK-1	Introduction	676
Nonmandatory Appendix LL	Graphical Representations of $F_{t,min}$ and $F_{t,max}$	682
Nonmandatory Appendix MM	Alternative Marking and Stamping of Graphite Pressure Vessels	685
MM-1	General Requirements	685
MM-2	Application of the Certification Mark	685
MM-3	Application of Characters Directly to Graphite	685
MM-4	Acceptance Criterion	685
Nonmandatory Appendix NN	Guidance to the Responsibilities of the User and Designated Agent	686
NN-1	Introduction	686
NN-2	Information Regarding the "User" Designation	686
NN-3	Information Regarding the User's "Designated Agent"	686
NN-4	Common Scenarios Involving the "User" or "Designated Agent" Responsibilities	687
NN-5	Examples Illustrating the NN-4 Common Scenarios Involving the "User or His Designated Agent"	687
NN-6	Specific Code-Assigned Responsibilities	687
FIGURES		
UG-28	Diagrammatic Representation of Variables for Design of Cylindrical Vessels Subjected to External Pressure	20
UG-28.1	Diagrammatic Representation of Lines of Support for Design of Cylindrical Vessels Subjected to External Pressure	21

UG-29.1	Various Arrangements of Stiffening Rings for Cylindrical Vessels Subjected to External Pressure	25
UG-29.2	Maximum Arc of Shell Left Unsupported Because of Gap in Stiffening Ring of Cylindrical Shell Under External Pressure	26
UG-30	Some Acceptable Methods of Attaching Stiffening Rings	27
UG-33.1	Length L_c of Some Typical Conical Sections for External Pressure	31
UG-34	Some Acceptable Types of Unstayed Flat Heads and Covers	33
UG-36	Large Head Openings — Reverse-Curve and Conical Shell-Reducer Sections	39
UG-37	Chart for Determining Value of F , as Required in UG-37	41
UG-37.1	Nomenclature and Formulas for Reinforced Openings	42
UG-38	Minimum Depth for Flange of Flued-In Openings	44
UG-39	Multiple Openings in Rim of Heads With a Large Central Opening	45
UG-40	Some Representative Configurations Describing the Reinforcement Dimension t_e and the Opening Dimension d	47
UG-41.1	Nozzle Attachment Weld Loads and Weld Strength Paths to Be Considered	50
UG-42	Examples of Multiple Openings	52
UG-47	Acceptable Proportions for Ends of Stays	56
UG-53.1	Example of Tube Spacing With Pitch of Holes Equal in Every Row	57
UG-53.2	Example of Tube Spacing With Pitch of Holes Unequal in Every Second Row	58
UG-53.3	Example of Tube Spacing With Pitch of Holes Varying in Every Second and Third Row ...	58
UG-53.4	Example of Tube Spacing With Tube Holes on Diagonal Lines	59
UG-53.5	Diagram for Determining the Efficiency of Longitudinal and Diagonal Ligaments Between Openings in Cylindrical Shells	60
UG-53.6	Diagram for Determining Equivalent Longitudinal Efficiency of Diagonal Ligaments Between Openings in Cylindrical Shells	61
UG-80.1	Maximum Permissible Deviation From a Circular Form e for Vessels Under External Pressure	63
UG-80.2	Example of Differences Between Maximum and Minimum Inside Diameters in Cylindrical, Conical, and Spherical Shells	63
UG-84	Simple Beam Impact Test Specimens (Charpy Type Test)	65
UG-84.1	Charpy V-Notch Impact Test Requirements for Full-Size Specimens for Carbon and Low Alloy Steels, Having a Specified Minimum Tensile Strength of Less Than 95 ksi, Listed in Table UCS-23	66
UG-84.1M	Charpy V-Notch Impact Test Requirements for Full-Size Specimens for Carbon and Low Alloy Steels, Having a Specified Minimum Tensile Strength of Less Than 655 MPa, Listed in Table UCS-23	67
UG-84.5	HAZ Impact Specimen Removal	69
UG-116	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard	82
UG-118	Form of Stamping	86
UG-129.1	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard for Pressure Relief Valves	93
UG-129.2	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard for Nonreclosing Pressure Relief Devices	93
UW-3	Illustration of Welded Joint Locations Typical of Categories A, B, C, and D	112
UW-9-1	Butt Welding of Plates of Unequal Thickness	114
UW-9-2	Butt Welding of Components to Thickened Neck Nozzles	114
UW-13.1	Heads Attached to Shells	118
UW-13.2	Attachment of Pressure Parts to Flat Plates to Form a Corner Joint	121
UW-13.3	Typical Pressure Parts With Butt-Welded Hubs	126
UW-13.4	Nozzle Necks Attached to Piping of Lesser Wall Thickness	126
UW-13.5	Fabricated Lap Joint Stub Ends for Lethal Service	127
UW-16.1	Some Acceptable Types of Welded Nozzles and Other Connections to Shells, Heads, etc. ...	128
UW-16.2	Some Acceptable Types of Small Standard Fittings	135
UW-16.3	Some Acceptable Types of Small Bolting Pads	136
UW-19.1	Typical Forms of Welded Staybolts	137

UW-19.2	Use of Plug and Slot Welds for Staying Plates	138
UW-20.1	Some Acceptable Types of Tube-to-Tubesheet Strength Welds	139
UW-21	Welds of Socket Weld Flanges to Nozzle Necks	141
UB-14	Examples of Filler Metal Application	159
UB-16	Some Acceptable Types of Brazed Joints	160
UCS-66	Impact Test Exemption Curves	179
UCS-66M	Impact Test Exemption Curves	182
UCS-66.1	Reduction in Minimum Design Metal Temperature Without Impact Testing	187
UCS-66.1M	Reduction in Minimum Design Metal Temperature Without Impact Testing	188
UCS-66.2	Diagram of UCS-66 Rules for Determining Lowest Minimum Design Metal Temperature (MDMT) Without Impact Testing	189
UCS-66.3	Some Typical Vessel Details Showing the Governing Thicknesses as Defined in UCS-66 ...	191
UHA-51-1	Weld Metal Delta Ferrite Content	218
UHT-6.1	Charpy V-Notch Impact Test Requirements	237
UHT-6.1M	Charpy V-Notch Impact Test Requirements	237
UHT-18.1	Acceptable Welded Nozzle Attachment Readily Radiographed to Code Standards	239
UHT-18.2	Acceptable Full Penetration Welded Nozzle Attachments Radiographable With Difficulty and Generally Requiring Special Techniques Including Multiple Exposures to Take Care of Thickness Variations	240
ULW-2.1	Some Acceptable Layered Shell Types	248
ULW-2.2	Some Acceptable Layered Head Types	249
ULW-17.1	Transitions of Layered Shell Sections	251
ULW-17.2	Some Acceptable Solid Head Attachments to Layered Shell Sections	252
ULW-17.3	Some Acceptable Flat Heads and Tubesheets With Hubs Joining Layered Shell Sections ..	254
ULW-17.4	Some Acceptable Flanges for Layered Shells	255
ULW-17.5	Some Acceptable Layered Head Attachments to Layered Shells	256
ULW-17.6	Some Acceptable Welded Joints of Layered-to-Layered and Layered-to-Solid Sections	257
ULW-18.1	Some Acceptable Nozzle Attachments in Layered Shell Sections	259
ULW-22	Some Acceptable Supports for Layered Vessels	261
ULW-32.1	Solid-to-Layered and Layered-to-Layered Test Plates	263
ULW-32.2	.....	264
ULW-32.3	.....	264
ULW-32.4	.....	265
ULW-54.1	.....	266
ULW-54.2	.....	267
ULW-77	.....	269
UHX-3	Terminology of Heat Exchanger Components	279
UHX-9	Some Representative Configurations Describing the Minimum Required Thickness of the Tubesheet Flanged Extension, h_r	281
UHX-10	Integral Channels	282
UHX-11.1	Tubesheet Geometry	284
UHX-11.2	Typical Untubed Lane Configurations	285
UHX-11.3	Curves for the Determination of E^*/E and ν^* (Equilateral Triangular Pattern)	286
UHX-11.4	Curves for the Determination of E^*/E and ν^* (Square Pattern)	287
UHX-12.1	U-Tube Tubesheet Configurations	289
UHX-12.2	Tube Layout Perimeter	290
UHX-13.3-1	F_m Versus X_a ($0.0 \leq Q_3 \leq 0.8$)	300
UHX-13.3-2	F_m Versus X_a ($-0.8 \leq Q_3 \leq 0.0$)	301
UHX-13.1	Fixed Tubesheet Configurations	296
UHX-13.2	Z_d , Z_v , Z_{vw} and Z_m Versus X_a	299
UHX-13.4	Shell With Increased Thickness Adjacent to the Tubesheets	302
UHX-13.10.3-1	Kettle Shell	312
UHX-14.1	Floating Tubesheet Heat Exchangers	314
UHX-14.2	Stationary Tubesheet Configurations	315
UHX-14.3	Floating Tubesheet Configurations	317
UIG-34-1	Typical Graphite Heat Exchanger	332

UIG-34-2	Configuration g Stationary Tubesheet	333
UIG-34-3	Configuration G Floating Tubesheet	333
UIG-36-1	Unacceptable Nozzle Attachment Details	334
UIG-36-2	Some Acceptable Nozzle Attachment Details in Impregnated Graphite Pressure Vessels ..	335
UIG-76-1	Tension Test Specimen	340
UIG-76-2	Cement Material Tension Test Specimen	341
UIG-76-3	Tube-to-Tubesheet Tension Test Specimen	342
UIG-76-4	Tube Cement Joint Tension Test Specimen	343
UIG-76-5	Tube Tension Test Specimen	344
1-4	Principal Dimensions of Typical Heads	361
1-6	Dished Covers With Bolting Flanges	366
1-7-1	.....	369
1-7-2	.....	370
2-4	Types of Flanges	379
2-7.1	Values of T , U , Y , and Z (Terms Involving K)	387
2-7.2	Values of F (Integral Flange Factors)	388
2-7.3	Values of V (Integral Flange Factors)	389
2-7.4	Values of F_L (Loose Hub Flange Factors)	390
2-7.5	Values of V_L (Loose Hub Flange Factors)	390
2-7.6	Values of f (Hub Stress Correction Factor)	391
2-13.1	Reverse Flange	393
2-13.2	Loose Ring Type Reverse Flange	394
4-1	Aligned Rounded Indications	401
4-2	Groups of Aligned Rounded Indications	402
4-3	Charts for t Equal to $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (3 mm to 6 mm), Inclusive	403
4-4	Charts for t Over $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 mm to 10 mm), Inclusive	404
4-5	Charts for t Over $\frac{3}{8}$ in. to $\frac{3}{4}$ in. (10 mm to 19 mm), Inclusive	404
4-6	Charts for t Over $\frac{3}{4}$ in. to 2 in. (19 mm to 50 mm), Inclusive	405
4-7	Charts for t Over 2 in. to 4 in. (50 mm to 100 mm), Inclusive	406
4-8	Charts for t Over 4 in. (100 mm)	407
5-1	Typical Flexible Shell Element Expansion Joints	409
5-2	Typical Nozzle Attachment Details Showing Minimum Length of Straight Flange or Outer Shell Element	410
9-2	Some Acceptable Types of Jacketed Vessels	420
9-5	Some Acceptable Types of Jacket Closures	422
9-6	Some Acceptable Types of Penetration Details	426
9-7	.....	427
11-1	Constant, C , for Gas or Vapor Related to Ratio of Specific Heats ($k = c_p/c_v$)	432
11-1M	Constant, C , for Gas or Vapor Related to Ratio of Specific Heats ($k = c_p/c_v$)	432
11-2	Flow Capacity Curve for Rating Nozzle-Type Safety Valves on Saturated Water (Based on 10% Overpressure)	434
11-2M	Flow Capacity Curve for Rating Nozzle-Type Safety Valves on Saturated Water (Based on 10% Overpressure)	434
13-2(a)	Vessels of Rectangular Cross Section	437
13-2(b)	Vessels of Obround Cross Section	441
13-2(c)	Vessel of Circular Cross Section With Central Dividing Plate	442
13-6	Plate With Multidiameter Hole Pattern	446
13-14(a)	.....	460
13-14(b)	Orientation of Panel Dimensions and Stresses	460
14-1	Integral Flat Head With Large Central Opening	466
17-1	Two Embossed Plates	472
17-2	Two Dimpled Plates	472
17-3	Embossed Plate to Plain Plate	472
17-4	Arc-Spot-Welded Two-Layer Assembly	473
17-5	Dimpled Plate Welded to Plain Plate	473
17-6	Three-Ply Assemblies	473

17-7	Single-Spot-Weld Tension Specimen, Two-Ply Joint	473
17-8	Seam-Weld Specimen for Tension and Macrosection, Two-Ply Joint	474
17-9	Single Spot-Weld Tension Specimen for Three-Ply Joint	474
17-10	Seam-Weld Specimen for Tension and Macrosection for Three-Ply Joint	474
17-11	Gas Metal Arc-Spot-Weld Block for Macrosections and Strength Tests	475
17-12	Gas Metal Arc-Spot-Weld Block for Bend Tests	476
17-13	Gas Tungsten-Arc Seam Weld, Plasma-Arc Seam Weld, Submerged-Arc Seam Weld, and Laser Beam Seam Weld Test Specimen for Bend Tests	477
17-14	.....	478
17-15	.....	478
17-16	Peel Test	478
17-17	Complete Penetration Welding Per 17-1(c)	479
22-1	Typical Sections of Special Seamless Vessels	484
24-1	Typical Hub and Clamp	489
24-2	Typical Clamp Lug Configurations	490
26-1-1	Typical Bellows Expansion Joints	496
26-1-2	Starting Points for the Measurement of the Length of Shell on Each Side of the Bellows ..	497
26-2	Dimensions to Determine I_{xx}	499
26-3	Possible Convolution Profile in the Neutral Position	501
26-4	Coefficient C_p	502
26-5	Coefficient C_f	503
26-6	Coefficient C_d	506
26-7	Bellows Subjected to an Axial Displacement x	509
26-8	Bellows Subjected to a Lateral Deflection y	512
26-9	Bellows Subjected to an Angular Rotation θ	513
26-10	Cyclic Displacements	514
26-11	Cyclic Displacements	515
26-12	Cyclic Displacements	515
26-13	Some Typical Expansion Bellows to Weld End Details	516
26-14	Toroidal Bellows Manufacturing Tolerances	517
30-1	Thickness Ratio Versus Diameter Ratio	524
31-1	.....	527
32-3	Nomenclature	529
32-4-1	Limits for Torispherical Head	530
32-4-2	Limits for Ellipsoidal Head	531
32-4-3	Limits for Hemispherical Head	531
32-5-1	LTA Blend Grinding	532
36-4-1	Test Specimen Arrangement	540
39-4-1	Schematic Diagram of Vacuum Apparatus	546
40-3-1	Typical Equipment (Dilometer) for Thermal Expansion Test	547
40-6-1	Typical Recording Curve in Thermal Expansion Test, $\Delta L_t = f(\theta)$	548
41-1.1-1	EIH Support Plate Gasketed With Mating Flange	550
41-4-1	Typical EIH Support Plate and Element Geometry	551
41-5-1	Some Representative Configurations Describing the Minimum Required Thickness of the EIH Support Plate Flanged Extension, h_r	552
45-3.1-1	Typical Plate Heat Exchanger	562
A-2	Some Acceptable Types of Tube-to-Tubesheet Welds	567
A-3	Typical Test Fixtures for Expanded or Welded Tube-to-Tubesheet Joints	568
K-2	Some Acceptable Types of Filler Plugs	579
L-1.4-1	Joint Efficiency and Weld Joint Type — Cylinders and Cones	581
L-1.4-2	Joint Efficiency and Weld Joint Type — Heads	582
L-1.4-3	Joint Efficiencies for Categories A and D Welded Joints in Shells, Heads, or Cones	583
L-1.4-4	Joint Efficiencies for Categories B and C Welded Joints in Shells or Cones	584
W-3.1	Example of the Use of Form U-4	627
Y-3.1	.....	635
Y-3.2	Flange Dimensions and Forces	636

Y-5.1.1	Class 1 Flange Assembly (Identical Flange Pairs)	638
Y-5.1.2	Class 2 Flange Assembly	638
Y-5.1.3	Class 3 Flange Assembly	639
DD-1	Sample Certificate of Authorization	648
EE-1	NPS 2 Pipe Jacket	650
EE-2	NPS 3 Pipe Jacket	651
EE-3	NPS 4 Pipe Jacket	652
EE-4	.....	653
EE-5	.....	653
JJ-1.2-1	Austenitic Stainless Steel Base Metal and HAZ Toughness Testing Requirements	671
JJ-1.2-2	Welding Procedure Qualification With Toughness Testing Requirements for Austenitic Stainless Steel	672
JJ-1.2-3	Welding Consumable Pre-Use Testing Requirements for Austenitic Stainless Steel	673
JJ-1.2-4	Production Toughness Testing Requirements for Austenitic Stainless Steel	674
JJ-1.2-5	Austenitic-Ferritic Duplex, Ferritic Chromium, and Martensitic Stainless Steel Toughness Testing Requirements	675
LL-1	Graphical Representation of $F_{t,min}$	683
LL-2	Graphical Representation of $F_{t,max}$	684

TABLES

U-3	Year of Acceptable Edition of Referenced Standards in This Division	5
UG-33.1	Values of Spherical Radius Factor K_o for Ellipsoidal Head With Pressure on Convex Side ..	30
UG-37	Values of Spherical Radius Factor K_1	43
UG-43	Minimum Number of Pipe Threads for Connections	52
UG-45	Nozzle Minimum Thickness Requirements	54
UG-79-1	Equations for Calculating Forming Strains	62
UG-84.2	Charpy Impact Test Temperature Reduction Below Minimum Design Metal Temperature .	68
UG-84.3	Specifications for Impact Tested Materials in Various Product Forms	68
UG-84.4	Impact Test Temperature Differential	68
UG-84.6	Required HAZ Impact Test Specimen Set Removal	69
UW-12	Maximum Allowable Joint Efficiencies for Arc and Gas Welded Joints	117
UW-16.1	Minimum Thickness Requirements for Fittings	134
UW-33	.....	144
UB-2	Maximum Design Temperatures for Brazing Filler Metal	157
UB-17	Recommended Joint Clearances at Brazing Temperature	160
UCS-23	Carbon and Low Alloy Steel	166
UCS-56-1	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 1	169
UCS-56-2	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 3	170
UCS-56-3	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 4	171
UCS-56-4	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-Nos. 5A, 5B, and 5C	172
UCS-56-5	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 9A	173
UCS-56-6	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 9B	174
UCS-56-7	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 10A	175
UCS-56-8	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 10B	175
UCS-56-9	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 10C	176
UCS-56-11	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 15E	177
UCS-56.1	Alternative Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels	178
UCS-57	Thickness Above Which Full Radiographic Examination of Butt-Welded Joints Is Mandatory	178
UCS-66	Tabular Values for Figure UCS-66 and Figure UCS-66M	185
UCS-79-1	Post-Cold-Forming Strain Limits and Heat Treatment Requirements for P-No. 15E Materials	196
UNF-23.1	Nonferrous Metals — Aluminum and Aluminum Alloy Products	200
UNF-23.2	Nonferrous Metals — Copper and Copper Alloys	200
UNF-23.3	Nonferrous Metals — Nickel, Cobalt, and High Nickel Alloys	201
UNF-23.4	Nonferrous Metals — Titanium and Titanium Alloys	202
UNF-23.5	Nonferrous Metals — Zirconium	202

UNF-79	Postfabrication Strain Limits and Required Heat Treatment	205
UHA-23	High Alloy Steel	210
UHA-32-1	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 6	212
UHA-32-2	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 7	213
UHA-32-3	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 8	213
UHA-32-4	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 10H	214
UHA-32-5	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 10I	214
UHA-32-6	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 10K	215
UHA-32-7	Postweld Heat Treatment Requirements for High Alloy Steels — P-No. 45	215
UHA-44	Postfabrication Strain Limits and Required Heat Treatment	216
UCI-23	Maximum Allowable Stress Values in Tension for Cast Iron	224
UCI-78.1		225
UCI-78.2		225
UCD-23	Maximum Allowable Stress Values in Tension for Cast Ductile Iron, ksi (MPa)	233
UCD-78.1		234
UCD-78.2		234
UHT-23	Ferritic Steels With Properties Enhanced by Heat Treatment	241
UHT-56	Postweld Heat Treatment Requirements for Materials in Table UHT-23	243
ULT-23	Maximum Allowable Stress Values in Tension for 5%, 8%, and 9% Nickel Steels, Types 304 and 316 Stainless Steels, and 5083-0 Aluminum Alloy at Cryogenic Temperatures for Welded and Nonwelded Construction	272
ULT-82	Minimum Tensile Strength Requirements for Welding Procedure Qualification Tests on Tension Specimens Conforming to Section IX, Figures QW-462.1(a) Through QW-462.1(e)	275
ULT-82M	Minimum Tensile Strength Requirements for Welding Procedure Qualification Tests on Tension Specimens Conforming to Section IX, Figures QW-462.1(a) Through QW-462.1(e)	276
UHX-8.1	Tubesheet Effective Bolt Load, W^*	280
UHX-12.4-1		291
UHX-13.1	Formulas for Determination of Z_{db} , Z_v , Z_m , Z_w , and F_m	297
UHX-13.2	Formulas for Determination of $F_{t,min}$ and $F_{t,max}$	298
UHX-13.4-1		301
UHX-13.4-2		302
UHX-13.8.4-1		309
UHX-14.4-1		318
UHX-14.6.4-1		322
UHX-17	Flexible Shell Element Expansion Joint Load Cases and Stress Limits	325
UIG-6-1	Properties of Certified Material	330
UIG-84-1	Test Frequency for Certified Materials	345
1-4.1	Values of Factor K	361
1-4.2	Values of Factor M	362
1-4.3	Maximum Metal Temperature	362
1-4.4	Values of Knuckle Radius, r	363
1-5.1	Values of Δ for Junctions at the Large Cylinder for $\alpha \leq 30$ deg	363
1-5.2	Values of Δ for Junctions at the Small Cylinder for $\alpha \leq 30$ deg	364
1-8.1	Values of Δ for Junctions at the Large Cylinder for $\alpha \leq 60$ deg	371
2-4	Recommended Minimum Gasket Contact Widths for Sheet and Composite Gaskets	382
2-5.1	Gasket Materials and Contact Facings	383
2-5.2	Effective Gasket Width	385
2-6	Moment Arms for Flange Loads Under Operating Conditions	386
2-7.1	Flange Factors in Formula Form	392
2-14	Flange Rigidity Factors	395
4-1		400
11-1	Molecular Weights of Gases and Vapors	433
13-8(d)		448
13-8(e)		453
13-13(c)		459
13-18.1		463

13-18(b)	.....	464
24-8	Allowable Design Stress for Clamp Connections	493
26-2-1	Maximum Design Temperatures for Application of the Rules of Mandatory Appendix 26 ..	497
26-8	Tabular Values for Coefficients B_1, B_2, B_3	511
26-10-1	U-Shaped Unreinforced and Reinforced Bellows Manufacturing Tolerances	514
26-15.1a	Polynomial Coefficients α_i for the Determination of C_p When $C_1 \leq 0.3$	517
26-15.1b	Polynomial Coefficients α_i for the Determination of C_p When $C_1 > 0.3$	517
26-15.2	Polynomial Coefficients β_i for the Determination of C_f	518
26-15.3	Polynomial Coefficients γ_i for the Determination of C_d	518
31-1	Material Specifications	526
31-2	Composition Requirements for 2 $\frac{1}{4}$ Cr-1Mo- $\frac{1}{4}$ V Weld Metal	527
33-1	Standard Units for Use in Equations	533
34-1	Material Specifications	534
34-2	Additional Requirements	535
42-5.1-1	.....	556
44-4-1	Allowable Materials and Design Stress	558
A-2	Efficiencies f_r	566
P-1	Criteria for Establishing Allowable Stress Values	593
W-3	Instructions for the Preparation of Manufacturer's Data Reports	621
W-3.1	Supplementary Instructions for the Preparation of Manufacturer's Data Reports for Layered Vessels	628
W-3.2	Supplementary Instructions for the Preparation of Manufacturer's or Assembler's Certificate of Conformance Forms UV-1 and UD-1	631
Y-6.1	Summary of Applicable Equations for Different Classes of Assemblies and Different Cate- gories of Flanges	639
Y-9.1	Flange Thickness and Area of Bolting for Various Classes of Assemblies and Flange Categories	644
QEXP-1	Instructions for Filling Out TEPS Form	666
KK-1	Instructions for the Preparation of User's Design Requirements	681
NN-6-1	Responsibilities of the User	689
NN-6-2	Matters of Agreement Between the User and the Manufacturer	690
NN-6-3	The Manufacturer's Responsibility to the User	690
NN-6-4	Recommendations to the User	690
NN-6-5	Responsibilities of the User or His Designated Agent	691
NN-6-6	Matters of Agreement Between the User or His Designated Agent and the Manufacturer ..	691
NN-6-7	The Manufacturer's Responsibility to the User or His Designated Agent	692
NN-6-8	Recommendations to the User or His Designated Agent	692
NN-6-9	Cautionary Advice Provided to the User	692
NN-6-10	Guidance Code to Users and Their Designated Agents	693
NN-6-11	User-Manufacturer Rules	693
FORMS		
CMQ	Certified Material Qualification Form	347
CCQ	Certified Cement Qualification Form	354
CPQ	Cementing Procedure Qualification Form	356
CTQ	Cementing Technician Qualification Form	358
26-1	Specification Sheet for ASME Section VIII, Division 1 Mandatory Appendix 26 Bellows Expansion Joints	519
26-1M	Specification Sheet for ASME Section VIII, Division 1 Mandatory Appendix 26 Bellows Expansion Joints	520
U-1	Manufacturer's Data Report for Pressure Vessels	600
U-1A	Manufacturer's Data Report for Pressure Vessels	603
U-1B	Manufacturer's Supplementary Data Report for Graphite Pressure Vessels	605
U-1P	Manufacturer's Data Report for Plate Heat Exchangers	606
U-2	Manufacturer's Partial Data Report	608
U-2A	Manufacturer's Partial Data Report (Alternative Form)	611

U-3	Manufacturer’s Certificate of Compliance Covering Pressure Vessels to Be Stamped With the UM Designator [See U-1(j)]	613
U-3A	Manufacturer’s Certificate of Compliance (Alternative Form) Covering Pressure Vessels to Be Stamped With the UM Designator [See U-1(j)]	615
U-3P	Manufacturer’s Certificate of Compliance for Plate Heat Exchangers Covering Pressure Vessels to Be Stamped With the UM Designator [See U-1(j)]	617
U-4	Manufacturer’s Data Report Supplementary Sheet	619
U-5	Manufacturer’s Data Report Supplementary Sheet Shell-and-Tube Heat Exchangers	620
UV-1	Manufacturer’s or Assembler’s Certificate of Conformance for Pressure Relief Valves	629
UD-1	Manufacturer’s Certificate of Conformance for Nonreclosing Pressure Relief Devices	630
QEXP-1	Tube Expanding Procedure Specification (TEPS)	664
QEXP-2	Suggested Format for Tube-to-Tubesheet Expanding Procedure Qualification Record for Test Qualification (TEPQR)	668
U-DR-1	User’s Design Requirements for Single-Chamber Pressure Vessels	677
U-DR-2	User’s Design Requirements for Multichamber Pressure Vessels	679
ENDNOTES	.....	695

LIST OF SECTIONS

(17)

SECTIONS

- I Rules for Construction of Power Boilers
- II Materials
 - Part A — Ferrous Material Specifications
 - Part B — Nonferrous Material Specifications
 - Part C — Specifications for Welding Rods, Electrodes, and Filler Metals
 - Part D — Properties (Customary)
 - Part D — Properties (Metric)
- III Rules for Construction of Nuclear Facility Components
 - Subsection NCA — General Requirements for Division 1 and Division 2
 - Appendices
 - Division 1^{*}
 - Subsection NB — Class 1 Components
 - Subsection NC — Class 2 Components
 - Subsection ND — Class 3 Components
 - Subsection NE — Class MC Components
 - Subsection NF — Supports
 - Subsection NG — Core Support Structures
 - Division 2 — Code for Concrete Containments
 - Division 3 — Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
 - Division 5 — High Temperature Reactors
- IV Rules for Construction of Heating Boilers
- V Nondestructive Examination
- VI Recommended Rules for the Care and Operation of Heating Boilers
- VII Recommended Guidelines for the Care of Power Boilers
- VIII Rules for Construction of Pressure Vessels
 - Division 1
 - Division 2 — Alternative Rules
 - Division 3 — Alternative Rules for Construction of High Pressure Vessels
- IX Welding, Brazing, and Fusing Qualifications
- X Fiber-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Power Plant Components
- XII Rules for Construction and Continued Service of Transport Tanks

^{*} The 2015 Edition of Section III was the last edition in which Section III, Division 1, Subsection NH, *Class 1 Components in Elevated Temperature Service*, was published. The requirements located within Subsection NH were moved to Section III, Division 5, Subsection HB, Subpart B for the elevated temperature construction of Class A components.

INTERPRETATIONS

Interpretations are issued in real time in ASME's Interpretations Database at <http://go.asme.org/Interpretations>. Historical BPVC interpretations may also be found in the Database.

CODE CASES

The Boiler and Pressure Vessel Code committees meet regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2017 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2019 Code.

FOREWORD*

In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

- (a) Committee on Power Boilers (I)
- (b) Committee on Materials (II)
- (c) Committee on Construction of Nuclear Facility Components (III)
- (d) Committee on Heating Boilers (IV)
- (e) Committee on Nondestructive Examination (V)
- (f) Committee on Pressure Vessels (VIII)
- (g) Committee on Welding, Brazing, and Fusing (IX)
- (h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)
- (i) Committee on Nuclear Inservice Inspection (XI)
- (j) Committee on Transport Tanks (XII)
- (k) Technical Oversight Management Committee (TOMC)

Where reference is made to “the Committee” in this Foreword, each of these committees is included individually and collectively.

The Committee’s function is to establish rules of safety relating only to pressure integrity, which govern the construction** of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity. Except for Sections XI and XII, and with a few other exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgment* refers to technical judgments made by knowledgeable engineers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the

* The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI’s requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

** *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at <http://go.asme.org/BPVCPublicReview> to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the Committee. ASME is to be notified should questions arise concerning improper use of an ASME Certification Mark.

When required by context in this Section, the singular shall be interpreted as the plural, and vice versa, and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

STATEMENT OF POLICY ON THE USE OF THE CERTIFICATION MARK AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use the Certification Mark for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the Certification Mark, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not “approve,” “certify,” “rate,” or “endorse” any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding the Certification Mark and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities “are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code,” or “meet the requirements of the ASME Boiler and Pressure Vessel Code.” An ASME corporate logo shall not be used by any organization other than ASME.

The Certification Mark shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of the Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the Certification Mark. General usage is permitted only when all of a manufacturer’s items are constructed under the rules.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the official Certification Mark described in the governing Section of the Code.

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME” or the Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

(17) SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL STANDARDS COMMITTEES

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the applicable Boiler and Pressure Vessel (BPV) Standards Committee (hereinafter referred to as the Committee). See the guidelines on approval of new materials under the ASME Boiler and Pressure Vessel Code in Section II, Part D for requirements for requests that involve adding new materials to the Code. See the guidelines on approval of new welding and brazing materials in Section II, Part C for requirements for requests that involve adding new welding and brazing materials (“consumables”) to the Code.

Technical inquiries can include requests for revisions or additions to the Code requirements, requests for Code Cases, or requests for Code Interpretations, as described below:

(1) *Code Revisions.* Code revisions are considered to accommodate technological developments, to address administrative requirements, to incorporate Code Cases, or to clarify Code intent.

(2) *Code Cases.* Code Cases represent alternatives or additions to existing Code requirements. Code Cases are written as a Question and Reply, and are usually intended to be incorporated into the Code at a later date. When used, Code Cases prescribe mandatory requirements in the same sense as the text of the Code. However, users are cautioned that not all regulators, jurisdictions, or Owners automatically accept Code Cases. The most common applications for Code Cases are as follows:

(-a) to permit early implementation of an approved Code revision based on an urgent need

(-b) to permit use of a new material for Code construction

(-c) to gain experience with new materials or alternative requirements prior to incorporation directly into the Code

(3) *Code Interpretations*

(-a) Code Interpretations provide clarification of the meaning of existing requirements in the Code and are presented in Inquiry and Reply format. Interpretations do not introduce new requirements.

(-b) If existing Code text does not fully convey the meaning that was intended, or conveys conflicting requirements, and revision of the requirements is required to support the Interpretation, an Intent Interpretation will be issued in parallel with a revision to the Code.

(b) Code requirements, Code Cases, and Code Interpretations established by the Committee are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or Owners to choose any method of design or any form of construction that conforms to the Code requirements.

(c) Inquiries that do not comply with the following guidance or that do not provide sufficient information for the Committee’s full understanding may result in the request being returned to the Inquirer with no action.

2 INQUIRY FORMAT

Submittals to the Committee should include the following information:

(a) *Purpose.* Specify one of the following:

(1) request for revision of present Code requirements

(2) request for new or additional Code requirements

(3) request for Code Case

(4) request for Code Interpretation

(b) *Background.* The Inquirer should provide the information needed for the Committee’s understanding of the Inquiry, being sure to include reference to the applicable Code Section, Division, Edition, Addenda (if applicable), paragraphs, figures, and tables. Preferably, the Inquirer should provide a copy of, or relevant extracts from, the specific referenced portions of the Code.

(c) Presentations. The Inquirer may desire to attend or be asked to attend a meeting of the Committee to make a formal presentation or to answer questions from the Committee members with regard to the Inquiry. Attendance at a BPV Standards Committee meeting shall be at the expense of the Inquirer. The Inquirer's attendance or lack of attendance at a meeting will not be used by the Committee as a basis for acceptance or rejection of the Inquiry by the Committee. However, if the Inquirer's request is unclear, attendance by the Inquirer or a representative may be necessary for the Committee to understand the request sufficiently to be able to provide an Interpretation. If the Inquirer desires to make a presentation at a Committee meeting, the Inquirer should provide advance notice to the Committee Secretary, to ensure time will be allotted for the presentation in the meeting agenda. The Inquirer should consider the need for additional audiovisual equipment that might not otherwise be provided by the Committee. With sufficient advance notice to the Committee Secretary, such equipment may be made available.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions should include the following information:

(a) Requested Revisions or Additions. For requested revisions, the Inquirer should identify those requirements of the Code that they believe should be revised, and should submit a copy of, or relevant extracts from, the appropriate requirements as they appear in the Code, marked up with the requested revision. For requested additions to the Code, the Inquirer should provide the recommended wording and should clearly indicate where they believe the additions should be located in the Code requirements.

(b) Statement of Need. The Inquirer should provide a brief explanation of the need for the revision or addition.

(c) Background Information. The Inquirer should provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request, that will allow the Committee to adequately evaluate the requested revision or addition. Sketches, tables, figures, and graphs should be submitted, as appropriate. The Inquirer should identify any pertinent portions of the Code that would be affected by the revision or addition and any portions of the Code that reference the requested revised or added paragraphs.

4 CODE CASES

Requests for Code Cases should be accompanied by a statement of need and background information similar to that described in 3(b) and 3(c), respectively, for Code revisions or additions. The urgency of the Code Case (e.g., project underway or imminent, new procedure) should be described. In addition, it is important that the request is in connection with equipment that will bear the Certification Mark, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and should be written as a Question and a Reply, in the same format as existing Code Cases. Requests for Code Cases should also indicate the applicable Code Editions and Addenda (if applicable) to which the requested Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations should be accompanied by the following information:

(1) Inquiry. The Inquirer should propose a condensed and precise Inquiry, omitting superfluous background information and, when possible, composing the Inquiry in such a way that a "yes" or a "no" Reply, with brief limitations or conditions, if needed, can be provided by the Committee. The proposed question should be technically and editorially correct.

(2) Reply. The Inquirer should propose a Reply that clearly and concisely answers the proposed Inquiry question. Preferably, the Reply should be "yes" or "no," with brief limitations or conditions, if needed.

(3) Background Information. The Inquirer should provide any need or background information, such as described in 3(b) and 3(c), respectively, for Code revisions or additions, that will assist the Committee in understanding the proposed Inquiry and Reply.

If the Inquirer believes a revision of the Code requirements would be helpful to support the Interpretation, the Inquirer may propose such a revision for consideration by the Committee. In most cases, such a proposal is not necessary.

(b) Requests for Code Interpretations should be limited to an Interpretation of a particular requirement in the Code or in a Code Case. Except with regard to interpreting a specific Code requirement, the Committee is not permitted to consider consulting-type requests such as the following:

(1) a review of calculations, design drawings, welding qualifications, or descriptions of equipment or parts to determine compliance with Code requirements

- (2) a request for assistance in performing any Code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation
- (3) a request seeking the rationale for Code requirements

6 SUBMITTALS

(a) *Submittal.* Requests for Code Interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at <http://go.asme.org/InterpretationRequest>. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt. If the Inquirer is unable to use the online form, the Inquirer may mail the request to the following address:

Secretary
ASME Boiler and Pressure Vessel Committee
Two Park Avenue
New York, NY 10016-5990

All other Inquiries should be mailed to the Secretary of the BPV Committee at the address above. Inquiries are unlikely to receive a response if they are not written in clear, legible English. They must also include the name of the Inquirer and the company they represent or are employed by, if applicable, and the Inquirer's address, telephone number, fax number, and e-mail address, if available.

(b) *Response.* The Secretary of the appropriate Committee will provide a written response, via letter or e-mail, as appropriate, to the Inquirer, upon completion of the requested action by the Committee. Inquirers may track the status of their Interpretation Request at <http://go.asme.org/Interpretations>.

PERSONNEL

ASME Boiler and Pressure Vessel Standards Committees, Subgroups, and Working Groups

January 1, 2017

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N. Carter	F. J. Sattler
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Working Group on Nonmetals Repair/Replacement Activities (SG-RRR) (BPV XI)

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Task Group on Repair by Carbon Fiber Composites (WGN-MRR) (BPV XI)

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Working Group on Design and Programs (SG-RRR) (BPV XI)

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Subgroup on Water-Cooled Systems (SG-WCS) (BPV XI)

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Working Group on Containment (SG-WCS) (BPV XI)

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SUMMARY OF CHANGES

Errata to the BPV Code may be posted on the ASME Web site to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in the BPV Code. Such Errata shall be used on the date posted.

Information regarding Special Notices and Errata is published by ASME at <http://go.asme.org/BPVCerrata>.

Changes given below are identified on the pages by a margin note, **(17)**, placed next to the affected area.

The Record Numbers listed below are explained in more detail in “List of Changes in Record Number Order” following this Summary of Changes.

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
xxxiii	List of Sections	Updated
xxxviii	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Revised in its entirety (13-2222)
xli	Personnel	Updated
2	U-1(e)(1)(-a)	Cross-reference revised (15-934)
2	U-1(f)	Revised (11-2106)
2	U-1(j)	Revised (11-1901)
3	U-2	Subparagraphs (h)(1) through (h)(3) revised (16-598)
5	Table U-3	References updated (13-177, 15-1843, 15-2605, 16-532, 16-2185)
4	U-4	In subpara. (b), fourth paragraph revised (09-619)
7	UG-4	Subparagraph (h) and Note added (12-2123)
9	UG-9	Revised (11-737)
9	UG-10	Revised in its entirety (06-1384)
10	UG-11	Subparagraphs (a) and (c)(5) revised (11-1901, 14-2389)
13	UG-16	(1) Subparagraph (c) revised (13-959) (2) In subpara. (d), last sentence deleted (15-1725)
22	UG-28(f)	First sentence revised (15-2324)
30	Table UG-33.1	Editorially reformatted
32	UG-34	(1) In subpara. (b), in definition of <i>W</i> , cross-references revised (15-1586) (2) In second equation of subpara. (d)(9), “ <i>SLd</i> ³ ” corrected by errata to “ <i>SLd</i> ² ” (16-2176)
36	UG-35.2	Revised (11-1901)
37	UG-35.3	Added (11-1901)
37	UG-36	(1) Subparagraph (b)(1) revised (11-907, 14-1745) (2) Subparagraphs (c)(2)(-c) and (c)(2)(-d) deleted (11-907)
43	Table UG-37	Editorially reformatted
43	UG-37(g)	Revised (16-1250)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
43	UG-37(h)	Revised (16-1250)
54	UG-46	Subparagraphs (a) and (a)(2) revised (15-2173)
57	UG-53(h)	(1) In subpara. (1), SI units revised (14-1745) (2) In subpara. (2), SI units added (14-1745)
59	UG-79	Subparagraph (d)(2) revised (13-959)
65	Figure UG-84	Revised (14-2153)
68	Table UG-84.2	In spanned column heading, "of" revised to "or" (16-54)
70	UG-84(h)	Subparagraph (3) revised, and subpara. (5) added (15-2021)
71	UG-90	Subparagraph (b)(6) revised (13-959)
73	UG-93	Subparagraphs (a)(1)(-b), (a)(2), (d)(4)(-a), and (d)(4)(-c), and last sentence of subpara. (d)(3) revised (12-603, 14-1271, 15-2591)
74	UG-96	In subpara. (a), first sentence revised (13-959)
75	UG-99	(1) Subparagraphs (a)(1) and (b) revised (10-1307, 13-959) (2) Subparagraph (k)(4) added (14-1850)
76	UG-100	Subparagraph (b) revised (10-1307)
82	UG-116	(1) Subparagraphs (a)(1)(-c) and (h)(4) added (12-1755, 13-1562) (2) Subparagraph (h)(1)(-a) revised (12-1755)
82	Figure UG-116	Revised (12-1755)
84	UG-117	Revised in its entirety (12-1755, 13-177, 16-598)
86	Figure UG-118	Revised (12-1755, 13-855, 16-2185)
87	UG-120	Revised (12-1734, 13-1858, 14-645, 16-598)
90	UG-126	Former subpara. (c) deleted, and former subpara. (d) redesignated as (c) (12-1472)
97	UG-131(f)	Revised (13-177)
100	UG-135	In last sentence of subpara. (a), cross-reference to UG-125(a)(2) revised to UG-125(a)(3) (14-2499)
103	UG-136(c)(3)(-d)	Revised (14-654)
104	UG-136(d)(4)(-a)(-6)	Revised (14-305)
104	UG-136(g)	Added (12-1472)
105	UG-137	Subparagraph (c)(3)(-d) revised (14-654)
107	UG-138(c)(3)(-d)	Revised (14-654)
108	UG-138(d)(5)(-e)(-2)	In subparas. (+b) and (+c), equations editorially revised
108	UG-138(d)(6)	Added (13-1751)
110	UW-2	First sentence of subpara. (a) and last sentence of subpara. (a)(1)(-c)(-1) revised (13-1029, 15-934, 15-1551)
111	UW-3	In first paragraph, penultimate sentence revised (16-100)
112	UW-5	Subparagraphs (b)(3) and (c) revised (15-2779)
113	UW-9	Subparagraphs (a) and (c) revised (10-1689, 14-1493)
114	Figure UW-9-1	Former Figure UW-9 editorially redesignated as Figure UW-9-1

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
114	Figure UW-9-2	Added (10-1689)
115	UW-11(a)(8)	Former subpara. (a)(8) deleted, and former subpara. (a)(9) redesignated as (a)(8) (14-1826)
115	UW-11(d)	First sentence revised (14-1826)
116	UW-11(e)(3)	Revised (15-2591)
116	UW-12	First paragraph revised (14-1826)
116	UW-13	(1) Subparagraphs (b)(4)(-c) and (e)(3) revised (15-934, 15-2591) (2) Former Mandatory Appendix 28 revised and redesignated as new subpara. (f), and existing subparas. (f) through (h) redesignated as (g) through (i), respectively (15-934)
121	Figure UW-13.2	Illustrations (r) and (s) added, and layout of illustrations (a) through (q) revised editorially (15-934)
126	Figure UW-13.3	In General Note (b), cross-reference to UW-13(f) revised to UW-13(g) (15-934)
126	Figure UW-13.4	Note (1) revised (14-2052)
134	Table UW-16.1	Title revised (16-1270)
134	UW-16(f)(3)(-a)(-6)	Revised (16-1270)
143	UW-34	Second sentence and endnote 71 revised (15-1523, 15-2591)
144	UW-35	Subparagraph (b)(1) revised (13-959)
147	UW-40(d)	Revised (15-2473)
147	UW-40(f)	Revised (06-5)
148	UW-51	Subparagraphs (a)(1) through (a)(4) revised (14-1826, 16-1520)
150	UW-53	Revised in its entirety (14-1826)
150	UW-54	Revised in its entirety (15-2605, 16-661)
150	UW-65	Deleted (11-2106)
151	UF-12	Second paragraph revised (07-706)
152	UF-27	In subpara. (b), definition of <i>E</i> revised (12-2123)
153	UF-31(b)(1)(-a)	Second sentence revised (15-2591)
154	UF-32(b)(4)	Revised (15-2591)
156	UF-125	Deleted (11-2106)
163	UB-60	Deleted (11-2106)
166	Table UCS-23	Entries for SA-307, SA-372, and SA/EN 10028-2 revised, and entry for SA/EN 10216-2 added (07-706, 11-1276, 14-2383, 15-587)
167	UCS-56	Subparagraphs (d)(2) and (d)(5) revised (15-1229, 15-1579)
170	Table UCS-56-2	General Note (d)(5) added (15-2352)
171	Table UCS-56-3	General Note (b)(5) added (15-2352)
172	Table UCS-56-4	General Note (b)(5) added (15-2352)
176	Table UCS-56-10	Deleted (15-2608, 16-322)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
177	Table UCS-56-11	In second column of Table and in Note (1), minimum holding temperature revised (15-2553)
178	Table UCS-57	Entry for 10F Gr. 1 deleted (15-2608, 16-322)
190	UCS-66(f)	First sentence revised (16-134)
179	Figure UCS-66	In Notes (2)(a) and (4), SA-299 added (13-1110)
182	Figure UCS-66M	In Notes (2)(a) and (4), SA-299 added (13-1110)
191	Figure UCS-66.3	Illustrations (d) and (e) revised (13-597)
194	UCS-68	Subparagraph (b)(2) revised (14-2074)
196	UCS-125	Deleted (11-2106)
197	Nonmandatory Appendix UCS-A	Former Nonmandatory Appendix CS editorially redesignated as Nonmandatory Appendix UCS-A
201	Table UNF-23.3	“UNS No.” entries for SB-163, SB-166, SB-167, SB-168, SB-366, SB-462, SB-463, SB-464, SB-468, SB-516, SB-517, SB-564, SB-574, SB-575, SB-619, SB-622, and SB-626 revised (05-434, 14-43, 14-1065)
204	UNF-91	Endnote 80 (formerly endnote 81) revised (15-1266)
204	UNF-125	Deleted (11-2106)
206	Nonmandatory Appendix UNF-A	Former Nonmandatory Appendix NF editorially redesignated as Nonmandatory Appendix UNF-A
210	Table UHA-23	(1) Revised (07-713, 07-792, 16-1087) (2) Entry for SA-240 corrected by errata to include UNS No. N08904, and in Note (1), “Type 309” corrected by errata to “Type 304” (15-1112, 15-2793)
213	Table UHA-32-3	In General Note, cross-reference revised (16-538)
217	UHA-51(a)(3)(-a)(-1)	Revised (10-1703)
217	UHA-51(b)	Revised (13-567)
218	UHA-51(e)(3)(-c)	Spelling of “chromium” corrected by errata (15-2793)
219	UHA-51(f)(4)(-c)	Second sentence revised (11-737)
220	UHA-65	Deleted (11-2106)
221	Nonmandatory Appendix UHA-A	(1) Former Nonmandatory Appendix HA editorially redesignated as Nonmandatory Appendix UHA-A (2) UHA-A-10 added (16-538)
226	UCI-125	Deleted (11-2106)
227	UCL-11	In subpara. (c), second paragraph, last sentence revised (11-737)
231	UCL-60	Deleted (11-2106)
235	UCD-125	Deleted (11-2106)
241	UHT-28	(1) In subpara. (a), first sentence revised (14-1176) (2) Subparagraph (c) added (14-1176)
242	UHT-57	In subpara. (e), first sentence revised (15-2591)
243	UHT-79	Subparagraphs editorially redesignated

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
246	UHT-115	First and last sentences revised (12-1755)
246	UHT-125	Deleted (11-2106)
269	ULW-90	Revised (12-1755)
269	ULW-125	Deleted (11-2106)
271	ULT-16	Subparagraphs editorially redesignated
277	ULT-125	Revised (11-2106)
278	UHX-4	In subpara. (b), first sentence revised (15-1605)
280	UHX-9.3	(1) Definition of S deleted, and definition of S_{fe} added (16-991) (2) In definitions of W and W_{m1} , cross-reference to UHX-4(c) revised to UHX-4(b) (15-1586)
281	UHX-9.5	In subparas. (a) and (c), equations revised (16-991)
282	UHX-11.3	In definition of E^* , Note deleted (12-2123)
288	UHX-12.3	In definition of E_s , Note deleted (12-2123)
294	UHX-13.3	(1) In definition of E_t , Note deleted (12-2123) (2) Definitions of Δ_j and Δ_s added (11-1693)
310	UHX-13.10	Added (07-218)
312	Figure UHX-13.10.3-1	Added (07-218)
313	UHX-14.3	In definition of E_t , Note deleted (12-2123)
324	UHX-16	Revised (11-1693)
324	UHX-17	(1) Title and subpara. (a) revised (16-100) (2) Subparagraph (c) added (11-1693)
325	Table UHX-17	Title revised (16-100)
325	UHX-18	Revised (16-154)
330	UIG-22	Last sentence added (11-2106)
345	UIG-96	Subparagraphs editorially redesignated
346	UIG-116	Subparagraphs (b) and (d) revised (12-1755)
346	UIG-120	Subparagraph (a) revised (12-1755)
346	UIG-125	Deleted (11-2106)
356	Form CPQ	Revised editorially
359	1-1	Subparagraphs editorially redesignated
359	1-2	Subparagraphs editorially redesignated
363	1-5	In subpara. (a), in definition of E_r , Note deleted (12-2123)
369	1-8	(1) In subpara. (a), in definition of E_x , Note deleted (12-2123) (2) In subpara. (b)(3), second paragraph revised (13-2125)
374	1-9	Deleted (11-907)
374	1-10	Deleted (11-907)
375	2-1	In first paragraph of subpara. (a), penultimate sentence revised (15-1228)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
375	2-2	Subparagraphs (d), (d)(1), (d)(2), and (d)(2)(-a) revised (05-768)
376	2-3	In nomenclature, order of definitions of R corrected by errata (16-894)
377	2-4	Subparagraphs editorially redesignated
397	3-2	(1) Definitions of <i>ASME Designated Organization</i> , <i>ASME designee</i> , <i>full vacuum (FV)</i> , and <i>Material Test Report</i> revised (12-603, 13-177, 15-2324) (2) Definitions of <i>completed pressure vessel</i> and <i>pressure vessel part</i> added (12-1734)
408	Mandatory Appendix 5	Title; 5-1(a), 5-1(d), 5-1(f), 5-3(f), 5-4, and 5-5(b) through 5-5(e); and Figures 5-1 and 5-2 revised (16-100)
428	10-5	Revised (12-1755)
429	10-13	(1) Subparagraph (b)(15) added (12-1734) (2) Subparagraph (c) revised (13-1522)
431	11-1	Nomenclature for “For air” equation revised editorially
443	13-5	In definition of E_3 , Note deleted (12-2123)
457	13-12	In subpara. (b)(1), eq. (2) revised (15-2812)
468	17-1	(1) Subparagraphs (a), (d), and (e)(1) revised (15-1847) (2) Subparagraph (b)(8) and last sentence of subpara. (f) added (15-1847)
468	17-2	Subparagraph (c) revised (15-1847)
469	17-4	Last sentence revised (15-1847)
469	17-5	In subpara. (b)(1), cross-references revised (15-1847)
469	17-7	Subparagraphs (a), (a)(2)(-a), (b)(1)(-b), and (c)(1) revised (15-1847)
471	17-8	In first sentence of subpara. (b)(1), cross-references revised (15-1847)
471	17-9	In last sentence, cross-references revised (15-1847)
484	22-2	Revised (07-706)
488	24-1	(1) In subpara. (a), second sentence revised (15-1228) (2) In subpara. (f), last sentence deleted (11-1901)
494	Mandatory Appendix 25	Deleted (13-177)
496	Figure 26-1-1	Illustration (a) revised (14-1629)
497	Figure 26-1-2	Illustration (a) revised (14-1629)
495	26-3	(1) Definitions of E_s , t_{eq} , and subscript s added (14-1629) (2) Definition of S_1''' revised (14-1629) (3) In definition of Y_{sm} , “ $K_{f\epsilon f}$ ” corrected by errata to “ $K_f\epsilon_f$ ” (15-2793)
499	26-4.1	In subpara. (d)(1), last sentence added (16-154)
501	26-6.1	In first paragraph, last sentence added (14-1629)
501	26-6.2	Subparagraphs (e) and (f) added (14-1629)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
501	26-6.3	Paragraphs 26-6.3.1, 26-6.3.2, and 26-6.3.3(a)(1) revised (14-1629, 16-102)
504	26-6.5.2	In subparas. (a) and (b), “ e_{eq} ” revised to “ t_{eq} ” (14-1629)
505	26-7.1	In first paragraph, last sentence added (14-1629)
507	26-7.4.1	In equation, “ N_q ” corrected by errata to “ N_q ” (15-2793)
510	26-8.5.1	Revised (13-360)
519	Form 26-1	Revised (16-154)
520	Form 26-1M	Revised (16-154)
521	27-2	In subpara. (b), definition of E revised (12-2123)
521	27-4	Revised (14-1850)
523	Mandatory Appendix 28	Information relocated to UW-13(f) (15-934)
528	31-4	Title and subparas. (a) and (b) revised (14-2496)
529	Mandatory Appendix 32	Revised in its entirety (16-751)
534	Table 34-1	Entry for 14Cr-16Ni-6Si-Cu-Mo added (07-792)
534	34-2	(1) Paragraphs editorially redesignated (2) Subparagraph (b) added (07-792)
535	Table 34-2	Entry for 14Cr-16Ni-6Si-Cu-Mo added (07-792)
534	34-3	Subparagraph (b) revised (07-792)
537	35-5	Cross-references to Forms revised (16-598)
543	38-2	Revised editorially
544	38-10	Subparagraphs editorially redesignated
546	39-7	Subparagraphs editorially redesignated
550	Mandatory Appendix 41	(1) In 41-1, 41-2, 41-6, and 41-10.1, paragraphs editorially redesignated (2) In 41-5, definition of E revised (12-2123)
557	43-2	Revised (14-1743)
558	44-5	Subparagraphs (a) and (c) revised (15-107)
561	Mandatory Appendix 45	Added (11-923)
570	Nonmandatory Appendix C	Paragraph titles added (16-2177)
571	Nonmandatory Appendix D	Paragraph titles added (16-2177)
572	Nonmandatory Appendix E	Paragraph titles added (16-2177)
573	Nonmandatory Appendix F	Paragraph titles added (16-2177)
574	Nonmandatory Appendix G	Paragraph titles added (16-2177)
580	L-1	Title revised editorially

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
580	L-1.4	Paragraphs redesignated editorially
580	L-11	Deleted (13-855)
585	Figure L-11-1	Deleted (13-855)
585	Figure L-11-2	Deleted (13-855)
585	Figure L-11-3	Deleted (13-855)
594	R-9	P-No. 10F deleted (15-2608, 16-322)
599	W-1	Subparagraph (g) added (13-1858)
599	W-2	First paragraph revised (16-598)
600	Form U-1	Revised (13-1858, 16-1094)
603	Form U-1A	Revised (13-1858, 16-1094)
605	Form U-1B	Revised (13-1858, 16-1094)
606	Form U-1P	(1) Revised (13-1858, 16-1094) (2) In line 5, "VII" corrected by errata to "VIII" (15-2793, 15-2923)
608	Form U-2	Revised (12-1755, 13-1858, 16-1094)
611	Form U-2A	Revised (12-1755, 13-1858, 16-1094)
613	Form U-3	Revised (13-1858, 16-509)
615	Form U-3A	Revised (13-1858, 16-509)
617	Form U-3P	Added (16-509)
619	Form U-4	Revised (13-1858, 16-1094)
620	Form U-5	Revised (13-1858, 16-1094)
621	Table W-3	Revised (13-1858, 14-1595, 14-2388, 16-509, 16-1094)
627	Figure W-3.1	Revised (13-1858, 16-1094)
633	Y-3	In subpara. (a), definition of <i>E</i> revised (12-2123)
646	Nonmandatory Appendix DD	Revised (12-1755, 16-962)
648	Figure DD-1	Updated by ASME Conformity Assessment
654	Nonmandatory Appendix FF	Revised (11-1901)
676	KK-1	Designator and title revised editorially
681	Table KK-1	Under "Instruction," entry for reference no. (7) revised (13-1153)
677	Form U-DR-1	Revised (13-1153)
686	NN-2	Subparagraph (b)(1) revised (11-1901)
689	Table NN-6-1	Revised to include quick-actuating closures (11-1901)

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
05-434	Added Alloy UNS N06025 to Table UNF-23.3. Annulled Code Case 2359-2.
05-768	Revised Mandatory Appendix 2, 2-2(d) per proposal file to use the wording from Section VIII, Division 2 as a common rule.
06-5	Revised UW-40(f) to clarify nominal thickness definitions for purposes of PWHT, to address double-groove welds and tube-to-tubesheet welds. Relocated unnumbered paragraph following UW-40(f)(5)(-h) to new UW-40(f)(7).
06-1384	Revised UG-10 to address the proper and complete recertification process. Deleted recertification by non-Certificate Holders from UG-10(a).
07-218	Added new equations for the calculation of kettle shell stiffness to use in Part UHX.
07-706	Revised Table UCS-23, and UF-12 and 22-2.
07-713	Added SA 995, Grade 4A to Table UHA-23.
07-792	Added UNS S38815 to Table UHA-23 and Mandatory Appendix 34.
09-619	Added a sentence to last paragraph of U-4.
10-1307	Revised UG-99(b) and UG-100(b) to use the term “pressure-boundary materials.”
10-1689	Redesignated current UW-9(c) as UW-9(c)(1). Added UW-9(c)(2). Added new Figure UW-9.1.
10-1703	Revised UHA-51(a)(3) to increase the FN limit of 316L.
11-737	In various paragraphs, deleted the word “certified” with regard to Material Test Reports.
11-907	Deleted references to 1-9 and 1-10 in UG-36. Deleted 1-9 in its entirety. Deleted 1-10 in its entirety.
11-923	Added new Mandatory Appendix 45 on plate heat exchangers.
11-1276	Added SA/EN 10028-2, Grade 13CrMo4-5 to Table UCS-23.
11-1693	Added new paragraphs to UHX-16 and UHX-17.
11-1901	Revised UG-35.2 to redefine and update rules for quick-actuating closures. Added a new UG-35.3 to define and create rules for quick-opening closures. Revised Nonmandatory Appendix FF to address both quick-actuating and quick-opening closures.
11-2106	Revised paragraph references in U-1(f). Deleted UW-65, UF-125, UB-60, UCS-125, UNF-125, UHA-65, UCI-125, UCL-60, UCD-125, UHT-125, ULW-125, and UIG-125. Retitled, revised paragraph reference, and incorporated common language in ULT-125. Revised UIG-22.
12-603	Revised UG-93(a)(1)(-b). Revised Mandatory Appendix 3 definition of “Material Test Report.”
12-1472	Deleted current set pressure adjustment requirements in UG-126(c) and replaced it with a new UG-136(g) that provides more detailed requirements, including guidance for completing Form UV-1. Redesignated UG-126(d) as UG-126(c) due to deletion of UG-126(c).
12-1734	Revised UG-120(c) by adding requirements for transfer of parts between Certificate Holders within the same organization. Added a new endnote describing the term “organization” as used in UG-120(c). Revised Mandatory Appendix 3 to add new definitions of “completed pressure vessel” and “pressure vessel part.” Added 10-13(b)(15).
12-1755	Established a new Certificate of Authorization for organizations fabricating parts without design responsibility. Revised UG-116, UG-117, UG-120, UHT-115, ULW-90, UIG-116, UIG-120, 10-5, Figures UG-116 and UG-118, and Nonmandatory Appendices W and DD.
12-2123	Added new UG-4(h) that specifies the use of physical properties in Section VIII, Division 1. Revised notes in UF-27(b), 27-2, 41-5, and Y-3. Deleted notes in UHX-11.3, UHX-12.3, UHX-13.3, UHX-14.3, 1-5(a), 1-8(a), and 13-5.
13-177	Added reference to ASME CA-1 (latest edition) to Table U-3. Replaced conformity assessment requirements in UG-117 and UG-131 with references to ASME CA-1. Replaced definitions in Mandatory Appendix 3 with references to ASME CA-1. Deleted Mandatory Appendix 25 (rules for acceptance of testing labs, which are now published in ASME CA-1).
13-360	Revised 26-8.5 to state the following: “Toroidal bellows designed per the rules of this Division are suitable for external design pressures up to 15 psi (103 kPa) or full vacuum. For external design pressures greater than 15 psi (103 kPa), see U-2(g).”
13-567	Revised the text of UHA-51(b) to eliminate conflicts with the requirements of UG-82(h) and UHA-51(d).

Record Number	Change
13-597	Revised Figure UCS-66.3, illustrations (d) and (e) to clarify the governing thickness with flat components.
13-855	Added reference to ASME PTB-4 in Figure UG-118. Deleted nameplate examples from Nonmandatory Appendix L.
13-959	Revised UG-16(c) on plate tolerance. Revised UG-79(d)(2), UG-90(b)(6), UG-96(a), UG-99(a)(1), and UW-35(b)(1) to use design thickness as appropriate.
13-1029	Revised UW-2(a) to exempt lethal service butt welds in stiffening rings designed per UG-29 from radiographic examination.
13-1110	Added "SA-299" to Note (2) and "SA-299 if normalized" to Note (4) of the Impact Exemption Curve notes in Figures UCS-66 and UCS-66M.
13-1153	Editorially revised Nonmandatory Appendix KK, Form U-DR-1.
13-1522	Revised 10-13(c) concerning the UM Designator.
13-1562	Added removal and destruction of interfering Certification Marked nameplates to UG-116(h)(4). Created Code Case for immediate application.
13-1751	Added UG-138(d)(6) to provide seat tightness requirements for pin devices.
13-1858	Revised UG-120(a)(2) and Nonmandatory Appendix W.
13-2125	Revised the cylinder length factor in 1-8(b)(3) from 1.4 to 2.0.
13-2222	Revised the front guidance on interpretations in its entirety.
14-43	Added UNS N10362 to Table UNF-23.3.
14-305	Revised wording of UG-136(d)(4)(-a)(-6) from "hydraulic or pneumatic lift assist device" to "auxiliary lift-assist device."
14-645	Revised UG-120(c) to clarify who signs the Form U-1 if there are both shop and field components to assembly of a pressure vessel.
14-654	Revised UG-136(c)(3)(-d), UG-137(c)(3)(-d), and UG-138(c)(3)(-d) to clarify actions that need to be taken within the 60-day period following a failure of replacement valves.
14-1065	Deleted UNS Nos. N08024 and N08026 from Table UNF-23.3.
14-1176	Added "and (c)" after "Except as permitted in (b)" in first sentence of UHT-28. Added UHT-28(c) for minor attachments.
14-1271	Revised UG-93(d)(4)(-a) and UG-93(d)(4)(-c) to update sketches referenced in Figure UW-13.2.
14-1493	Revised UW-9(a) to clarify the weld joint types covered in Part UW. Corrected the UW-27(b) reference in UW-9(a) to UW-27(a)(2).
14-1595	Revised Table W-3, reference no. (73) to be consistent with Section VIII, Division 2, Table 2-D.1, note no. (54).
14-1629	In Mandatory Appendix 26, added new rules for bellows internally attached to the shell.
14-1743	Revised 43-2.
14-1745	Revised UG-36(b)(1), UG-53(h)(1), UG-53(h)(2), and 1-10(d) to update metric conversions.
14-1826	Revised UW-11(a)(8), UW-11(d), UW-12, UW-51(a)(4), and UW-53 to clarify when manual and automated UT examination methods are acceptable.
14-1850	Added UG-99(k)(4) and 27-4(b).
14-2052	Revised Figure UW-13.4, Note (1) to indicate that t_n shall not be less than that required by UG-45.
14-2074	Reformatted UCS-68(b)(2) into UCS-68(b)(2)(-a) and UCS-68(b)(2)(-b). Retained existing requirements of UCS-68(b)(2), and in the new UCS-68(b)(2)(-b), clarified that PWHT is not mandatory for tube-to-tubesheet seal welds defined per UW-20.2(c).
14-2153	Revised dimension lines in Figure UG-84.
14-2383	Added SA-307, Grade A to Table UCS-23.
14-2388	Revised Table W-3, reference no. (53).
14-2389	Revised UG-11(c)(5) to provide an exemption to the requirement for a Material Test Report for ASME product standard parts.
14-2496	Revised the title of 31-4 and the first sentence of 31-4(a). Added a sentence after the first sentence of 31-4(b).
14-2499	Corrected the reference in UG-135(a) to UG-125(a)(3).
15-107	Revised 44-5(a) to specify that static head is to be included in the design pressure, P , and revised 44-5(c) to specify that cold stretch pressure, P_c , shall be measured at the top of the vessel during cold stretching.

Record Number	Change
15-587	Added SA/EN 10216-2 P235GH, P265GH, 16Mo3, 13CrMo4-5, and 10CrMo9-10 to Table UCS-23.
15-934	Incorporated the provisions of Mandatory Appendix 28 into new UW-13(f). Redesignated remaining UW-13 paragraphs. Corrected references to UW-13 subparagraphs. Deleted Mandatory Appendix 28.
15-1112	Errata correction. See Summary of Changes for details.
15-1228	Revised 2-1 and 24-1.
15-1229	Revised UCS-56(d)(2).
15-1266	Corrected reference in endnote 81.
15-1523	Revised UW-34 to permit spin-holes not exceeding the size limitations of UG-36(c)(3)(-a).
15-1551	Revised UW-2(a) to clarify that RT is to be performed in accordance with UW-51.
15-1579	Revised UCS-56(d)(5) to implement thermal gradient limitations during the cooling phase of the PWHT process.
15-1586	Revised references in UG-34 and UHX-9.3.
15-1605	Revised UHX-4(b) to indicate that standard flanges (see UG-44) are no longer standard and need supporting calculations when pass partitions are present.
15-1725	Revised UG-16(d) regarding methods for including provision for the allowed manufacturing undertolerance in determining the selected pipe thickness used in design.
15-1843	Deleted reference to ACCP CP-1 in Table U-3.
15-1847	In Mandatory Appendix 17, moved all figures to the end of the Appendix. Added 17-1(b)(8) to incorporate Code Case 2829 and added reference to 17-1(b)(8) anywhere 17-1(b)(6) was cited. In 17-1(f), added a new sentence to incorporate Code Case 2424. In 17-2(c), changed "impact test" to "qualification with toughness testing." In 17-4, changed "0.045 in." to "0.030 in." to incorporate Code Case 2507. Updated 17-7 to incorporate changes desired in Item 10-111. Changed "inspection" to "examination" in three places.
15-2021	Revised UG-84(h)(3) and added new UG-84(h)(5) to address testing requirements for impact test qualifications of multiple-process welding procedures.
15-2173	Revised UG-46(a) to indicate exemptions to the requirement for inspection openings on the shell side of some shell-and-tube heat exchangers.
15-2324	Revised UG-28(f), and in 3-2, revised metric definition of full vacuum (FV) to 103 kPa.
15-2352	Revised Tables UCS-56-2, UCS-56-3, and UCS-56-4 to add PWHT exemptions for tube-to-tubesheet seal welds.
15-2473	Revised UW-40(d) to provide informative guidance on PWHT of dissimilar metal weld joints.
15-2553	In Table UCS-56-11, revised the minimum PWHT temperature from 1,350°F (730°C) to 1,300°F (705°C) and the minimum holding temperature in Note (1) from 1,325°F (720°C) to 1,250°F (675°C).
15-2591	Changed "nonmagnetic" to "nonferromagnetic" in UG-93(d)(3), UW-13(b)(4)(-c), UF-31(b)(1)(-a), UF-32(b)(4), UHT-57(e), and endnote 71. Deleted hyphen from "nonferromagnetic" in UW-11(e)(3).
15-2605	Revised Table U-3 and UW-54 to reference Section V, Article 1, T-120(e), T-120(f), T-120(g), T-120(h), or T-120(i), as applicable, for NDE personnel qualification and certification requirements.
15-2608	In Table UCS-57 and R-9, deleted references to P-No. 10F. Deleted Table UCS-56-10, which addressed PWHT for P-No. 10F.
15-2779	Revised wording of UW-5(b)(3) and UW-5(c) to clarify meaning.
15-2793	Errata correction. See Summary of Changes for details.
15-2812	Modified 13-12, eq. (2).
15-2923	Errata correction. See Summary of Changes for details.
16-54	Revised wording in the column heading of Table UG-84.2, for consistency with Section VIII, Division 2, Table 3.11.
16-100	Updated Mandatory Appendix 5, specifically Figures 5-1 and 5-2, to include corner-corner and flued-only flexible shell element expansion joints and to allow thin liners. Generalized the terminology from "flanged-and-flued or flanged-only" to "flexible shell element" expansion joints in UHX-17 and Mandatory Appendix 5. Added references to "outer shell elements," the cylinder between flexible elements, to 5-3(f), 5-4(b), 5-4(c), 5-4(d), 5-5(c), and Figures 5-1 and 5-2.

Record Number	Change
	Separated fabrication requirements for welds within the flexible element from welds attaching the flexible element to the shell in 5-4(a) and 5-4(b). Clarified flexible shell element corner weld categorization, design, and fillet sizing in UW-3 and 5-4(b)(2). Added permission to use a thin liner in 5-4(c). Added requirement for welds to Type 1 butts in the shell adjacent to the flexible element in 5-4(d). Separated inspection requirements for welds within the flexible element from welds attaching the flexible element to the shell in 5-5(b) and 5-5(c).
16-102	Revised 26-6.3.3(a)(1) to restrict circumferential membrane stress in end convolution of externally attached bellows to short tangents.
16-134	Inserted the words “other than bolting materials” between the words “Materials” and “having” in UCS-66(f).
16-154	Revised UHX-18, 26-4.1(d)(1), and Forms 26-1 and 26.1M to ensure that bellows expansion joints are properly hydrotested.
16-322	Deleted references to P-No.10F where they appear in Section VIII, Division 1. Deleted Table UCS-56-10, the last line of Table UCS-57, and the preheat line under the heading of R-9.
16-509	Added new Form U-3P to Nonmandatory Appendix W.
16-532	Revised Table U-3 to update year of acceptable edition for those standards that were reviewed.
16-538	Revised “UHA-108” to “UHA-110” in Table UHA-32-3 and added UHA-110.
16-598	Added references to Form U-1P in U-2, UG-120, Mandatory Appendix 35, and Nonmandatory Appendix W. Added references to Form U-3P in UG-117 and UG-120.
16-661	Deleted endnote 75.
16-751	Revised 32-3 through 32-8. Added new 32-4 and 32-5, and revised all figures showing head-to-shell details.
16-894	Errata correction. See Summary of Changes for details.
16-962	Revised Nonmandatory Appendix DD.
16-991	Revised UHX-9.3 and UHX-9.5 by replacing S with S_{fe} in the nomenclature and in both equations of UHX-9.5.
16-1087	Revised Table UHA-23 to correct an error.
16-1094	Changed “National Board (inc. endorsements)” to “National Board Authorized Inspector Commission number” on all Manufacturer’s Data Reports. Changed “Commissions and endorsements” to “Commissions” and added “National Board Authorized Inspector Commission number” on Form U-1B.
16-1250	Revised UG-37 to change the term “telltale hole” to “vent hole.”
16-1270	Revised UW-16(f)(3)(-a)(-6) and title of Table UW-16.1.
16-1520	Revised UW-51(a)(1) through UW-51(a)(3) to clarify the acceptability of radiographic examination techniques other than film-based radiography.
16-2176	Errata correction. See Summary of Changes for details.
16-2177	Added titles to the paragraphs in Nonmandatory Appendices C, D, E, F, and G.
16-2185	Revised Table U-3 to include ASME PTB-4, and in Figure UG-118, deleted the title of ASME PTB-4.

CROSS-REFERENCING AND STYLISTIC CHANGES IN THE BOILER AND PRESSURE VESSEL CODE

There have been structural and stylistic changes to BPVC, starting with the 2011 Addenda, that should be noted to aid navigating the contents. The following is an overview of the changes:

Subparagraph Breakdowns/Nested Lists Hierarchy

- First-level breakdowns are designated as (a), (b), (c), etc., as in the past.
- Second-level breakdowns are designated as (1), (2), (3), etc., as in the past.
- Third-level breakdowns are now designated as (-a), (-b), (-c), etc.
- Fourth-level breakdowns are now designated as (-1), (-2), (-3), etc.
- Fifth-level breakdowns are now designated as (+a), (+b), (+c), etc.
- Sixth-level breakdowns are now designated as (+1), (+2), etc.

Footnotes

With the exception of those included in the front matter (roman-numbered pages), all footnotes are treated as endnotes. The endnotes are referenced in numeric order and appear at the end of each BPVC section/subsection.

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees has been moved to the front matter. This information now appears in all Boiler Code Sections (except for Code Case books).

Cross-References

It is our intention to establish cross-reference link functionality in the current edition and moving forward. To facilitate this, cross-reference style has changed. Cross-references within a subsection or subarticle will not include the designator/identifier of that subsection/subarticle. Examples follow:

- *(Sub-)Paragraph Cross-References.* The cross-references to subparagraph breakdowns will follow the hierarchy of the designators under which the breakdown appears.
 - If subparagraph (-a) appears in X.1(c)(1) and is referenced in X.1(c)(1), it will be referenced as (-a).
 - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(c)(2), it will be referenced as (1)(-a).
 - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
 - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).
- *Equation Cross-References.* The cross-references to equations will follow the same logic. For example, if eq. (1) appears in X.1(a)(1) but is referenced in X.1(b), it will be referenced as eq. (a)(1)(1). If eq. (1) appears in X.1(a)(1) but is referenced in a different subsection/subarticle/paragraph, it will be referenced as eq. X.1(a)(1)(1).

INTRODUCTION

U-1 SCOPE

(a) See below.

(1) The Foreword provides the basis for the rules described in this Division.

(2) For the scope of this Division, pressure vessels are containers for the containment of pressure, either internal or external. This pressure may be obtained from an external source, or by the application of heat from a direct or indirect source, or any combination thereof.

(3) This Division contains mandatory requirements, specific prohibitions, and nonmandatory guidance for pressure vessel materials, design, fabrication, examination, inspection, testing, certification, and pressure relief. The Code does not address all aspects of these activities, and those aspects which are not specifically addressed should not be considered prohibited. Engineering judgment must be consistent with the philosophy of this Division, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of this Division. See also informative and nonmandatory guidance regarding metallurgical phenomena in Section II, Part D, Nonmandatory Appendix A.

(b) This Division is divided into three Subsections, Mandatory Appendices, and Nonmandatory Appendices. **Subsection A** consists of **Part UG**, covering the general requirements applicable to all pressure vessels. **Subsection B** covers specific requirements that are applicable to the various methods used in the fabrication of pressure vessels. It consists of **Parts UW, UF, and UB** dealing with welded, forged, and brazed methods, respectively. **Subsection C** covers specific requirements applicable to the several classes of materials used in pressure vessel construction. It consists of **Parts UCS, UNF, UHA, UCI, UCL, UCD, UHT, ULW, ULT**, and **Part UIG** dealing with carbon and low alloy steels, nonferrous metals, high alloy steels, cast iron, clad and lined material, cast ductile iron, ferritic steels with properties enhanced by heat treatment, layered construction, low temperature materials, and impregnated graphite, respectively. Section II, Part D also contains tables of maximum allowable stress values for these classes of materials, except for impregnated graphite.

The Mandatory Appendices address specific subjects not covered elsewhere in this Division, and their requirements are mandatory when the subject covered is included in construction under this Division. The Nonmandatory Appendices provide information and suggested good practices.

(c) See below.

(1) The scope of this Division has been established to identify the components and parameters considered in formulating the rules given in this Division. Laws or regulations issued by municipality, state, provincial, federal, or other enforcement or regulatory bodies having jurisdiction at the location of an installation establish the mandatory applicability of the Code rules, in whole or in part, within their jurisdiction. Those laws or regulations may require the use of this Division of the Code for vessels or components not considered to be within its Scope. These laws or regulations should be reviewed to determine size or service limitations of the coverage which may be different or more restrictive than those given here.

(2) Based on the Committee's consideration, the following classes of vessels are not included in the scope of this Division; however, any pressure vessel which meets all the applicable requirements of this Division may be stamped with the Certification Mark with the U Designer:

(-a) those within the scope of other Sections;

(-b) fired process tubular heaters;

(-c) pressure containers which are integral parts or components of rotating or reciprocating mechanical devices, such as pumps, compressors, turbines, generators, engines, and hydraulic or pneumatic cylinders where the primary design considerations and/or stresses are derived from the functional requirements of the device;

(-d) structures whose primary function is the transport of fluids from one location to another within a system of which it is an integral part, that is, piping systems;

(-e) piping components, such as pipe, flanges, bolting, gaskets, valves, expansion joints, and fittings, and the pressure-containing parts of other components, such as strainers and devices which serve such purposes as mixing, separating, snubbing, distributing, and metering or controlling flow, provided that pressure-containing parts of such components are generally recognized as piping components or accessories;

(-f) a vessel for containing water¹ under pressure, including those containing air the compression of which serves only as a cushion, when none of the following limitations are exceeded:

(-1) a design pressure of 300 psi (2 MPa);

(-2) a design temperature of 210°F (99°C);

(-g) a hot water supply storage tank heated by steam or any other indirect means when none of the following limitations is exceeded: