

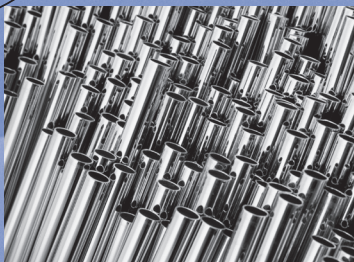
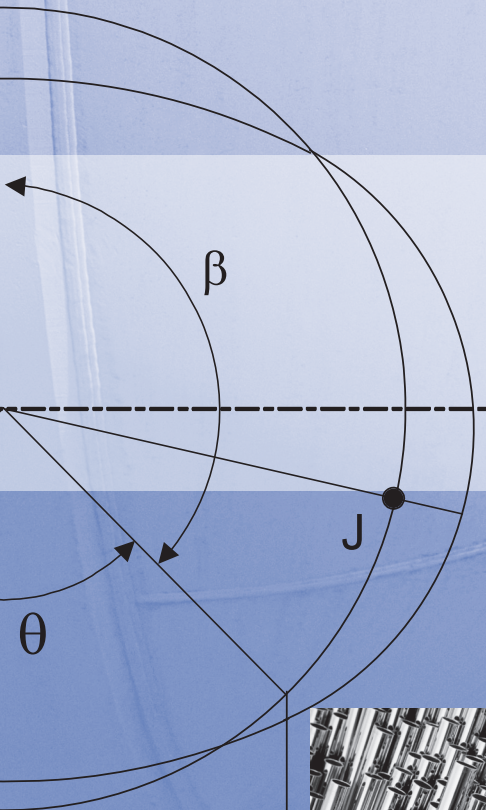
# 2010 ASME Boiler and Pressure Vessel Code

AN INTERNATIONAL CODE

## VIII

### Division 1

# Rules for Construction of Pressure Vessels



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AN INTERNATIONAL CODE

# 2010 ASME Boiler & Pressure Vessel Code

2010 Edition

July 1, 2010

## VIII

### Division 1

## RULES FOR CONSTRUCTION OF PRESSURE VESSELS

ASME Boiler and Pressure Vessel Committee on Pressure Vessels



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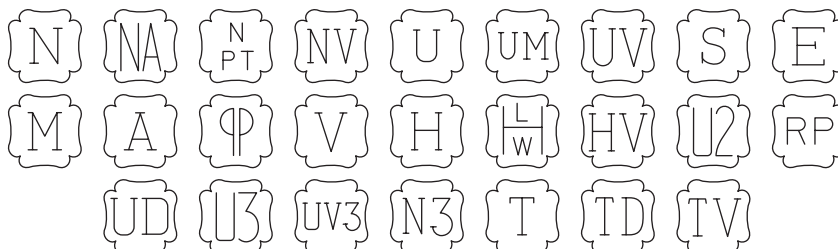
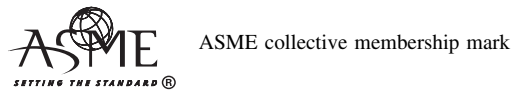
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2011a Addenda

July 1, 2011

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# CONTENTS

List of Sections .....	xxv
Foreword .....	xxvii
Statement of Policy on the Use of the Certification Mark and Code Authorization in Advertising .....	xxix
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items .....	xxix
Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee — Mandatory .....	xxx
Personnel .....	xxxii
Summary of Changes .....	xlv
List of Changes in Record Number Order .....	li
<b>Introduction</b> .....	1
<b>SUBSECTION A GENERAL REQUIREMENTS</b> .....	8
<b>Part UG General Requirements for All Methods of Construction and All Materials</b> .....	8
UG-1 Scope .....	8
<b>Materials</b>	
UG-4 General .....	8
UG-5 Plate .....	9
UG-6 Forgings .....	9
UG-7 Castings .....	9
UG-8 Pipe and Tubes .....	9
UG-9 Welding Materials .....	10
UG-10 Material Identified With or Produced to a Specification Not Permitted by This Division, and Material Not Fully Identified .....	10
UG-11 Prefabricated or Preformed Pressure Parts Furnished Without a Certification Mark .....	11
UG-12 Bolts and Studs .....	14
UG-13 Nuts and Washers .....	14
UG-14 Rods and Bars .....	14
UG-15 Product Specification .....	14
<b>Design</b>	
UG-16 General .....	14
UG-17 Methods of Fabrication in Combination .....	15
UG-18 Materials in Combination .....	15
UG-19 Special Constructions .....	15
UG-20 Design Temperature .....	16
UG-21 Design Pressure .....	17
UG-22 Loadings .....	17
UG-23 Maximum Allowable Stress Values .....	17
UG-24 Castings .....	19
UG-25 Corrosion .....	19
UG-26 Linings .....	20



UG-27	Thickness of Shells Under Internal Pressure .....	20
UG-28	Thickness of Shells and Tubes Under External Pressure.....	21
UG-29	Stiffening Rings for Cylindrical Shells Under External Pressure .....	24
UG-30	Attachment of Stiffening Rings.....	26
UG-31	Tubes, and Pipe When Used as Tubes or Shells.....	28
UG-32	Formed Heads, and Sections, Pressure on Concave Side .....	30
UG-33	Formed Heads, Pressure on Convex Side .....	31
UG-34	Unstayed Flat Heads and Covers .....	34
UG-35	Other Types of Closures .....	38

### Openings and Reinforcements

UG-36	Openings in Pressure Vessels.....	39
UG-37	Reinforcement Required for Openings in Shells and Formed Heads .....	42
UG-38	Flued Openings in Shells and Formed Heads .....	45
UG-39	Reinforcement Required for Openings in Flat Heads.....	45
UG-40	Limits of Reinforcement .....	47
UG-41	Strength of Reinforcement .....	47
UG-42	Reinforcement of Multiple Openings .....	52
UG-43	Methods of Attachment of Pipe and Nozzle Necks to Vessel Walls .....	53
UG-44	Flanges and Pipe Fittings .....	54
UG-45	Nozzle Neck Thickness .....	55
UG-46	Inspection Openings.....	55

### Braced and Stayed Surfaces

UG-47	Braced and Stayed Surfaces .....	57
UG-48	Staybolts .....	58
UG-49	Location of Staybolts.....	58
UG-50	Dimensions of Staybolts .....	58

### Ligaments

UG-53	Ligaments .....	58
UG-54	Supports .....	60
UG-55	Lugs for Platforms, Ladders, and Other Attachments to Vessel Walls .....	60

### Fabrication

UG-75	General .....	63
UG-76	Cutting Plates and Other Stock .....	63
UG-77	Material Identification (See UG-85).....	63
UG-78	Repair of Defects in Materials.....	63
UG-79	Forming Shell Sections and Heads.....	63
UG-80	Permissible Out-of-Roundness of Cylindrical, Conical, and Spherical Shells.....	64
UG-81	Tolerance for Formed Heads .....	65
UG-82	Lugs and Fitting Attachments .....	66
UG-83	Holes for Screw Stays .....	66
UG-84	Charpy Impact Tests .....	66
UG-85	Heat Treatment .....	72

### Inspection and Tests

UG-90	General .....	72
UG-91	The Inspector.....	73
UG-92	Access for Inspector.....	73
UG-93	Inspection of Materials .....	73
UG-94	Marking on Materials.....	75
UG-95	Examination of Surfaces During Fabrication .....	75



UG-96	Dimensional Check of Component Parts . . . . .	75
UG-97	Inspection During Fabrication . . . . .	75
UG-98	Maximum Allowable Working Pressure . . . . .	75
UG-99	Standard Hydrostatic Test . . . . .	75
UG-100	Pneumatic Test (See UW-50) . . . . .	77
UG-101	Proof Tests to Establish Maximum Allowable Working Pressure . . . . .	78
UG-102	Test Gages . . . . .	83
UG-103	Nondestructive Testing . . . . .	83

**Marking and Reports**

UG-115	General . . . . .	83
UG-116	Required Marking . . . . .	83
UG-117	Certificates of Authorization and Certification Marks . . . . .	85
UG-118	Methods of Marking . . . . .	87
UG-119	Nameplates . . . . .	87
UG-120	Data Reports . . . . .	88

**Overpressure Protection**

UG-125	General . . . . .	90
UG-126	Pressure Relief Valves . . . . .	91
UG-127	Nonreclosing Pressure Relief Devices . . . . .	91
UG-128	Liquid Pressure Relief Valves . . . . .	94
UG-129	Marking . . . . .	94
UG-130	Code Symbol Stamp . . . . .	96
UG-131	Certification of Capacity of Pressure Relief Devices . . . . .	96
UG-132	Certification of Capacity of Pressure Relief Valves in Combination With Nonreclosing Pressure Relief Devices . . . . .	100
UG-133	Determination of Pressure Relieving Requirements . . . . .	101
UG-134	Pressure Settings and Performance Requirements . . . . .	102
UG-135	Installation . . . . .	102
UG-136	Minimum Requirements for Pressure Relief Valves . . . . .	103
UG-137	Minimum Requirements for Rupture Disk Devices . . . . .	106
UG-138	Minimum Requirements for Pin Devices . . . . .	108
UG-140	Overpressure Protection by System Design . . . . .	110

**Figures**

UG-28	Diagrammatic Representation of Variables for Design of Cylindrical Vessels Subjected to External Pressure . . . . .	21
UG-28.1	Diagrammatic Representation of Lines of Support for Design of Cylindrical Vessels Subjected to External Pressure . . . . .	22
UG-29.1	Various Arrangements of Stiffening Rings for Cylindrical Vessels Subjected to External Pressure . . . . .	27
UG-29.2	Maximum Arc of Shell Left Unsupported Because of Gap in Stiffening Ring of Cylindrical Shell Under External Pressure . . . . .	28
UG-30	Some Acceptable Methods of Attaching Stiffening Rings . . . . .	29
UG-33.1	Length $L_c$ of Some Typical Conical Sections for External Pressure . . . . .	33
UG-34	Some Acceptable Types of Unstayed Flat Heads and Covers . . . . .	36
UG-36	Large Head Openings — Reverse-Curve and Conical Shell-Reducer Sections . . . . .	40
UG-37	Chart for Determining Value of $F$ , as Required in UG-37 . . . . .	42
UG-37.1	Nomenclature and Formulas for Reinforced Openings . . . . .	43
UG-38	Minimum Depth for Flange of Flued-In Openings . . . . .	45
UG-39	Multiple Openings in Rim of Heads With a Large Central Opening . . . . .	48
UG-40	Some Representative Configurations Describing the Reinforcement Dimension $t_e$ and the Opening Dimension $d$ . . . . .	49





UG-41.1	Nozzle Attachment Weld Loads and Weld Strength Paths to Be Considered . . . . .	51
UG-42	Examples of Multiple Openings . . . . .	53
UG-47	Acceptable Proportions for Ends of Stays. . . . .	57
UG-53.1	Example of Tube Spacing With Pitch of Holes Equal in Every Row . . . . .	59
UG-53.2	Example of Tube Spacing With Pitch of Holes Unequal in Every Second Row . . . . .	59
UG-53.3	Example of Tube Spacing With Pitch of Holes Varying in Every Second and Third Row . . . . .	59
UG-53.4	Example of Tube Spacing With Tube Holes on Diagonal Lines. . . . .	60
UG-53.5	Diagram for Determining the Efficiency of Longitudinal and Diagonal Ligaments Between Openings in Cylindrical Shells. . . . .	61
UG-53.6	Diagram for Determining Equivalent Longitudinal Efficiency of Diagonal Ligaments Between Openings in Cylindrical Shells. . . . .	62
UG-80.1	Maximum Permissible Deviation From a Circular Form <i>e</i> for Vessels Under External Pressure . . . . .	64
UG-80.2	Example of Differences Between Maximum and Minimum Inside Diameters in Cylindrical, Conical, and Spherical Shells. . . . .	64
UG-84	Simple Beam Impact Test Specimens (Charpy Type Test). . . . .	66
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 . . . . .	68
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. . . . .	69
UG-116	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard. . . . .	83
UG-118	Form of Stamping. . . . .	88
UG-129.1	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard for Pressure Relief Valves . . . . .	95
UG-129.2	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard for Nonreclosing Pressure Relief Devices . . . . .	96
 <b>Tables</b>		
UG-33.1	Values of Spherical Radius Factor $K_o$ for Ellipsoidal Head With Pressure on Convex Side . . . . .	31
UG-37	Values of Spherical Radius Factor $K_1$ . . . . .	44
UG-43	Minimum Number of Pipe Threads for Connections . . . . .	54
UG-45	Nozzle Minimum Thickness Requirements. . . . .	56
UG-84.2	Charpy Impact Test Temperature Reduction Below Minimum Design Metal Temperature. . . . .	70
UG-84.3	Specifications for Impact Tested Materials in Various Product Forms. . . . .	70
UG-84.4	Impact Test Temperature Differential . . . . .	70
 <b>SUBSECTION B REQUIREMENTS PERTAINING TO METHODS OF FABRICATION OF PRESSURE VESSELS. . . . .</b>		
<b>112</b>		
 <b>Part UW Requirements for Pressure Vessels Fabricated by Welding . . . . .</b>		
<b>112</b>		
 <b>General</b>		
UW-1	Scope . . . . .	112
UW-2	Service Restrictions . . . . .	112
UW-3	Welded Joint Category . . . . .	114



## Materials

UW-5	General .....	114
------	---------------	-----

## Design

UW-8	General .....	115
UW-9	Design of Welded Joints .....	115
UW-10	Postweld Heat Treatment .....	116
UW-11	Radiographic and Ultrasonic Examination .....	116
UW-12	Joint Efficiencies .....	117
UW-13	Attachment Details .....	117
UW-14	Openings in or Adjacent to Welds .....	126
UW-15	Welded Connections .....	126
UW-16	Minimum Requirements for Attachment Welds at Openings .....	127
UW-17	Plug Welds .....	137
UW-18	Fillet Welds .....	138
UW-19	Welded Stayed Construction .....	138
UW-20	Tube-to-Tubesheet Welds .....	139
UW-21	ASME B16.5 Socket and Slip-On Flange Welds .....	141

## Fabrication

UW-26	General .....	141
UW-27	Welding Processes .....	142
UW-28	Qualification of Welding Procedure .....	143
UW-29	Tests of Welders and Welding Operators .....	143
UW-30	Lowest Permissible Temperatures for Welding .....	143
UW-31	Cutting, Fitting, and Alignment .....	144
UW-32	Cleaning of Surfaces to Be Welded .....	144
UW-33	Alignment Tolerance .....	144
UW-34	Spin-Holes .....	145
UW-35	Finished Longitudinal and Circumferential Joints .....	145
UW-36	Fillet Welds .....	145
UW-37	Miscellaneous Welding Requirements .....	145
UW-38	Repair of Weld Defects .....	146
UW-39	Peening .....	146
UW-40	Procedures for Postweld Heat Treatment .....	147
UW-41	Sectioning of Welded Joints .....	148
UW-42	Surface Weld Metal Buildup .....	148

## Inspection and Tests

UW-46	General .....	149
UW-47	Check of Welding Procedure .....	149
UW-48	Check of Welder and Welding Operator Qualifications .....	149
UW-49	Check of Postweld Heat Treatment Practice .....	149
UW-50	Nondestructive Examination of Welds on Pneumatically Tested Vessels .....	149
UW-51	Radiographic Examination of Welded Joints .....	149
UW-52	Spot Examination of Welded Joints .....	150
UW-53	Technique for Ultrasonic Examination of Welded Joints .....	151
UW-54	Qualification of Nondestructive Examination Personnel .....	151

## Marking and Reports

UW-60	General .....	151
-------	---------------	-----



## Pressure Relief Devices

UW-65	General .....	151
-------	---------------	-----

## Figures

UW-3	Illustration of Welded Joint Locations Typical of Categories A, B, C, and D.....	114
UW-9	Butt Welding of Plates of Unequal Thickness.....	115
UW-13.1	Heads Attached to Shells .....	120
UW-13.2	Attachment of Pressure Parts to Flat Plates to Form a Corner Joint.....	124
UW-13.3	Typical Pressure Parts With Butt Welded Hubs .....	125
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 .....	137
UW-19.1	Typical Forms of Welded Staybolts .....	138
UW-19.2	Use of Plug and Slot Welds for Staying Plates.....	139
UW-20.1	Some Acceptable Types of Tube-to-Tubesheet Strength Welds .....	140
UW-21	Typical Details for Slip-On and Socket Welded Flange Attachment Welds....	142

## Tables

UW-12	Maximum Allowable Joint Efficiencies for Arc and Gas Welded Joints.....	118
UW-16.1	Minimum Thickness Required by UW-16(f)(3)(a)(6).....	134
UW-33	.....	144

<b>Part UF</b>	<b>Requirements for Pressure Vessels Fabricated by Forging .....</b>	<b>152</b>
----------------	----------------------------------------------------------------------	------------

## General

UF-1	Scope .....	152
------	-------------	-----

## Materials

UF-5	General .....	152
UF-6	Forgings .....	152
UF-7	Forged Steel Rolls Used for Corrugating Paper Machinery .....	152

## Design

UF-12	General .....	152
UF-13	Head Design.....	153
UF-25	Corrosion Allowance.....	153

## Fabrication

UF-26	General .....	153
UF-27	Tolerances on Body Forgings .....	153
UF-28	Methods of Forming Forged Heads .....	153
UF-29	Tolerance on Forged Heads .....	153
UF-30	Localized Thin Areas.....	154
UF-31	Heat Treatment .....	154
UF-32	Welding for Fabrication .....	154
UF-37	Repair of Defects in Material.....	155
UF-38	Repair of Weld Defects.....	156
UF-43	Attachment of Threaded Nozzles to Integrally Forged Necks and Thickened Heads on Vessels.....	156



## Inspection and Tests

UF-45	General .....	156
UF-46	Acceptance by Inspector .....	156
UF-47	Parts Forging .....	156
UF-52	Check of Heat Treatment and Postweld Heat Treatment.....	156
UF-53	Test Specimens .....	157
UF-54	Tests and Retests.....	157
UF-55	Ultrasonic Examination .....	157

## Marking and Reports

UF-115	General .....	157
--------	---------------	-----

## Pressure Relief Devices

UF-125	General .....	157
--------	---------------	-----

## Part UB Requirements for Pressure Vessels Fabricated by Brazing .....

### General

UB-1	Scope .....	158
UB-2	Elevated Temperature .....	158
UB-3	Service Restrictions .....	158

### Materials

UB-5	General .....	158
UB-6	Brazing Filler Metals.....	158
UB-7	Fluxes and Atmospheres.....	158

### Design

UB-9	General .....	158
UB-10	Strength of Brazed Joints .....	159
UB-11	Qualification of Brazed Joints for Design Temperatures up to the Maximum Shown in Column 1 of Table UB-2.....	159
UB-12	Qualification of Brazed Joints for Design Temperatures in the Range Shown in Column 2 of Table UB-2.....	159
UB-13	Corrosion .....	159
UB-14	Joint Efficiency Factors.....	159
UB-15	Application of Brazing Filler Metal .....	160
UB-16	Permissible Types of Joints .....	160
UB-17	Joint Clearance .....	160
UB-18	Joint Brazing Procedure .....	161
UB-19	Openings.....	161
UB-20	Nozzles .....	161
UB-21	Brazed Connections .....	162
UB-22	Low Temperature Operation.....	162

### Fabrication

UB-30	General .....	162
UB-31	Qualification of Brazing Procedure.....	162
UB-32	Qualification of Brazers and Brazing Operators .....	163
UB-33	Buttstraps .....	163
UB-34	Cleaning of Surfaces to Be Brazed.....	163
UB-35	Clearance Between Surfaces to Be Brazed.....	163



UB-36	Postbrazing Operations .....	163
UB-37	Repair of Defective Brazing.....	163
<b>Inspection and Tests</b>		
UB-40	General .....	163
UB-41	Inspection During Fabrication .....	164
UB-42	Procedure .....	164
UB-43	Brazer and Brazing Operator .....	164
UB-44	Visual Examination .....	164
UB-50	Exemptions.....	164
<b>Marking and Reports</b>		
UB-55	General .....	164
<b>Pressure Relief Devices</b>		
UB-60	General .....	164
<b>Figures</b>		
UB-14	Examples of Filler Metal Application .....	160
UB-16	Some Acceptable Types of Brazed Joints.....	161
<b>Tables</b>		
UB-2	Maximum Design Temperatures for Brazing Filler Metal .....	159
UB-17	Recommended Joint Clearances at Brazing Temperature .....	161
<b>SUBSECTION C</b>	<b>REQUIREMENTS PERTAINING TO CLASSES OF MATERIALS.....</b>	<b>165</b>
<b>Part UCS</b>	<b>Requirements for Pressure Vessels Constructed of Carbon and Low Alloy Steels.....</b>	<b>165</b>
<b>General</b>		
UCS-1	Scope .....	165
<b>Materials</b>		
UCS-5	General .....	165
UCS-6	Steel Plates .....	166
UCS-7	Steel Forgings .....	166
UCS-8	Steel Castings .....	166
UCS-9	Steel Pipe and Tubes .....	166
UCS-10	Bolt Materials .....	166
UCS-11	Nuts and Washers.....	166
UCS-12	Bars and Shapes .....	168
<b>Design</b>		
UCS-16	General .....	168
UCS-19	Welded Joints .....	168
UCS-23	Maximum Allowable Stress Values .....	168
UCS-27	Shells Made From Pipe.....	168
UCS-28	Thickness of Shells Under External Pressure.....	168
UCS-29	Stiffening Rings for Shells Under External Pressure .....	168
UCS-30	Attachment of Stiffening Rings to Shell .....	168
UCS-33	Formed Heads, Pressure on Convex Side .....	168
UCS-56	Requirements for Postweld Heat Treatment.....	168
UCS-57	Radiographic Examination .....	178





## Low Temperature Operation

UCS-65	Scope .....	179
UCS-66	Materials .....	179
UCS-67	Impact Tests of Welding Procedures .....	184
UCS-68	Design .....	190

## Fabrication

UCS-75	General .....	194
UCS-79	Forming Shell Sections and Heads .....	194
UCS-85	Heat Treatment of Test Specimens .....	194

## Inspection and Tests

UCS-90	General .....	195
--------	---------------	-----

## Marking and Reports

UCS-115	General .....	195
---------	---------------	-----

## Pressure Relief Devices

UCS-125	General .....	195
---------	---------------	-----

## Nonmandatory Appendix CS

UCS-150	General .....	195
UCS-151	Creep-Rupture Properties of Carbon Steels .....	195
UCS-160	Vessels Operating at Temperatures Colder Than the MDMT Stamped on the Nameplate .....	195

## Figures

UCS-66	Impact Test Exemption Curves .....	180
UCS-66M	Impact Test Exemption Curves .....	183
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

## Tables

UCS-23	Carbon and Low Alloy Steel .....	167
UCS-56	Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels .....	170
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 Fig. UCS-66 and Fig. UCS-66M .....	185

## Part UNF Requirements for Pressure Vessels Constructed of Nonferrous Materials

<b>General</b>		
UNF-1	Scope .....	196
UNF-3	Uses .....	196
UNF-4	Conditions of Service .....	196



## Materials

UNF-5	General .....	196
UNF-6	Nonferrous Plate .....	196
UNF-7	Forgings .....	196
UNF-8	Castings .....	196
UNF-12	Bolt Materials .....	196
UNF-13	Nuts and Washers .....	197
UNF-14	Rods, Bars, and Shapes .....	197
UNF-15	Other Materials .....	197

## Design

UNF-16	General .....	197
UNF-19	Welded Joints .....	197
UNF-23	Maximum Allowable Stress Values .....	197
UNF-28	Thickness of Shells Under External Pressure .....	201
UNF-30	Stiffening Rings .....	201
UNF-33	Formed Heads, Pressure on Convex Side .....	201
UNF-56	Postweld Heat Treatment .....	201
UNF-57	Radiographic Examination .....	202
UNF-58	Liquid Penetrant Examination .....	202
UNF-65	Low Temperature Operation .....	202

## Fabrication

UNF-75	General .....	202
UNF-77	Forming Shell Sections and Heads .....	203
UNF-78	Welding .....	203
UNF-79	Requirements for Postfabrication Heat Treatment Due to Straining .....	203

## Inspection and Tests

UNF-90	General .....	204
UNF-91	Requirements for Penetrameter .....	204
UNF-95	Welding Test Plates .....	204

## Marking and Reports

UNF-115	General .....	204
---------	---------------	-----

## Pressure Relief Devices

UNF-125	General Vessels .....	204
---------	-----------------------	-----

## Appendix NF

	<b>Characteristics of the Nonferrous Materials (Informative and Nonmandatory) .....</b>	<b>204</b>
NF-1	Purpose .....	204
NF-2	General .....	204
NF-3	Properties .....	205
NF-4	Magnetic Properties .....	205
NF-5	Elevated Temperature Effects .....	205
NF-6	Low Temperature Behavior .....	205
NF-7	Thermal Cutting .....	205
NF-8	Machining .....	205
NF-9	Gas Welding .....	205
NF-10	Metal Arc Welding .....	205
NF-11	Inert Gas Metal Arc Welding .....	205
NF-12	Resistance Welding .....	205



NF-13	Corrosion .....	205
NF-14	Special Comments .....	205
<b>Tables</b>		
UNF-23.1	Nonferrous Metals — Aluminum and Aluminum Alloy Products .....	198
UNF-23.2	Nonferrous Metals — Copper and Copper Alloys .....	198
UNF-23.3	Nonferrous Metals — Nickel, Cobalt, and High Nickel Alloys .....	199
UNF-23.4	Nonferrous Metals — Titanium and Titanium Alloys .....	200
UNF-23.5	Nonferrous Metals — Zirconium .....	201
UNF-79	Postfabrication Strain Limits and Required Heat Treatment .....	203
<b>Part UHA</b>	<b>Requirements for Pressure Vessels Constructed of High Alloy Steel .....</b>	<b>206</b>
<b>General</b>		
UHA-1	Scope .....	206
UHA-5	Uses .....	206
UHA-6	Conditions of Service .....	206
UHA-8	Material .....	206
<b>Materials</b>		
UHA-11	General .....	206
UHA-12	Bolt Materials .....	206
UHA-13	Nuts and Washers .....	209
<b>Design</b>		
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 .....	210
UHA-31	Formed Heads, Pressure on Convex Side .....	210
UHA-32	Requirements for Postweld Heat Treatment .....	210
UHA-33	Radiographic Examination .....	210
UHA-34	Liquid Penetrant Examination .....	210
<b>Fabrication</b>		
UHA-40	General .....	210
UHA-42	Weld Metal Composition .....	210
UHA-44	Requirements for Postfabrication Heat Treatment Due to Straining .....	213
<b>Inspection and Tests</b>		
UHA-50	General .....	213
UHA-51	Impact Tests .....	213
UHA-52	Welded Test Plates .....	217
<b>Marking and Reports</b>		
UHA-60	General .....	217
<b>Pressure Relief Devices</b>		
UHA-65	General .....	217



<b>Appendix HA</b>	<b>Suggestions on the Selection and Treatment of Austenitic Chromium–Nickel and Ferritic and Martensitic High Chromium Steels (Informative and Nonmandatory)</b> .....	217
UHA-100	General .....	217
UHA-101	Structure .....	217
UHA-102	Intergranular Corrosion .....	217
UHA-103	Stress Corrosion Cracking .....	217
UHA-104	Sigma Phase Embrittlement .....	217
UHA-105	Heat Treatment of Austenitic Chromium–Nickel Steels .....	217
UHA-107	Dissimilar Weld Metal.....	217
UHA-108	Fabrication .....	217
UHA-109	885°F (475°C) Embrittlement .....	218
<b>Tables</b>		
UHA-23	High Alloy Steel.....	207
UHA-32	Postweld Heat Treatment Requirements for High Alloy Steels .....	211
UHA-44	Postfabrication Strain Limits and Required Heat Treatment.....	214
<b>Part UCI</b>	<b>Requirements for Pressure Vessels Constructed of Cast Iron</b> .....	219
<b>General</b>		
UCI-1	Scope .....	219
UCI-2	Service Restrictions .....	219
UCI-3	Pressure–Temperature Limitations .....	219
<b>Materials</b>		
UCI-5	General .....	219
UCI-12	Bolt Materials .....	219
<b>Design</b>		
UCI-16	General .....	219
UCI-23	Maximum Allowable Stress Values .....	220
UCI-28	Thickness of Shells Under External Pressure.....	220
UCI-29	Dual Metal Cylinders.....	220
UCI-32	Heads With Pressure on Concave Side .....	220
UCI-33	Heads With Pressure on Convex Side .....	221
UCI-35	Spherically Shaped Covers (Heads) .....	221
UCI-36	Openings and Reinforcements .....	221
UCI-37	Corners and Fillets .....	221
<b>Fabrication</b>		
UCI-75	General .....	221
UCI-78	Repairs in Cast Iron Materials.....	221
<b>Inspection and Tests</b>		
UCI-90	General .....	222
UCI-99	Standard Hydrostatic Test.....	222
UCI-101	Hydrostatic Test to Destruction.....	222



<b>Marking and Reports</b>		
UCI-115	General .....	223
<b>Pressure Relief Devices</b>		
UCI-125	General .....	223
<b>Tables</b>		
UCI-23	Maximum Allowable Stress Values in Tension for Cast Iron .....	220
UCI-78.1	.....	221
UCI-78.2	.....	222
<b>Part UCL</b>	<b>Requirements for Welded Pressure Vessels Constructed of Material With Corrosion Resistant Integral Cladding, Weld Metal Overlay Cladding, or With Applied Linings .....</b>	<b>224</b>
<b>General</b>		
UCL-1	Scope .....	224
UCL-2	Methods of Fabrication .....	224
UCL-3	Conditions of Service.....	224
<b>Materials</b>		
UCL-10	General .....	224
UCL-11	Integral and Weld Metal Overlay Clad Material .....	224
UCL-12	Lining .....	225
<b>Design</b>		
UCL-20	General .....	225
UCL-23	Maximum Allowable Stress Values .....	225
UCL-24	Maximum Allowable Working Temperature .....	226
UCL-25	Corrosion of Cladding or Lining Material .....	226
UCL-26	Thickness of Shells and Heads Under External Pressure .....	226
UCL-27	Low Temperature Operations.....	226
<b>Fabrication</b>		
UCL-30	General .....	226
UCL-31	Joints in Integral or Weld Metal Overlay Cladding and Applied Linings.....	226
UCL-32	Weld Metal Composition .....	226
UCL-33	Inserted Strips in Clad Material.....	227
UCL-34	Postweld Heat Treatment .....	227
UCL-35	Radiographic Examination .....	227
UCL-36	Examination of Chromium Stainless Steel Cladding or Lining .....	227
UCL-40	Welding Procedures .....	228
UCL-42	Alloy Welds in Base Metal .....	228
UCL-46	Fillet Welds .....	228
<b>Inspection and Tests</b>		
UCL-50	General .....	228
UCL-51	Tightness of Applied Lining.....	228
UCL-52	Hydrostatic Test .....	228
<b>Marking and Reports</b>		
UCL-55	General .....	228





<b>Pressure Relief Devices</b>		
UCL-60	General .....	228
<b>Part UCD</b>	<b>Requirements for Pressure Vessels Constructed of Cast Ductile Iron .....</b>	<b>229</b>
<b>General</b>		
UCD-1	Scope .....	229
UCD-2	Service Restrictions .....	229
UCD-3	Pressure–Temperature Limitations .....	229
<b>Materials</b>		
UCD-5	General .....	229
UCD-12	Bolt Materials .....	229
<b>Design</b>		
UCD-16	General .....	229
UCD-23	Maximum Allowable Stress Values .....	230
UCD-28	Thickness of Shells Under External Pressure .....	230
UCD-32	Heads With Pressure on Concave Side .....	230
UCD-33	Heads With Pressure on Convex Side .....	230
UCD-35	Spherically Shaped Covers (Heads) .....	230
UCD-36	Openings and Reinforcements .....	230
UCD-37	Corners and Fillets .....	230
<b>Fabrication</b>		
UCD-75	General .....	231
UCD-78	Repairs in Cast Ductile Iron Material .....	231
<b>Inspection and Tests</b>		
UCD-90	General .....	232
UCD-99	Standard Hydrostatic Test .....	232
UCD-101	Hydrostatic Test to Destruction .....	232
<b>Marking and Reports</b>		
UCD-115	General .....	232
<b>Pressure Relief Devices</b>		
UCD-125	General .....	232
<b>Tables</b>		
UCD-23	Maximum Allowable Stress Values in Tension for Cast Ductile Iron, ksi (MPa) .....	230
UCD-78.1	.....	231
UCD-78.2	.....	231
<b>Part UHT</b>	<b>Requirements for Pressure Vessels Constructed of Ferritic Steels With Tensile Properties Enhanced by Heat Treatment.....</b>	<b>233</b>
<b>General</b>		
UHT-1	Scope .....	233



## Materials

UHT-5	General .....	233
UHT-6	Test Requirements .....	233

## Design

UHT-16	General .....	234
UHT-17	Welded Joints .....	234
UHT-18	Nozzles .....	235
UHT-19	Conical Sections .....	235
UHT-20	Joint Alignment.....	235
UHT-23	Maximum Allowable Stress Values .....	235
UHT-25	Corrosion Allowance .....	238
UHT-27	Thickness of Shells Under External Pressure.....	238
UHT-28	Structural Attachments and Stiffening Rings .....	238
UHT-29	Stiffening Rings for Shells Under External Pressure .....	238
UHT-30	Attachment of Stiffening Rings to Shells .....	238
UHT-32	Formed Heads, Pressure on Concave Side .....	238
UHT-33	Formed Heads, Pressure on Convex Side .....	238
UHT-34	Hemispherical Heads .....	239
UHT-40	Materials Having Different Coefficients of Expansion.....	239
UHT-56	Postweld Heat Treatment .....	239
UHT-57	Examination .....	239

## Fabrication

UHT-75	General .....	241
UHT-79	Forming Shell Sections and Heads.....	241
UHT-80	Heat Treatment .....	241
UHT-81	Heat Treatment Verification Tests .....	241
UHT-82	Welding.....	242
UHT-83	Methods of Metal Removal .....	243
UHT-84	Weld Finish .....	243
UHT-85	Structural and Temporary Welds.....	243
UHT-86	Marking on Plates and Other Materials.....	243

## Inspection and Tests

UHT-90	General .....	243
--------	---------------	-----

## Marking and Reports

UHT-115	General .....	243
---------	---------------	-----

## Pressure Relief Devices

UHT-125	General .....	244
---------	---------------	-----

## Figures

UHT-6.1	Charpy V-Notch Impact Test Requirements.....	234
UHT-6.1M	Charpy V-Notch Impact Test Requirements.....	234
UHT-18.1	Acceptable Welded Nozzle Attachment Readily Radiographed to Code Standards .....	236
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.....	237



<b>Table</b>		
UHT-23	Ferritic Steels With Properties Enhanced by Heat Treatment.....	238
UHT-56	Postweld Heat Treatment Requirements for Materials in Table UHT-23 .....	240
<b>Part ULW</b>	<b>Requirements for Pressure Vessels Fabricated by Layered Construction.....</b>	<b>245</b>
<b>Introduction</b>		
ULW-1	Scope .....	245
ULW-2	Nomenclature.....	245
<b>Material</b>		
ULW-5	General .....	245
<b>Design</b>		
ULW-16	General .....	245
ULW-17	Design of Welded Joints.....	248
ULW-18	Nozzle Attachments and Opening Reinforcement.....	256
ULW-20	Welded Joint Efficiency .....	256
ULW-22	Attachments .....	256
ULW-26	Postweld Heat Treatment .....	256
<b>Welding</b>		
ULW-31	Welded Joints .....	260
ULW-32	Welding Procedure Qualification.....	260
ULW-33	Performance Qualification.....	260
<b>Nondestructive Examination of Welded Joints</b>		
ULW-50	General .....	260
ULW-51	Inner Shells and Inner Heads.....	260
ULW-52	Layers — Welded Joints.....	260
ULW-53	Layers — Step Welded Girth Joints.....	263
ULW-54	Butt Joints.....	263
ULW-55	Flat Head and Tubesheet Weld Joints .....	263
ULW-56	Nozzle and Communicating Chambers Weld Joints.....	263
ULW-57	Random Spot Examination and Repairs of Weld .....	264
<b>Fabrication</b>		
ULW-75	General .....	266
ULW-76	Vent Holes .....	266
ULW-77	Contact Between Layers .....	266
ULW-78	Alternative to Measuring Contact Between Layers During Construction .....	266
<b>Inspection and Testing</b>		
ULW-90	General .....	267
<b>Marking and Reports</b>		
ULW-115	General .....	267
<b>Pressure Relief Devices</b>		
ULW-125	General .....	267



<b>Figures</b>		
ULW-2.1	Some Acceptable Layered Shell Types .....	246
ULW-2.2	Some Acceptable Layered Head Types .....	247
ULW-17.1	Transitions of Layered Shell Sections .....	249
ULW-17.2	Some Acceptable Solid Head Attachments to Layered Shell Sections.....	250
ULW-17.3	Some Acceptable Flat Heads and Tubesheets With Hubs Joining Layered Shell Sections .....	252
ULW-17.4	Some Acceptable Flanges for Layered Shells .....	253
ULW-17.5	Some Acceptable Layered Head Attachments to Layered Shells .....	254
ULW-17.6	Some Acceptable Welded Joints of Layered-to-Layered and Layered-to-Solid Sections.....	255
ULW-18.1	Some Acceptable Nozzle Attachments in Layered Shell Sections .....	257
ULW-22	Some Acceptable Supports for Layered Vessels .....	259
ULW-32.1	Solid-to-Layered and Layered-to-Layered Test Plates .....	261
ULW-32.2	.....	262
ULW-32.3	.....	262
ULW-32.4	.....	262
ULW-54.1	.....	264
ULW-54.2	.....	265
ULW-77	.....	267
<b>Part ULT</b>	<b>Alternative Rules for Pressure Vessels Constructed of Materials Having Higher Allowable Stresses at Low Temperature .....</b>	<b>268</b>
<b>General</b>		
ULT-1	Scope .....	268
ULT-2	Conditions of Service.....	268
ULT-5	General .....	268
<b>Design</b>		
ULT-16	General .....	269
ULT-17	Welded Joints .....	269
ULT-18	Nozzles and Other Connections.....	269
ULT-23	Maximum Allowable Stress Values .....	269
ULT-27	Thickness of Shells.....	269
ULT-28	Thickness of Shells Under External Pressure.....	269
ULT-29	Stiffening Rings for Shells Under External Pressure .....	269
ULT-30	Structural Attachments.....	269
ULT-56	Postweld Heat Treatment .....	274
ULT-57	Examination.....	274
<b>Fabrication</b>		
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
<b>Inspection and Tests</b>		
ULT-90	General .....	274
ULT-99	Hydrostatic Test .....	274
ULT-100	Pneumatic Test .....	277



<b>Marking and Reports</b>		
ULT-115	General .....	277
<b>Pressure Relief Devices</b>		
ULT-125	General .....	278
<b>Figure</b>		
ULT-82	Weld Metal Delta Ferrite Content.....	277
<b>Tables</b>		
ULT-23	Maximum Allowable Stress Values in Tension for 5%, 8%, and 9% Nickel Steels, Type 304 Stainless Steel, and 5083-O Aluminum Alloy at Cryogenic Temperatures for Welded and Nonwelded Construction.....	270
ULT-82	Minimum Tensile Strength Requirements for Welding Procedure Qualification Tests on Tension Specimens Conforming to QW-462.1.....	275
<b>Part UHX</b>		
	<b>Rules for Shell-and-Tube Heat Exchangers.....</b>	<b>279</b>
UHX-1	Scope .....	279
UHX-2	Materials and Methods of Fabrication .....	279
UHX-3	Terminology.....	279
UHX-4	Design .....	279
UHX-8	Tubesheet Effective Bolt Load, $W^*$ .....	279
UHX-9	Tubesheet Flanged Extension.....	281
UHX-10	General Conditions of Applicability for Tubesheets.....	282
UHX-11	Tubesheet Characteristics .....	282
UHX-12	Rules for the Design of U-Tube Tubesheets .....	286
UHX-13	Rules for the Design of Fixed Tubesheets .....	294
UHX-14	Rules for the Design of Floating Tubesheets .....	308
UHX-16	Bellows Expansion Joints .....	319
UHX-17	Flanged-and-Flued or Flanged-Only Expansion Joints.....	319
UHX-18	Pressure Test Requirements .....	320
UHX-19	Heat Exchanger Marking and Reports.....	320
UHX-20	Examples.....	321
<b>Figures</b>		
UHX-3	Terminology of Heat Exchanger Components .....	280
UHX-9	Some Representative Configurations Describing the Minimum Required Thickness of the Tubesheet Flanged Extension, $h_r$ .....	282
UHX-10	Integral Channels .....	283
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 $\nu^*$ (Equilateral Triangular Pattern) .....	287
UHX-11.4	Curves for the Determination of $E^*/E$ and $\nu^*$ (Square Pattern).....	288
UHX-12.1	U-Tube Tubesheet Configurations.....	289
UHX-12.2	Tube Layout Perimeter .....	290
UHX-13.1	Fixed Tubesheet Configurations .....	295
UHX-13.2	$Z_d$ , $Z_v$ , $Z_w$ , and $Z_m$ Versus $X_a$ .....	301
UHX-13.3-1	$F_m$ Versus $X_a$ ( $0.0 \leq Q_3 \leq 0.8$ ).....	302
UHX-13.3-2	$F_m$ Versus $X_a$ ( $-0.8 \leq Q_3 \leq 0.0$ ) .....	303
UHX-13.4	Shell With Increased Thickness Adjacent to the Tubesheets .....	305
UHX-14.1	Floating Tubesheet Heat Exchangers .....	309
UHX-14.2	Stationary Tubesheet Configurations .....	310
UHX-14.3	Floating Tubesheet Configurations .....	311





<b>Tables</b>		
UHX-8.1	Tubesheet Effective Bolt Load, $W^*$ .....	281
UHX-13.1	Formulas for Determination of $Z_d$ , $Z_v$ , $Z_m$ , $Z_w$ , and $F_m$ .....	300
UHX-13.2	Formulas for the Determination of $F_{t,min}$ and $F_{t,max}$ .....	304
UHX-17	Flanged-and-Flued or Flanged-Only Expansion Joint Load Cases and Stress Limits .....	320
UHX-20.2.1-1	Summary Table for Steps 7 and 8, Elastic Iteration Tubesheet Results .....	329
UHX-20.2.2-1	Summary Table for Steps 7 and 8, Tubesheet Results .....	332
UHX-20.2.3-1	Summary Table for Step 6 .....	334
UHX-20.2.3-2	Summary Table for Steps 7 and 8, Elastic Iteration .....	335
UHX-20.2.3-3	Summary Table for Step 10, Shell and Channel Stress Results .....	335
<b>Part UIG</b>	<b>Requirements for Pressure Vessels Constructed of Impregnated Graphite</b> .....	<b>342</b>
<b>Nonmandatory Introduction</b> .....		
<b>General</b>		
UIG-1	Scope .....	342
UIG-2	Equipment and Service Limitations .....	343
UIG-3	Terminology .....	343
<b>Materials</b>		
UIG-5	Raw Material Control .....	343
UIG-6	Certified Material Control .....	343
UIG-7	Additional Properties .....	344
UIG-8	Tolerances for Impregnated Graphite Tubes .....	344
<b>Design</b>		
UIG-22	Loadings .....	344
UIG-23	Maximum Allowable Stress Values for Certified Material .....	344
UIG-27	Thickness of Cylindrical Shells Made of Certified Materials Under Internal Pressure .....	344
UIG-28	External Pressure .....	345
UIG-29	Euler Buckling of Extruded Graphite Tubes .....	345
UIG-34	Calculating Flat Heads, Covers, and Tubesheets .....	345
UIG-36	Openings and Reinforcements .....	347
UIG-45	Nozzle Neck Thickness .....	347
UIG-60	Lethal Service .....	347
<b>Fabrication</b>		
UIG-75	General Requirements .....	353
UIG-76	Procedure and Personnel Qualification .....	353
UIG-77	Certified Material Specification .....	353
UIG-78	Certified Cement Specification .....	354
UIG-79	Certified Cementing Procedure Specification .....	354
UIG-80	Cementing Technician Qualification .....	355
UIG-81	Repair of Materials .....	355
UIG-84	Required Tests .....	359
<b>Inspection and Tests</b>		
UIG-90	General .....	360
UIG-95	Visual Examination .....	360



UIG-96	Qualification of Visual Examination Personnel .....	360
UIG-97	Acceptance Standards and Documentation .....	360
UIG-99	Pressure Tests .....	360
UIG-112	Quality Control Requirements .....	361
UIG-115	Markings and Reports .....	361
UIG-116	Required Markings .....	361
UIG-120	Data Reports .....	361
UIG-121	Records .....	361
UIG-125	Pressure Relief Devices .....	361

**Figures**

UIG-34-1	Typical Graphite Heat Exchanger .....	346
UIG-34-2	Configuration g Stationary Tubesheet .....	347
UIG-34-3	Configuration G Floating Tubesheet .....	347
UIG-36-1	Unacceptable Nozzle Attachment Details .....	348
UIG-36-2	Some Acceptable Nozzle Attachment Details in Impregnated Graphite Pressure Vessels .....	349
UIG-76-1	Tension Test Specimen .....	354
UIG-76-2	Cement Material Tension Test Specimen .....	355
UIG-76-3	Tube to Tubesheet Tension Test Specimen .....	356
UIG-76-4	Tube Cement Joint Tension Test Specimen .....	357
UIG-76-5	Tube Tension Test Specimen .....	358

**Tables**

UIG-6-1	Properties of Certified Material .....	344
UIG-84-1	Test Frequency for Certified Materials .....	359

**MANDATORY APPENDICES**

1	Supplementary Design Formulas .....	375
2	Rules for Bolted Flange Connections With Ring Type Gaskets .....	396
3	Definitions .....	418
4	Rounded Indications Charts Acceptance Standard for Radiographically Determined Rounded Indications in Welds .....	421
5	Flanged-and-Flued or Flanged-Only Expansion Joints .....	430
6	Methods for Magnetic Particle Examination (MT) .....	433
7	Examination of Steel Castings .....	435
8	Methods for Liquid Penetrant Examination (PT) .....	438
9	Jacketed Vessels .....	440
10	Quality Control System .....	449
11	Capacity Conversions for Safety Valves .....	452
12	Ultrasonic Examination of Welds (UT) .....	456
13	Vessels of Noncircular Cross Section .....	457
14	Integral Flat Heads With a Large, Single, Circular, Centrally Located Opening .....	497
16	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee .....	504
17	Dimpled or Embossed Assemblies .....	505
18	Adhesive Attachment of Nameplates .....	515
19	Electrically Heated or Gas Fired Jacketed Steam Kettles .....	516
20	Hubs Machined From Plate .....	517
21	Jacketed Vessels Constructed of Work-Hardened Nickel .....	518
22	Integrally Forged Vessels .....	519



23	External Pressure Design of Copper, Copper Alloy, and Titanium Alloy Condenser and Heat Exchanger Tubes With Integral Fins . . . . .	521
24	Design Rules for Clamp Connections . . . . .	523
25	Acceptance of Testing Laboratories and Authorized Observers for Capacity Certification of Pressure Relief Valves . . . . .	529
26	Bellows Expansion Joints . . . . .	531
27	Alternative Requirements for Glass-Lined Vessels . . . . .	557
28	Alternative Corner Weld Joint Detail for Box Headers for Air-Cooled Heat Exchangers . . . . .	560
30	Rules for Drilled Holes Not Penetrating Through Vessel Wall . . . . .	563
31	Rules for Cr–Mo Steels With Additional Requirements for Welding and Heat Treatment . . . . .	565
32	Local Thin Areas in Cylindrical Shells and in Spherical Segments of Shells . . . . .	568
33	Standards Units for Use in Equations . . . . .	571
34	Requirements for Use of High Silicon Stainless Steels for Pressure Vessels . . . . .	572
35	Rules for Mass-Production of Pressure Vessels . . . . .	574
36	Standard Test Method for Determining the Flexural Strength of Certified Materials Using Three-Point Loading . . . . .	577
37	Standard Test Method for Determining the Tensile Strength of Certified Impregnated Graphite Materials . . . . .	579
38	Standard Test Method for Compressive Strength of Impregnated Graphite . . . . .	581
39	Testing the Coefficient of Permeability of Impregnated Graphite . . . . .	583
40	Thermal Expansion Test Method for Graphite and Impregnated Graphite . . . . .	585
41	Electric Immersion Heater Element Support Plates . . . . .	588
42	Diffusion Bonding . . . . .	593

**NONMANDATORY APPENDICES**

A	Basis for Establishing Allowable Loads for Tube-to-Tubesheet Joints . . . . .	595
C	Suggested Methods for Obtaining the Operating Temperature of Vessel Walls in Service . . . . .	601
D	Suggested Good Practice Regarding Internal Structures . . . . .	602
E	Suggested Good Practice Regarding Corrosion Allowance . . . . .	603
F	Suggested Good Practice Regarding Linings . . . . .	604
G	Suggested Good Practice Regarding Piping Reactions and Design of Supports and Attachments . . . . .	605
H	Guidance to Accommodate Loadings Produced by Deflagration . . . . .	607
K	Sectioning of Welded Joints . . . . .	609
L	Examples Illustrating the Application of Code Formulas and Rules . . . . .	611
M	Installation and Operation . . . . .	660
P	Basis for Establishing Allowable Stress Values for UCI, UCD, and ULT Materials . . . . .	666
R	Preheating . . . . .	667
S	Design Considerations for Bolted Flange Connections . . . . .	669
T	Temperature Protection . . . . .	671
W	Guide for Preparing Manufacturer’s Data Reports . . . . .	672
Y	Flat Face Flanges With Metal-to-Metal Contact Outside the Bolt Circle . . . . .	691
DD	Guide to Information Appearing on Certificate of Authorization (See Fig. DD-1) . . . . .	704
EE	Half-Pipe Jackets . . . . .	707
FF	Guide for the Design and Operation of Quick-Actuating (Quick-Opening) Closures . . . . .	712



GG	Guidance for the Use of U.S. Customary and SI Units in the ASME Boiler and Pressure Vessel Code .....	715
HH	Tube Expanding Procedures and Qualification .....	718
JJ	Flowcharts Illustrating Impact Testing Requirements and Exemptions From Impact Testing by the Rules of UHA-51 .....	728
KK	Guide for Preparing User's Design Requirements .....	735
LL	Graphical Representations of $F_{t,min}$ and $F_{t,max}$ .....	741
MM	Alternative Marking and Stamping of Graphite Pressure Vessels .....	744
<b>Index</b>	.....	745



# 2010 ASME

## BOILER AND PRESSURE VESSEL CODE

(10)

### 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
  - 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
    - Subsection NH — Class 1 Components in Elevated Temperature Service
  - Appendices
  - Division 2 — Code for Concrete Containments
  - Division 3 — Containments for Transportation and Storage of Spent Nuclear Fuel and High Level Radioactive Material and Waste
- 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 and Brazing 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



## **ADDENDA**

Addenda, which include additions and revisions to individual Sections of the Code, will be sent automatically to purchasers of the applicable Sections up to the publication of the 2013 Code. The 2010 Code is available only in the loose-leaf format; accordingly, the Addenda will be issued in the loose-leaf format.

## **INTERPRETATIONS**

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. The Interpretations for each individual Section will be published separately and will be included as part of the update service to that Section. Interpretations of Section III, Divisions 1

and 2, will be included with the update service to Subsection NCA.

Interpretations of the Code are posted in January and July at <http://cstools.asme.org/interpretations.cfm>.

## **CODE CASES**

The Boiler and Pressure Vessel Committee meets 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 2010 Code Cases book: “Boilers and Pressure Vessels” and “Nuclear Components.” Supplements will be sent automatically to the purchasers of the Code Cases books up to the publication of the 2013 Code.



# FOREWORD

(10)  
(a)

The American Society of Mechanical Engineers set up a committee in 1911 for the purpose of formulating standard rules for the construction of steam boilers and other pressure vessels. This committee is now called the Boiler and Pressure Vessel Committee.

The Committee's function is to establish rules of safety, relating only to pressure integrity, governing the construction<sup>1</sup> of boilers, pressure vessels, transport tanks and nuclear components, and inservice inspection for pressure integrity of nuclear components and transport tanks, and to interpret these rules when questions arise regarding their intent. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks and nuclear components, and the inservice inspection of nuclear components and transport tanks. The user of the Code should refer to other pertinent codes, standards, laws, regulations, or other relevant documents. With few 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. Recognizing this, the Committee has approved a wide variety of construction rules in this Section to allow the user or his designee to select those which will provide a pressure vessel having a margin for deterioration in service so as to give a reasonably long, safe period of usefulness. Accordingly, it is not intended that this Section be used as a design handbook; rather, engineering judgment must be employed in the selection of those sets of Code rules suitable to any specific service or need.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction 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 designers 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.

<sup>1</sup> *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

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 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 they are responsible for the application of these programs to their design.

The Code does not fully address tolerances. When dimensions, sizes, or other parameters are not specified with tolerances, the values of these parameters are considered nominal and allowable tolerances or local variances may be considered acceptable when based on engineering judgment and standard practices as determined by the designer.

The Boiler and Pressure Vessel Committee deals with the care and inspection of boilers and pressure vessels in service only to the extent of providing suggested rules of good practice as an aid to owners and their inspectors.

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 Boiler and Pressure Vessel Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Boiler and Pressure Vessel 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 Committee). Proposed revisions to the Code resulting from inquiries will be presented to the Standards Committees for appropriate action. The action of the Standards Committees becomes effective only after confirmation by letter ballot of the Committees and approval by ASME.





Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute and published at <http://cstools.asme.org/csconnect/public/index.cfm?PublicReview=Revisions> to invite comments from all interested persons. After the allotted time for public review and final approval by ASME, revisions are published in updates to the Code.

Code Cases may be used in the construction of components to be stamped with the Certification Mark beginning with the date of their approval by ASME.

After Code revisions are approved by ASME, they may be used beginning with the date of issuance. Revisions, except for revisions to material specifications in Section II, Parts A and B, become mandatory six months after such date of issuance, except for boilers or pressure vessels contracted for prior to the end of the six-month period. Revisions to material specifications are originated by the American Society for Testing and Materials (ASTM) and other recognized national or international organizations, and are usually adopted by ASME. However, those revisions may or may not have any effect on the suitability of material, produced to earlier editions of specifications, for use in ASME construction. ASME material specifications approved for use in each construction Code are listed in the Guideline for Acceptable ASTM Editions and in the Guideline for Acceptable Non-ASTM Editions, in Section II, Parts A and B. These Guidelines list, for each specification, the latest edition adopted by ASME, and earlier and later editions considered by ASME to be identical for ASME construction.

The Boiler and Pressure Vessel Committee in the formulation of its rules and in the establishment of maximum design and operating pressures considers materials, construction, method of fabrication, inspection, and safety devices.

The Code 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 ASME Boiler and Pressure Vessel Committee. ASME is to be notified should questions arise concerning improper use of the Certification Mark.

The specifications for materials given in Section II are identical with or similar to those of specifications published by ASTM, AWS, and other recognized national or international organizations. When reference is made in an ASME material specification to a non-ASME specification for which a companion ASME specification exists, the reference shall be interpreted as applying to the ASME material specification. Not all materials included in the material specifications in Section II have been adopted for Code use. Usage is limited to those materials and grades adopted by at least one of the other Sections of the Code for application under rules of that Section. All materials allowed by these various Sections and used for construction within the scope of their rules shall be furnished in accordance with material specifications contained in Section II or referenced in the Guidelines for Acceptable Editions in Section II, Parts A and B, except where otherwise provided in Code Cases or in the applicable Section of the Code. Materials covered by these specifications are acceptable for use in items covered by the Code Sections only to the degree indicated in the applicable Section. Materials for Code use should preferably be ordered, produced, and documented on this basis; Guidelines for Acceptable Editions in Section II, Parts A and B list editions of ASME and year dates of specifications that meet ASME requirements and which may be used in Code construction. Material produced to an acceptable specification with requirements different from the requirements of the corresponding specifications listed in the Guidelines for Acceptable Editions in Part A or Part B may also be used in accordance with the above, provided the material manufacturer or vessel manufacturer certifies with evidence acceptable to the Authorized Inspector that the corresponding requirements of specifications listed in the Guidelines for Acceptable Editions in Part A or Part B have been met. Material produced to an acceptable material specification is not limited as to country of origin.

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

(10)  
(a)

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

(a)

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.



(a)

# SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL COMMITTEE — MANDATORY

## 1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the Committee. See Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code in Section II, Parts C and D for additional requirements for requests involving adding new materials to the Code. Technical inquiries include requests for revisions or additions to the Code rules, requests for Code Cases, and requests for Code interpretations, as described below.

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

(2) *Code Cases.* Code Cases represent alternatives or additions to existing Code rules. 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 jurisdictions or owners automatically accept Code Cases. The most common applications for Code Cases are:

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

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

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

(3) *Code Interpretations.* Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an interpretation, an Intent Interpretation will be issued and the Code will be revised.

(b) The Code rules, 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 rules.

(c) Inquiries that do not comply with these provisions 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 shall include:

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

(1) revision of present Code rules

(2) new or additional Code rules

(3) Code Case

(4) Code Interpretation

(b) *Background.* 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, provide a copy of the specific referenced portions of the Code.

(c) *Presentations.* The inquirer may desire 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 Committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the Committee.

## 3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

(a) *Proposed Revisions or Additions.* For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.



(b) *Statement of Need.* Provide a brief explanation of the need for the revision or addition.

(c) *Background Information.* 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 proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate. When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

(a) **4 CODE CASES**

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined 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, etc.) must be defined and it must be confirmed 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 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 proposed Code Case applies.

**5 CODE INTERPRETATIONS**

(a) Requests for Code Interpretations shall provide the following:

(1) *Inquiry.* Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a “yes” or a “no” *Reply*, with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

(2) *Reply.* Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the

*Reply* should be “yes” or “no,” with brief provisos if needed.

(3) *Background Information.* Provide any background information that will assist the Committee in understanding the proposed *Inquiry* and *Reply*.

(b) Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The Committee cannot 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**

Submittals to and responses from the Committee shall meet the following:

(a) *Submittal.* Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will also be considered. They shall include the name, address, telephone number, fax number, and e-mail address, if available, of the inquirer and be mailed to the following address:

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

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org.

(b) *Response.* The Secretary of the ASME Boiler and Pressure Vessel Committee or of the appropriate Subcommittee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the inquirer upon completion of the requested action by the Code Committee.



(a)

## PERSONNEL

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

As of January 1, 2011

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## SUMMARY OF CHANGES

The 2011 Code, which includes Addenda changes, is being issued in its entirety. While the pages of the Code are printed in loose-leaf format for the users' convenience, it is advisable that the existing 2010 pages be retained for reference. The next Edition of the Code will be published in 2013.

A Special Notice may be posted on the ASME Web site in advance of the next edition of the Boiler and Pressure Vessel Code to provide approved revisions to Code requirements. Such revisions may be used on the date posted and will become mandatory 6 months after the date of issuance in the next edition. A Special Notice may also include a revision to a Code Case. The superseded version of the Code Case shall not be used.

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 BPV Codes. Such errata shall be used on the date posted.

Information regarding Special Notices and Errata is published on the ASME Web site under the Boiler and Pressure Vessel Code Resources Page at <http://www.asme.org/kb/standards/publications/bpvc-resources>.

Changes in this Addenda, given below, are identified on the pages by a margin note, **(a)**, placed next to the affected area. Revisions to the 2010 Edition are indicated by **(10)**. For the listing below, the *Page* references the affected area. A margin note, **(a)**, placed next to the heading indicates *Location*. Revisions are listed under *Change*.

The Record Numbers listed below are explained in more detail in "List of Changes in Record Number Order" following the Summary of Changes.

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
xxvii, xxviii	Foreword	Tenth and fourteenth paragraphs revised (10-1191)
xxix	Statement of Policy on the Use of the Certification Mark and Code Authorization in Advertising	Revised (10-1191)
xxix	Statement of Policy on the Use of ASME Marking to Identify Manufactured Items	Revised (10-1191)
xxx, xxxi	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee — Mandatory	(1) Moved from Appendix 16 and revised (2) Paragraph 4 revised (10-1191)
xxxii–xliv	Personnel	Updated
1, 2	U-1	(1) Subparagraph U-1(c)(2) revised (10-1191) (2) Subparagraph U-1(d) revised (10-1191)
3, 4	U-2	(1) First sentence in subpara. (b)(1) revised (10-1191) (2) Last sentence in subpara. (b)(2) revised (10-1191) (3) Subparagraph (f)(2) revised (10-1191) (4) Subparagraph (h)(3) revised (10-1191)
5	U-5	Added (10-1964)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
6, 7	Table U-3	(1) Revised (10-878) (2) "Year" entry for Pressure Relief Devices revised (09-1328) (3) Standard Guide for Preparation of Metallographic Specimens added (10-882)
11–14	UG-11	Revised in its entirety (09-1912)
15, 16	UG-19	Last sentence in subpara. (a) revised (10-1517)
	UG-20	Note added to subpara. (a) (10-1211)
21, 24	UG-28	Subparagraph (f) revised (10-1191)
30	UG-32	Subparagraph (b) deleted (10-1525)
34, 35	UG-34	In subpara. (c)(2), reference to Formula (3) corrected to Formula (4) by errata, and reference to Formula (4) corrected to Formula (5) by errata (11-52)
36	Figure UG-34	Illustration (g) revised (09-2038)
45	UG-39	Last sentence added to subpara. UG-39(a) (01-389)
47	UG-40	(1) Subparagraph (b)(2) revised (09-1406) (2) Subparagraph (e) revised (09-1912)
54, 55	UG-44	New subpara. (a) added, and subsequent subparagraphs redesignated (09-1912)
72–74	UG-90	(1) Subparagraphs (a) and (c)(1) revised (10-1191) (2) Last sentence added to subpara. (n) (08-1192)
	UG-93	Subparagraph (a)(1) revised (08-1192)
75, 76	UG-99	(1) Last sentence added to subpara. (b) (07-1169) (2) Subparagraph (f) revised (08-1077)
83–90	UG-102	First sentence in subpara. (a) revised (07-1169)
	Figure UG-116	Revised (10-1191)
	UG-116	(1) Subparagraphs (1)(a), (b), (b)(1), (e), (f)(1), (f)(2), (g), (g)(1), (g)(2), (h)(1)(a), (h)(1)(c), and (h)(2) revised (10-1191) (2) Subparagraphs (j) and (k) revised (10-1517)
	UG-117	(1) Revised (10-1191) (2) Fifth paragraph under subpara. UG-117(f) revised (08-1192)
	UG-119	Subparagraphs (c) and (f) revised (10-1191)
	Figure UG-118	Revised (10-1191)
	UG-120	(1) Subparagraphs (a), (a)(4), and (c) revised (10-1191) (2) Subparagraph (b) revised (10-1517)
	UG-125	Subparagraph (a) revised (09-1915)
94–97	UG-129	Subparagraphs (a)(7), (b), (e)(10), (f)(9), and (g) revised (10-1191)
	Figure UG-129.1	Revised (10-1191)
	Figure UG-129.2	Revised (10-1191)
	UG-130	Revised (10-1191)
	UG-131	(1) Subparagraphs (a) and (d)(2) revised (10-1191) (2) Footnote 59 revised (10-1191)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
103–109	UG-136	Subparagraphs UG-136(c)(3), (c)(3)(d), UG-136(c)(4), (c)(4)(1), UG-136(c)(5), and UG-136(d)(1) revised (10-1191)
	UG-137	Subparagraphs UG-137(c)(3), (c)(3)(d), and UG-137(d)(1) revised (10-1191)
	UG-138	Subparagraph (c)(3), (c)(3)(d), and (d)(1) revised (10-1191)
114, 115	UW-3	First paragraph revised (10-545)
	UW-5	Subparagraph (e) added; former subpara. (e) redesignated as (f) (07-679)
116	UW-11	Subparagraph (a) revised in its entirety (08-659)
117	UW-12	First sentence in subpara. (f) revised (07-1760)
	UW-13	In subpara. (b)(1), reference to Fig. UW-13.1, sketch (j) revised to sketch (i) by errata (10-750)
127, 134	UW-16	Subparagraph UW-16(f)(3)(a)(4) revised (10-289)
141–143	UW-21	Revised (10-424)
	Figure UW-21	Illustration (1) revised (10-11)
	UW-26	Subparagraph (d)(5) revised (10-1191)
	UW-27	(1) Subparagraph (a)(2) added; former (a)(2) redesignated as (a)(3) and revised (07-1760) (2) Subparagraphs (e) and (f) revised (07-679)
148, 149	UW-42	Revised (10-41)
	UW-50	Revised (10-960)
	UW-51	Subparagraph (a)(4) added (04-698)
162	UB-30	Subparagraphs (d) and (d)(5) revised (09-367, 10-1191)
165	UCS-5	Subparagraph (c) revised (09-1092)
166	UCS-6	Subparagraph (c) added (07-679)
167	Table UCS-23	(1) SA-841 added (07-683) (2) SA/AS 1548 revised (09-1009) (3) SA/EN 10028-2 revised (08-1293)
170	Table UCS-56	Note (2)(b) revised (07-679)
179, 184	UCS-66	(1) Subparagraph (a) revised (10-1060) (2) Subparagraph (j) revised (10-1060)
182	Figure UCS-66	Notes (2)(a) and (4) revised (08-1293, 09-1009)
184, 190	UCS-67	Revised (10-1060)
194, 195	UCS-85	Last sentence added to subpara. UCS-85(f) (07-679)
208	Table UHA-23	(1) Under SA-213, S34751 added (07-683) (2) Under SA-312, S34751 added (07-683) (3) SA-451 added (07-793)
210	UHA-32	In subpara. (c), the reference to UHA-105(b) corrected to UHA-105 by errata (10-1104)
213–215	UHA-51	Subparagraphs (a)(4)(a)(1) and (a)(4)(b) revised (10-802)
	Table UHA-44	(1) 304L added (06-621) (2) 347LN added (07-683) (3) Note (2) revised (07-683)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
221	UCI-35	Subparagraph (b)(3) revised (09-1912)
243	UHT-115	Last sentence revised (10-1191)
267	ULW-90	Revised (10-1191)
	ULW-115	Subparagraph (c) revised (10-1191)
277	ULT-115	Subparagraph (a)(1) revised (10-1191)
279, 281	UHX-4	Subparagraph UHX-4(d) revised (10-355)
	UHX-8	Added (04-786)
	Table UHX-8.1	Added (04-786)
286, 291	UHX-12.3	$W_c$ , $W_s$ , and $W_{max}$ deleted; $W^*$ added (04-786)
292, 293	UHX-12.5.6	Equations in Configurations b through f revised (04-786)
	UHX-12.5.8	Last paragraph deleted by errata (10-1104)
294, 296	UHX-13.3	$W$ deleted; $W^*$ added (04-786)
298	UHX-13.5.6	Equation beginning with $P_w$ revised (04-786)
	UHX-13.5.7	Equation revised (04-786)
306	UHX-13.6.4	In subpara. UHX-13.6.4(e), " $S_s$ " corrected to " $S_s$ " by errata (10-1737)
307, 308	UHX-13.8.4	Equation in subpara. UHX-13.8.4(f) revised (04-786)
312, 313	UHX-14.3	$W$ deleted; $W^*$ added (04-786)
315	UHX-14.5.7	Equation revised (04-786)
317, 318	UHX-14.6.4	Equation in subpara. UHX-14.6.4(d) revised (04-786)
	UHX-14.8.1	Spelling of "using" in the last paragraph corrected by errata (10-1737)
319	UHX-14.8.3	(1) In subpara. UHX-14.8.3(c), in the last line, $E_s^* = E_s$ corrected to $E_c^* = E_c$ by errata (10-1737) (2) In subpara. 14.8.3(f), in the last paragraph, "<" corrected to "≤" by errata (10-1737)
344	Table UIG-6-1	First two entries under the "Block" column head revised (10-777)
347	Figure UIG-34-2	Title and " $G_t$ " corrected by errata to read " $G_c$ " (10-679)
359	Table UIG-84-1	(1) Spelling of "blocks" corrected by errata (10-769) (2) Sixth entry in Testing Frequency column revised (10-774)
361	UIG-112	Subparagraph (b) revised (10-1191)
	UIG-116	Subparagraphs (b) and (d) revised (10-1191)
	UIG-120	Subparagraph (a) revised (10-1191)
390, 394	1-10	(1) In subpara. (b)(1), Step 11, eq. (38), $A_t$ corrected to $A_T$ by errata (10-1104) (2) In subpara. (b)(2), reference to Fig. 1-10-5 corrected to Fig. 1-10-4 by errata (10-1104)
397, 398	2-3	(1) Definition of $g_o$ revised (08-1602) (2) $M_0$ corrected to $M_o$ by errata (10-1737)
399, 403	2-5	In subpara. (d), eq. (3), $2_a$ corrected to $2a$ by errata (10-1737)





<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
411	2-12	In subpara. (a), reference to subpara. UG-44(a) revised to subpara. UG-44(b) (09-1912)
413	Table 2-7.1	In the last sentence of the first column, $g_i$ revised to $g_1$ by errata (10-750)
418–420	3-2	(1) Definitions of <i>acceptance by the Inspector, ASME Designee, certificate of compliance, material, material manufacturer, material supplier, and Material Test Report</i> revised (08-1192) (2) Definition of <i>vessel Manufacturer</i> revised (10-1191) (3) Definitions of <i>Certification of Authorization, Certification Mark, Certification Mark Stamp, and Certification Designator (Designator)</i> added (10-1191)
430–432	5-1	Subparagraph 5-1(f) added (10-94)
	5-3	In subpara. 5-3(f), $t$ revised to $t_f$ (10-94)
	5-4	Revised (10-768)
	Figure 5-1	Definition of $t$ revised (10-94)
	5-5	Revised (10-768)
	Figure 5-2	The variable $t$ revised to $t_f$ (10-94)
433	6-1	Subparagraph (d) added (10-1423)
438	8-1	Subparagraph (d) added (10-1423)
449	10-1	Second sentence revised (10-1191)
450	10-13	(1) Subparagraph (b)(5) added and subsequent subparagraphs redesignated (09-1912) (2) Subparagraph (b)(7) revised (08-1504) (3) Subparagraphs (c) and (c)(1) revised (10-1191)
504	Appendix 16	Moved to the front matter and revised
516	19-5	Revised (10-1191)
521	23-4	Subparagraph (a)(1) revised (10-448)
523	24-1	Subparagraphs (a) and (f) revised (07-1405)
527	24-4	Subparagraph (d) revised; eq. (6) added and subsequent equations renumbered (07-1405)
528	Table 24-8	In first entry in the Allowable Stress column, $S_{AM}$ corrected to $S_{AH}$ by errata (10-1737)
531–535	26-1	First sentence revised (10-680)
	26-3	Definitions of $L_f$ and $P$ revised; definition of $t_s$ added (10-680)
	Figure 26-1	Illustration (b) revised (10-680)
	26-4.1	Subparagraphs (a), (b), (g), and (i) revised; new subpara. (h) added and subsequent paragraph redesignated (10-680)
	26-4.2	Last paragraph in subpara. (b) revised (10-680)
546	26-9.5.2	Subparagraph (b) revised (10-680)
	26-9.5.3	Subparagraph (b) revised (10-680)
	Figure 26-10	Revised (10-680)
	Figure 26-11	Revised (10-680)
547	26-10	(1) Subparagraphs (a) and (b) revised (10-680) (2) Subparagraph (c) revised (08-1206)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
	26-11	Revised (10-768)
	26-12	Revised (10-768)
548	Figure 26-13	Revised (08-1206)
552	26-16	Deleted (10-768)
572	34-4	Minimum design metal temperature of $-20^{\circ}\text{C}$ corrected to $-46^{\circ}\text{C}$ by errata (10-750)
574, 575	35-1	Revised (10-1191)
	35-2	Revised (10-1191)
	35-4	(1) Subparagraphs (a) and (e) revised (09-1462) (2) Subparagraph (c) revised (10-1191)
579	37-6	In subpara. (c), reference to 4.2 corrected to subpara. 37-4(b) by errata (10-769)
586	Figure 40-6-1	On the $y$ -axis, $\theta_m$ corrected to $\theta_M$ by errata (10-769)
588–592	Mandatory Appendix 41	Added (01-389)
593, 594	Mandatory Appendix 42	Added (10-882)
595, 596	A-1	In subpara. (e)(3)(b), commas inserted around $(P_o + P_i)$ by errata (10-1737)
598, 600	A-2	Definition of $d_o$ corrected by errata (10-1737)
	A-3	In subpara. (a), “below” added after “(k)” by errata (10-1737)
	A-5	In the first sentence, “satisfied” replaced “met” by errata (10-1737)
620	L-1.6.1	Equations corrected by errata (11-52)
621	L-1.6.3	Equation corrected by errata (11-52)
660, 661	M-5.2	Under <i>valve operation controls</i> , subpara. (a) revised (09-1459)
662	M-5.7	First sentence revised (09-1459)
685	Table W-3	Note Nos. 59 and 67 revised (10-1191)
689	Form UD-1	Table in 2A revised (06-906)
690	Table W-3.2	Note Nos. 9, 20, 21, 22, and 24 revised (06-906)
704, 705	Nonmandatory Appendix DD	Items 2, 4, and 6 revised (10-1191)
744	MM-1	Subparagraphs (a) and (c) revised (10-1191)
	MM-2	Subparagraphs (d) and (e) revised (10-1191)
	MM-3	Note under subpara. (e) revised (10-1191)

**NOTE:**

Volume 61 of the Interpretations to Section VIII-1 of the ASME Boiler and Pressure Vessel Code follows the last page of this Addenda.



## LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
01-389	Added new Mandatory Appendix for Electric Immersion Heater Element Support Plates. Sentence added to UG-39 at the end of the paragraph.
04-698	Added para. 4 to UW-51, Radiographic Examination of Welded Joints.
04-786	Added UHX-8 for the tubesheet effective bolt load, $W^*$ , to be used in the perforated region of the tubesheet. Revised the calculation procedures to incorporate the correct nomenclature and formulae.
06-621	Added 304L to Table UHA-44.
06-906	Changed the heading of column 8 in Form UD-1, Table 2A, to Marked Burst or Set Pressure. Deleted the heading of column 9, "disk," from Form UD-1, Table 2A. Added "or pin" after "rupture disk" in Form UD-1, Certificate of Shop Compliance. Added "as applicable" after "device" in Table W-3.2, Note (9). Added "or set" after "burst" in Table W-3.2, Note (20). Added "or pin" after "disk" in Table W-3.2, Note (20). Deleted "disk" after "specified" in Table W-3.2, Note (21). Added "or pin" after "disk" in Table W-3.2, Note (21). Added "or pin device as applicable" after "disk" in Table W-3.2, Note (22). Added "as applicable" after "identifier" in Table W-3.2, Note (24).
07-644	Revised UCS-67, UCS-67(a), and UCS-67(b); deleted UCS-67(c) and UCS-67(d), clarifying the requirements for impact testing of welds and welding procedure qualifications.
07-679	Added UW-5(e) and renumbered the previous UW-5(e) as UW-5(f). Added UCS-6(c). Added SA-841, Grade A, Class 1 and Grade B, Class 2 to Table UCS-23. Added a statement in Table UCS-56 at the end of Note (2)(b). Added a statement to UCS-85(f).
07-683	Revised UHA-23 and UHA-44 to add SA-213 TP347LN, UNS S34751, and SA-312 TP347LN, UNS S34751.
07-793	Revised Table UHA-23 to add SA-451 J92800 (CPF3M) and J92900 (CPF8M).
07-1169	Revised the first sentence of UG-102(a) to define the installation of a pressure gage by a pressure connection. Added static head considerations to UG-99(b).
07-1405	Added consideration of loads other than pressure, such as piping loads to 24-1(a). Modified retainer requirements in 24-1(f). Added alternative to eq. (5) in 24-1(d): a requirement to provide the User with controlled bolting procedure, if used, and a warning regarding overstressing the clamp.
07-1760	Added "(3)" after "UW-27(a)" in UW-12(f). Inserted new (a)(3).
08-103	Added new note to UG-20(a), which references WRC Bulletin 470, "Recommended Design Details for Elevated Temperature Service."
08-659	Clarified UW-11(a)(1), (2), (3), (4), and (5) on full radiographic examination requirements with exemptions for Categories B and C butt welds for nozzles and communicating chambers. Added full radiography requirement, UW-11(a)(4)(b), for unfired steam boilers with a design pressure not exceeding 50 psi but the wall thickness at the welded joint exceeding the thickness requiring full radiography.
08-1077	Revised UG-99(f) to allow for vacuum testing as an alternative for vacuum service vessels, and to impose leak testing requirements for performing vacuum testing.
08-1192	Revised definitions in Appendix 3. Deleted definition of material supplier in Appendix 3. Revised UG-90(c)(1)(n). Revised UG-93(a)(1). Added new UG-93(a)(1)(a) and UG-93(a)(1)(b). Revised UG-117(f).
08-1206	Clarified the requirement for circumferential welds attaching the bellows element to the shell or weld end.
08-1293	Revised Table UCS-23 and Fig. UCS-66, Notes (2)(a) and (4) to add SA/EN 10028-2 P235GH and P265GH.
08-1504	Added the phrase "for each welder who welded on the vessel" to the end of 10-13(b)(6).
08-1602	Revised the definition of $g_0$ in 2-3 of Appendix 2.
09-1009	Updated steel grade designations in Table UCS-23 and Note (4) for Fig. UCS-66. Added SA/AS 1548 Grades PT430NR, PT460NR, and PT490NR in Note (2)(a) for Fig. UCS-66.



Record Number	Change
09-1092	Revised the parenthetical statement in UCS-5(c) to focus attention on the alternative provisions of Part UF.
09-1328	Revised the edition of PTC 25 from 2001 to 2008 in Table U-3.
09-1367	Revised UB-30.
09-1406	Made the definition of $R_n$ in UG-40(b)(2) consistent with UG-37(a).
09-1459	Enhanced the definition of “mechanical interlocks” in M-5.2 and clarified paragraph M-5.7 to state specifically that process control valves are not allowed in the relief path where there is normally process flow.
09-1462	Revised 35-4(a) and 35-4(e) to clarify that the Manufacturer is responsible for submitting the inspection and quality control procedure and the Quality Control System to the AIA of record, the legal jurisdiction, and the ASME Designee for review and acceptance.
09-1912	Revised UG-11. Revised reference in UG-40(e). Revised UG-44 to add ASME B16.1. Revised UCI-35(b)(3). Revised reference in 2-12. Revised 10-13.
09-1915	Modified UG-125 to clarify the pressure relief requirements for unfired steam boilers.
09-2038	Revised $t_w$ to be not less than $1.25t_s$ instead of $1.2t_s$ in Fig. UG-34, illustration (g).
10-11	Revised Fig. UW-21, illustration (1).
10-41	Editorially revised UW-42.
10-94	Added a paragraph to permit the use of the operating metal temperature properties for the thermal loading cases. Separated the nomenclature for the flexible element thickness and the uncorroded straight flange thickness in Appendix 5.
10-289	Added the words “as required by (3) above” to UW-16(f)(3)(a)(4) to provide requirements for $t_f$ such that it will accommodate the required fillet weld size.
10-355	Added UHX-4(d)(2) that addresses distributor belts where the shell is continuous across the belt.
10-424	Revised UW-21 to allow the use of ASME B16.5 socket and slip-on flanges for all vessel parts.
10-448	Revised Appendix 23, 23-4(2), to increase the design temperature limit for copper and copper alloys.
10-545	Added references to some weld joints in UW-3 not assigned a Category.
10-680	Editorially revised Appendix 26. Made effective length of one reinforcing fastener in Appendix 26 consistent with length as defined in PCC-1.
10-750	Corrected by errata. See Summary of Changes.
10-768	Revised 5-4, 5-5, 26-4, 26-10, 26-11, and 26-12 for consistency with Division 2 and deleted 26-16.
10-774	Revised Table UIG-84-1.
10-769	Corrected by errata. See Summary of Changes.
10-777	Revised Table UIG-6-1.
10-802	Revised UHA-51(a)(4) to permit the use of gas tungsten arc welding (GTAW) or gas metal arc welding (GMAW) with Type 308L weld filler metal, in addition to the Type 316L filler metal.
10-878	Revised Table U-3 to update “year of acceptable edition” for those standards that were reviewed.
10-882	Added new Mandatory Appendix on Diffusion Bonding and Qualification.
10-960	Revised UW-50 to clarify that the required NDE is to take place prior to pneumatic testing.
10-1060	Divided the content of UCS-67(a) into four subparagraphs (previously there were three), and reorganized the content of new subparagraph UCS-67(a)(3). Divided the content of UCS-67(b) into four subparagraphs (previously there were three). These editorial changes were made to improve clarity for Code users.
10-1104	Corrected by errata. See Summary of Changes.
10-1191	The following summarizes the changes made to words and phrases to accommodate the change to a single ASME Certification Mark from 28 different ASME Marks: (a) Revised “Code Symbol” and “ASME Code Symbol” to read “Certification Mark.” (b) Revised “Code stamped” to read “stamped with the Certification Mark” or “Certification Marked stamped.” (c) Revised “Code stamp holder” to read “Certificate holder.” (d) Revised “Certificate of Authorization Holder” to read “Certificate holder.” (e) Revised “U Certificate of Authorization” to read “Certificate of Authorization with the U Designator.” (f) “Certificate of Authorization” is not revised. (g) Revised “holder of a valid U Certificate of Authorization” to read “Certificate Holder with the U Designator.” (h) Revised “U Stamp” to read “Certification Mark with the U Designator.” (i) Revised “Code U Symbol” to read “Certification Mark with the U Designator.” (j) Revised “Code UV Symbol” or “Code UD Symbol” to read “Certification Mark with the UV Designator” or “Certification Mark with the UD Designator.” (k) Revised “UM vessels” to read “vessels bearing the UM Designator.” (l) Revised “UM Stamp” or “UM Code Symbol” to read “Certification Mark with the UM Designator.” (m) Revised “appropriate Code Symbol” to read “Certification Mark with the appropriate Designator.”
10-1211	Made editorial revisions for clarity.



Record Number	Change
10-1423	Inserted new 6-1(d) clarifying MT documentation requirements.
	Inserted new 8-1(d) clarifying PT documentation requirements.
10-1517	Clarified the marking and data report requirements for combination units and common elements adjacent to at least one Code chamber. Reorganized the paragraphs relating to the marking and MDR requirements for combination units. Renumbered UG-116(l) to UG-116(k).
10-1525	Deleted the text in UG-32(b) and replaced it with "Deleted."
10-1737	Corrected by errata. See Summary of Changes.
10-1964	Added new U-5 addressing tolerances formerly contained in the Foreword.
11-52	Corrected by errata. See Summary of Changes.



# INTRODUCTION

## SCOPE

### (a) U-1 SCOPE

#### *U-1(a)*

*U-1(a)(1)* The Foreword provides the basis for the rules described in this Division.

*U-1(a)(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.

*U-1(a)(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 Appendix A of Section II, Part D.

*U-1(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 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.

#### *U-1(c)*

*U-1(c)(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.

*U-1(c)(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 Designator:

(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) except as covered in U-1(f), 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, 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 water<sup>1</sup> 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:

- (1) a heat input of 200,000 Btu/hr (58.6 kW);
- (2) a water temperature of 210°F (99°C);
- (3) a nominal water containing capacity of 120 gal (450 L);

(h) vessels not exceeding the design pressure (see 3-2), at the top of the vessel, limitations below, with no limitation on size [see UG-28(f), 9-1(c)]:

(1) vessels having an internal or external pressure not exceeding 15 psi (100 kPa);

(2) combination units having an internal or external pressure in each chamber not exceeding 15 psi (100 kPa) and differential pressure on the common elements not exceeding 15 psi (100 kPa) [see UG-19(a)];

(i) vessels having an inside diameter, width, height, or cross section diagonal not exceeding 6 in. (152 mm), with no limitation on length of vessel or pressure;

(j) pressure vessels for human occupancy.<sup>2</sup>

*U-1(d)* The rules of this Division have been formulated on the basis of design principles and construction practices applicable to vessels designed for pressures not exceeding 3000 psi (20 MPa). For pressures above 3000 psi (20 MPa), deviations from and additions to these rules usually are necessary to meet the requirements of design principles and construction practices for these higher pressures. Only in the event that after having applied these additional design principles and construction practices the vessel still complies with all of the requirements of this Division may it be stamped with the applicable Certification Mark with the Designator.

*U-1(e)* In relation to the geometry of pressure containing parts, the scope of this Division shall include the following:

*U-1(e)(1)* where external piping; other pressure vessels including heat exchangers; or mechanical devices, such as pumps, mixers, or compressors, are to be connected to the vessel:

(a) the welding end connection for the first circumferential joint for welded connections [see UW-13(h)];

(b) the first threaded joint for screwed connections;

(c) the face of the first flange for bolted, flanged connections;

(d) the first sealing surface for proprietary connections or fittings;

*U-1(e)(2)* where nonpressure parts are welded directly to either the internal or external pressure retaining surface of a pressure vessel, this scope shall include the design, fabrication, testing, and material requirements established for nonpressure part attachments by the applicable paragraphs of this Division,<sup>3</sup>

*U-1(e)(3)* pressure retaining covers for vessel openings, such as manhole or handhole covers, and bolted covers with their attaching bolting and nuts;

*U-1(e)(4)* the first sealing surface for proprietary fittings or components for which rules are not provided by this Division, such as gages, instruments, and nonmetallic components.

*U-1(f)* The scope of the Division includes provisions for pressure relief devices necessary to satisfy the requirements of UG-125 through UG-137 and Appendix 11.

*U-1(g)(1)* Unfired steam boilers shall be constructed in accordance with the rules of Section I or this Division [see UG-125(b) and UW-2(c)].

*U-1(g)(2)* The following pressure vessels in which steam is generated shall not be considered as unfired steam boilers, and shall be constructed in accordance with the rules of this Division:

*U-1(g)(2)(a)* vessels known as evaporators or heat exchangers;

*U-1(g)(2)(b)* vessels in which steam is generated by the use of heat resulting from operation of a processing system containing a number of pressure vessels such as used in the manufacture of chemical and petroleum products;

*U-1(g)(2)(c)* vessels in which steam is generated but not withdrawn for external use.

*U-1(h)* Pressure vessels or parts subject to direct firing from the combustion of fuel (solid, liquid, or gaseous), which are not within the scope of Sections I, III, or IV may be constructed in accordance with the rules of this Division [see UW-2(d)].

*U-1(i)* Gas fired jacketed steam kettles with jacket operating pressures not exceeding 50 psi (345 kPa) may be constructed in accordance with the rules of this Division (see Appendix 19).

*U-1(j)* Pressure vessels exclusive of those covered in U-1(c), U-1(g), U-1(h), and U-1(i) that are not required by the rules of this Division to be fully radiographed, which are not provided with quick actuating closures (see UG-35), and that do not exceed the following volume and pressure

<sup>1</sup> The water may contain additives provided the flash point of the aqueous solution at atmospheric pressure is 185°F or higher. The flash point shall be determined by the methods specified in ASTM D 93 or in ASTM D 56, whichever is appropriate.

<sup>2</sup> Requirements for pressure vessels for human occupancy are covered by ASME PVHO-1.

<sup>3</sup> These requirements for design, fabrication, testing, and material for nonpressure part attachments do not establish the length, size, or shape of the attachment material. Pads and standoffs are permitted and the scope can terminate at the next welded or mechanical joint.



limits may be exempted from inspection by Inspectors, as defined in UG-91, provided that they comply in all other respects with the requirements of this Division:

*U-1(j)(1)* 5 cu ft (0.14 m<sup>3</sup>) in volume and 250 psi (1.7 MPa) design pressure; or

*U-1(j)(2)* 3 cu ft (0.08 m<sup>3</sup>) in volume and 350 psi (2.4 MPa) design pressure;

*U-1(j)(3)* 1½ cu ft (0.04 m<sup>3</sup>) in volume and 600 psi (4.1 MPa) design pressure.

In an assembly of vessels, the limitations in (1) through (3) above apply to each vessel and not the assembly as a whole. Straight line interpolation for intermediate volumes and design pressures is permitted. Vessels fabricated in accordance with this rule shall be marked with the “UM” Symbol in Fig. UG-116 sketch (b) and with the data required in UG-116. Certificates of Compliance shall satisfy the requirements of UG-120(a).

## GENERAL

### (a) U-2 GENERAL

(a) The user or his designated agent<sup>4</sup> shall establish the design requirements for pressure vessels, taking into consideration factors associated with normal operation, such other conditions as startup and shutdown, and abnormal conditions which may become a governing design consideration (see UG-22).

Such consideration shall include but shall not be limited to the following:

(1) the need for corrosion allowances;

(2) the definition of lethal services. For example, see UW-2(a).

(3) the need for postweld heat treatment beyond the requirements of this Division and dependent on service conditions;

(4) for pressure vessels in which steam is generated, or water is heated [see U-1(g) and (h)], the need for piping, valves, instruments, and fittings to perform the functions covered by PG-59 through PG-61 of Section I.

(5) the degree of nondestructive examinations(s) and the selection of applicable acceptance standards, when such examinations are applied, are beyond the requirements of this Division.

Sample User Design Requirements forms and guidance on their preparation are found in Nonmandatory Appendix KK. This sample form might not be applicable to all pressure vessels that may be constructed in accordance with this Division. The user is cautioned that input

<sup>4</sup> For this Division, the user’s designated agent may be either a design agency specifically engaged by the user, the Manufacturer of a system for a specific service that includes a pressure vessel as a part and that is purchased by the user, or an organization that offers pressure vessels for sale or lease for specific services.

from the Manufacturer may be necessary for completion of this form.

### (b) Responsibilities<sup>5</sup>

(1) The Manufacturer of any vessel or part to be marked with the Certification Mark has the responsibility of complying with all of the applicable requirements of this Division and, through proper certification, of assuring that all work done by others also complies. The vessel or part Manufacturer shall have available for the Inspector’s review the applicable design calculations. See 10-5 and 10-15(d).

(2) Some types of work, such as forming, nondestructive examination, and heat treating, may be performed by others (for welding, see UW-26 and UW-31). It is the vessel or part Manufacturer’s responsibility to ensure that all work so performed complies with all the applicable requirements of this Division. After ensuring Code compliance, the vessel or part may be stamped with the Certification Mark and Designator by the appropriate Certificate Holder after acceptance by the Inspector.

(c) A vessel may be designed and constructed using any combination of the methods of fabrication and the classes of materials covered by this Division provided the rules applying to each method and material are complied with and the vessel is marked as required by UG-116.

(d) When the strength of any part cannot be computed with a satisfactory assurance of safety, the rules provide procedures for establishing its maximum allowable working pressure.

(e) It is the duty of the Inspector to make all of the inspections specified by the rules of this Division, and of monitoring the quality control and the examinations made by the Manufacturer. He shall make such other inspections as in his judgment are necessary to permit him to certify that the vessel has been designed and constructed in accordance with the requirements. The Inspector has the duty of verifying that the applicable calculations have been made and are on file at Manufacturer’s plant at the time the Data Report is signed. Any questions concerning the calculations raised by the Inspector must be resolved. See UG-90(c)(1).

(f) The rules of this Division shall serve as the basis for the Inspector to:

(1) perform the required duties;

(2) authorize the application of the Certification Mark;

(3) sign the Certificate of Shop (or Field Assembly) Inspection.

(g) This Division of Section VIII does not contain rules to cover all details of design and construction. Where complete details are not given, it is intended that the Manufacturer, subject to the acceptance of the Inspector, shall

<sup>5</sup> See UG-90(b) and UG-90(c)(1) for summaries of the responsibilities of the Manufacturer and the duties of the Inspector.

