

AN INTERNATIONAL CODE

2007 ASME Boiler & Pressure Vessel Code

VIII

Division 1

RULES FOR CONSTRUCTION OF PRESSURE VESSELS



The American Society of
Mechanical Engineers



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2007 ASME Boiler & Pressure Vessel Code

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July 1, 2008

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RULES FOR CONSTRUCTION OF PRESSURE VESSELS

ASME Boiler and Pressure Vessel Committee
Subcommittee on Pressure Vessels



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2007 ASME

BOILER AND PRESSURE VESSEL CODE

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ADDENDA

Colored-sheet Addenda, which include additions and revisions to individual Sections of the Code, are published annually and will be sent automatically to purchasers of the applicable Sections up to the publication of the 2010 Code. The 2007 Code is available only in the loose-leaf format; accordingly, the Addenda will be issued in the loose-leaf, replacement-page 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 distributed annually in July with the issuance of the edition and subsequent addenda. Interpretations posted in January at www.cstools.asme.org/interpretations are included in the July distribution.

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 2007 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 2010 Code.

SUMMARY OF CHANGES

Addenda to the 2007 Edition of the Code are issued in the form of replacement pages. Revisions, additions, or deletions are incorporated directly into the affected pages. It is advisable, however, that all replaced pages be retained for reference.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **A08**, placed next to the affected area. Revisions to the 2007 Edition are indicated by **07**. For the listing below, the *Page* references the affected area. A margin note, **A08**, 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>
xxix–xxxix	Roster	Updated to reflect 2008 Addenda
2	U-1(c)(2)(h)	Reference to 3.2 corrected by errata (07-1572)
	U-1(e)(1)(a)	Reference to UW-13(g) corrected by errata to UW-13(h) (07-1572)
	U-1(e)(3)	Reference to bolted covers added (06-236)
3	U-2(a)	Paragraph added (04-1682)
6, 7	Table U-3	(1) Repair of Pressure Equipment and Piping entry added (03-776) (2) Pressure Relieving and Depressuring Systems entry added (02-4260) (3) Year entries under Charpy Pendulum Impact Test Parts 2 and 3 corrected from 2006 to 1998 by errata (07-1572)
15, 16	UG-21	Second sentence revised (02-3551)
	UG-22	(1) Parenthetical statement deleted from subpara. (b) (02-3551) (2) Subparagraph (j) added (02-3551)
20	UG-28(c)(1)	Second sentence of Step 3 revised (06-738)
31	UG-33(f)(1)(a)	Second sentence of Step 3 revised (06-738)
33	UG-34(b)	Reference to UW-3(a)(1) in definition of <i>E</i> corrected by errata to UW-3(a) (07-1572)
38	UG-36(c)(2)(c)	Added (00-072)
71	UG-90(c)(2)	Revised in its entirety (03-776)
76	UG-101(b)	Reference to UG-90(2) corrected by errata to UG-90(b)(2) (07-1572)
85–88.1	UG-119(e)	Revised in its entirety (06-809)
	UG-120	(1) New subpara. (e) added (06-236) (2) Former subpara. (e) redesignated as subpara. (f) (06-236)
	Overpressure Protection	Renamed from “Pressure Relief Devices” (02-4260)

(c)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
	UG-125	(1) Subparagraph (a) revised in its entirety (02-4260) (2) In subpara. (b), "as defined in U-1(g)" deleted by errata (07-1572) (3) Subparagraph (c) revised (06-1323, 02-4260)
91–92.1	UG-127(d)	Added (06-1323)
104	UG-140	Added (02-4260)
107	UW-3(b)	Last sentence added (07-599)
126	UW-16(f)	Revised (01-046)
	UW-16(f)(3)(a)	The phrase "and bolting pads" deleted (01-046)
129–130.1	UW-16(g)	Added (01-046)
	Fig. UW-16.3	Added (01-046)
140, 141	UW-51(a)	Subparagraph (2) deleted and subsequent paragraphs renumbered (05-1376)
142	UW-54	Added (05-1376)
158	Table UCS-23	SA/GB 6654 entry added (05-533)
173	Fig. UCS-66	(1) Note (3) revised (07-1333) (2) Entry SA-516 under Note (4) revised (07-1882)
188	UNF-19(e)	Revised (03-752)
190, 191	Table UNF-23.3	(1) N06210 added (03-752) (2) N10665 added (06-1641) (3) N05500 added (05-530)
197	NF-3	Last sentence revised (05-1160)
202	Table UHA-23	(1) SA/EN 10028-7 added (06-1330) (2) Notes (1) and (2) added (06-1330)
207	UHA-51(a)(4)(b)(2)	Parenthetical value corrected by errata from "130 ksi $\sqrt{m}$ " to "130 MPa $\sqrt{m}$ " (07-107)
208	Table UHA-44	Grades 201-1, 201-2, and 204 added (07-772)
225	UCD-37(a)	Subparagraph (b) deleted (06-1560)
277	E_{tT}	Revised from E_t (03-75)
	S_{tT}	Revised from S_t (03-75)
	UHX-11.5.1(a)	In third equation, E_t revised to E_{tT} ; S_t revised to S_{tT} (03-75)
286	UHX-12.6.3(b)(3)	(1) Configuration designators corrected by errata from italics to roman type (07-1572) (2) Spelling of "overstressed" corrected by errata (07-1572) (3) In configurations e and f, σ_s corrected to σ_c by errata (07-1572)
287	UHX-13.3	Entry for $E_{s,w}$ added (04-206)
290, 291	UHX-13.4(e)	(1) Revised (04-206) (2) Subparagraphs (1) and (2) deleted (04-206)
	UHX-13.5.3	Last paragraph revised to include " Z_w " (06-962)
	UHX-13.5.4	Equations revised to include " Z_w " (06-962)
	UHX-13.5.7	Revised (06-962)

(d)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
292	Table UHX-13.1	Revised (06-962)
293, 297–299	Table UHX-13.2	Added (06-962)
	UHX-13.5.9	Revised in its entirety (04-206, 06-962)
	UHX-13.5.10	Added (04-206)
	UHX-13.5.11	Redesignated from UHX-13.5.10 and revised (04-206)
	UHX-13.5.12	Redesignated from UHX-13.5.11 and revised (04-206)
	UHX-13.6.4	(1) Subparagraph (e) added (04-206) (2) Subparagraph (f) redesignated from UHX-13.6.4(e); “Step 10” revised to read “Step 11” (04-206)
294	Fig. UHX-13.2	Revised to include “ Z_w ” (06-962)
300–300.2	UHX-13.8.4(g)	Reference to Step 10 revised to Step 11 (04-206)
	UHX-13.9.3	(1) Reference to UHX-13.9 corrected to 13.5 by errata (07-1572) (2) In subpara. (a), reference to Step 9 corrected to Step 10 (04-206) (3) In subpara. (b), reference to Step 10 corrected to Step 11 (04-206) (4) In subpara. (c), reference to Step 11 corrected to Step 12 (04-206) (5) Configuration designators corrected by errata from italics to roman type (07-1572) (6) In 13.9.3(b)(3), “then” deleted from configurations a, b, and c (04-206)
304	UHX-14.4(a)	Revised (06-962)
305	UHX-14.5.3	Last paragraph revised to include “ Z_w ” (06-962)
306, 307	UHX-14.5.7	Revised in its entirety (06-962)
	UHX-14.5.9	Revised in its entirety (06-962)
309–310.1	UHX-14.7	(1) In subpara. (b)(3), configuration entries corrected by errata from italics to roman type (07-1572) (2) In subpara. (d), configuration entries corrected by errata from italics to roman type (07-1572)
	UHX-17(a)(1)	Revised (07-1572, 07-1868)
	Table UHX-17	Column heads corrected by errata (07-1572)
316–322.4	UHX-20.2	Revised in its entirety (03-75)
	Table UHX-20.2.1-1	Added (03-75)
	Table UHX-20.2.2-1	Added (03-75)
	Table UHX-20.2.3-1	Added (03-75)
	Table UHX-20.2.3-2	Added (03-75)
	Table UHX-20.2.3-3	Added (03-75)
341–342.1	Fig. 1-9	Added (00-072)
	1-9	Added (00-072)
345, 346	1-10(b)(3)	(1) Minus sign inserted in the denominator of eq. (46) by errata (07-1572) (2) Coefficient of 0.5 inserted in the numerator before $R_{nc} \sin \alpha$ by errata (07-1572)

(e)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
347	2-1(b)	Penultimate sentence revised (06-74)
349, 353	2-4(a)(1)	References to Fig. 2-4, sketches (4b) and (4c), added to the second and third sentences (06-74)
350	Fig. 2-4	(1) Sketches (4b) and (4c) added (06-925) (2) Note (2) revised to include references to sketches (4b) and (4c) (06-925)
354, 359	2-7	References to sketches (4b) and (4c) added in subparas. (a) and (b) (06-925)
355, 356	Table 2-5.1	Under "Gasket Material" column, "asbestos" replaced with "mineral fiber" (07-1030)
359, 360	2-8	References to Fig. 2-4, sketches (4b) and (4c) added in subparas. (b) and (c) (06-925)
367, 368	2-14	(1) Paragraph added to subpara. (a) (06-74) (2) Subparagraph (b) revised (06-74) (3) New subpara. (c) added; former subpara. (c) redesignated as subpara. (d) (06-74)
381	5-1(a)	Second sentence corrected by errata (07-1572)
451	14.5(c)	Denominator in the second equation corrected by errata from "1.9948" to "1.9448" (07-1572)
499	26-12(a)	Subparagraph (1) deleted by errata (07-1572)
501	26-14.1.2(m)(3)	The term "2.35y" corrected by errata to read "2.3Sy" (07-1572)
504	26-15.3	Equation corrected by errata (07-107)
525.1–525.3	Nonmandatory Appendix 35	Added (03-776)
543	Fig. L-1.4-1	Revised (06-789)
551–552.1	L-1.6	Added (06-789)
611, 614	Table W-3	(1) The phrase "in feet and inches" deleted from Note No. 17 by errata (07-1572) (2) Note No. 53 revised (06-236)
647, 648	HH-3	Definitions of <i>explosive expanding</i> ; <i>hydroexpanding</i> ; <i>segmental expander</i> ; <i>serrations</i> ; <i>torque control</i> ; <i>tube end enhancement</i> ; <i>tube expanding</i> ; <i>tube hole enhancement</i> ; <i>tube rolling tool</i> ; and <i>uniform pressure expanding</i> revised (05-1315)
	HH-4	Revised in its entirety (05-1315)
649	HH-7.1	(1) Subparagraph (m) revised (05-1315) (2) Subparagraph (v) added (05-1315)
	HH-7.2(j)	Revised (05-1315)
651, 652	Form QEXP-1	Corrected by errata (07-107)
653, 654	Table QEXP-1	(1) Note No. 10 corrected by errata (07-107) (2) Note No. 11 added by errata, with all subsequent Notes redesignated (07-107) (3) Note No. 29 corrected from "0.0109 in." to "0.109 in." by errata (07-107)

(f)



<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
663.1–663.6	Nonmandatory Appendix KK	Added (04-1682)
663.7–663.9	Nonmandatory Appendix LL	Added (06-962)

NOTE:

Volume 58 of the Interpretations to Section VIII, Division 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
00-072	Revised UG-36(c)(2) by adding (2)(c) allowing for Mandatory Appendix 1-9 to be used in lieu of UG-37. Revised Mandatory Appendix 1 to add 1-9, Alternative Rules for Reinforcement of Openings Under Internal Pressure.
01-046	Revised UW-16(f) by removing bolting pads; added new UW-16(g), rules for Bolting Pads; added Fig. UW-16.3, Some Acceptable Types of Small Bolting Pads.
02-3551	Revised UG-21 and UG-22 to clarify static head and test considerations.
02-4260	Revised Table U-3 to incorporate reference to API RP 521 and UG-125 to incorporate references to over-pressure protection by system design. Added new UG-140 to incorporate Code Case 2211.
03-75	Revised the examples in UHX-20 to be more representative of real exchangers while also incorporating the use of the current allowable stress listings, thermal expansion coefficients, and elastic properties as shown in Section II, Part D.
03-752	Approved revisions to Table UNF-23.3 and para. UNF-19.
03-776	Revised UG-90(c)(2) and added new Mandatory Appendix 35 and added ASME PCC-2, 2006 to Table U-3.
04-206	Added rules to limit the shell membrane and compressive stress in para. UHX-13.5.10, and renumbered current paras. UHX-13.5.10 and 13.5.11 to UHX-13.5.11 and 13.5.12, respectively. Revised references in other UHX-13 paragraphs to be consistent with these modifications.
04-1682	Revised U-2(a) by pointing the user to a new nonmandatory appendix, Guide for Preparing User's Design Requirements Forms. Added a new nonmandatory appendix, Guide for Preparing User's Design Requirements.
05-530	Added SF-468 UNS N05500 to Table UNF-23.3. Incorporated Code Case 1192-1 for SF-468-N05500 fasteners.
05-533	Added SA/GB 6654 material to Table UCS-23.
05-1160	Editorially corrected NF-3.
05-1315	Editorially revised HH-3, HH-4, HH-7.1, and HH-7.2; no technical changes.
05-1376	1. Inserted a new UW-54(a) through (c) (Qualification of Nondestructive Examination Personnel). 2. Deleted existing UW-51(a)(2) and renumbered subsequent paragraphs.
06-74	Paragraph 2-14 of Appendix 2 revised to address flange rigidity for reverse flanges and the use of successful service at specified service conditions.
06-236	Revised U-1(e)(3), UG-120(e), and Appendix W, Table W-3, and added UG-120(f) to include bolting for permanent covers.
06-738	Paragraphs UG-28 and UG-33 revised to prohibit extrapolation.
06-789	Revised Fig. L-1.4-1 and added new para. L-1.6 examples.
06-809	Revised UG-119(e) to clarify bracket attachment methods to permit nameplate pads, brackets, or structures to be attached to vessels with mechanical fasteners.
06-925	Added new Mandatory Appendix 2, Fig. 2-4 illustrations (4b) and (4c) for a loose flange with a partial-penetration groove weld plus fillet weld.
06-962	Revised UHX-13 and UHX-14 by deleting the formula for tube stresses calculated only at the periphery of the bundle and adding the formulas for tube stresses calculated at any diametrical point in the bundle. Revised UHX-13 and UHX-14 to account for $P_e = 0$ (avoid divide by zero) and to introduce term Z_w .
06-1323	Modified UG-125(a) and UG-125(c) and added new section UG-127(d) for open vents and flow paths.
06-1330	Updated Tables UHA-23 and added Notes stating the following: (1) X5CrNi18-10 shall be considered as Type 304 for the rules of this Part. (2) X5CrNiMo17-12-2 shall be considered as Type 316 for the rules of this Part.
06-1560	Deleted UCD-37(b).
06-1641	Revised Table UNF-23.3 to include SB-564 for UNS N10665.
07-107	Corrected by errata.
07-599	Revised UW-3(b) to provide guidance when a circumferential butt welded joint angle, alpha, between two members is greater than 0 deg.
07-772	Table UHA-44 revised to add S20100 and S20400 PFHT requirements.
07-1030	Revised Table 2-5.1 to replace the term "asbestos" with "mineral fiber."
07-1333	1. Revised SA-182 Grade 21 and 22 to Grades F21 and F22 to correct the grade designations. 2. Added "liquid quenched and tempered" for SA-336 and SA-387. 3. Revised Note (3)(b).
07-1572	Corrected by errata.
07-1868	Revised UHX-17(a)(1) to give an equation for the case when the expansion joint stiffness is zero.
07-1882	Revised Note (4) of Fig. UCS-66 to add "or quenched and tempered" to SA-516 if normalized.

(h)



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FOREWORD

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 construction¹ 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 which 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.

¹ *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 Mandatory Appendix covering preparation of technical inquiries). Proposed revisions to the Code resulting from inquiries will be presented to the Main Committee for appropriate action. The action of the Main Committee becomes effective only after confirmation by letter ballot of the Committee and approval by ASME.

Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute 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 annually in Addenda to the Code.

Code Cases may be used in the construction of components to be stamped with the ASME Code symbol 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 shown on the Addenda. 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 Guidelines for Acceptable 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, methods 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 an ASME Code symbol.

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 ASTM 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; Guideline for Acceptable ASTM Editions in Section II, Part A and Guideline for Acceptable ASTM Editions in Section II, Part 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 Guideline for Acceptable ASTM 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 Guideline for Acceptable ASTM 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 CODE SYMBOLS AND CODE AUTHORIZATION IN ADVERTISING

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

Organizations that are authorized to use Code Symbols 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 Code Symbols for the benefit of the users, the enforcement jurisdictions, and the holders of the symbols who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the symbols, 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 a Code Symbol 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.”

The ASME Symbol 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 a Code Symbol who may also use the facsimile in advertising to show that clearly specified items will carry the symbol. General usage is permitted only when all of a manufacturer’s items are constructed under the rules.

The ASME logo, which is the cloverleaf with the letters ASME within, shall not be used by any organization other than ASME.

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

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

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME” or the various Code

Symbols 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.

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SUMMARY OF CHANGES

The 2007 Edition of this Code contains revisions in addition to the 2004 Edition with 2005 and 2006 Addenda. The revisions are identified with the designation **07** in the margin and, as described in the Foreword, become mandatory six months after the publication date of the 2007 Edition. To invoke these revisions before their mandatory date, use the designation “2007 Edition” in documentation required by this Code. If you choose not to invoke these revisions before their mandatory date, use the designation “2004 Edition through the 2006 Addenda” in documentation required by this Code.

The BC numbers listed below are explained in more detail in “List of Changes in BC Order” following this Summary of Changes.

Changes given below are identified on the pages by a margin note, **07**, placed next to the affected area.

<i>Page</i>	<i>Location</i>	<i>Change (BC Number)</i>
1, 2	U-1	(1) In U-1(f), reference to UG-136 corrected by errata to read UG-137 (BC05-1438) (2) U-1(g) revised (BC04-1041)
6, 7	Table U-3	(1) Edition year for Welded and Seamless Wrought Steel Pipe (ASME B36.10M) corrected by errata to read 2004 (BC06-1380) (2) Metric standards added (BC05-822)
13	UG-11(c)(5)	Added (BC04-1295)
	UG-14(b)	Revised (BC06-1322)
37, 38	UG-35.2(d)(1)	Revised (BC06-32)
	UG-36(b)(1)	Revised (BC05-1346, BC06-44)
40, 41	UG-37(a)	Paragraph added under E_1 (BC05-1249)
43	UG-37(h)	Added (BC02-2707)
45, 49	UG-40(e)	Reference to UG-44(j) corrected by errata to read UG-44(i) (BC06-1380)
	UG-42(a)(2)	Revised (BC06-44)
	UG-42(c)	Last sentence revised (BC06-44)
	UG-42(e)	Revised (BC06-44)
64	UG-84(a)	Revised (BC05-822)
	UG-84(b)(1)	Revised (BC05-822)
66	Fig. UG-84.1	General Note (c) revised (BC05-597)
67	Fig. UG-84.1M	General Note (c) revised (BC05-597)
71	UG-90(b)(19)	Revised (BC99-586)
81	UG-116(a)	Subparagraphs (3), (4), and (5) corrected by errata to delete units of measure (BC06-1380)
	UG-116(e)	Revised (BC04-1455)
84	UG-117(f)	Fifth paragraph revised (BC99-586)
85	Fig. UG-118	Units of measure deleted by errata (BC06-1380)
86	UG-120(a)	Revised (BC99-586, BC06-525, BC06-561)

<i>Page</i>	<i>Location</i>	<i>Change (BC Number)</i>
97	UG-134	Title revised (BC04-1311)
98	UG-134(f)	Added (BC04-1311)
100	UG-136(c)(3)(a)	Last sentence added (BC04-1310)
	UG-136(c)(3)(b)	Revised (BC04-1310)
	UG-136(c)(3)(c)	Revised (BC04-1311)
101, 102	UG-136(d)(2)	Revised (BC02-3580)
	UG-136(d)(3)	Footnote 63 added (BC02-3580)
	UG-136(d)(4)	Corrected by errata (BC06-1380)
103	UG-137(d)(2)	Revised (BC02-3580)
110–117	UW-13	(1) References to sketches in Fig. UW-13.1 revised (BC01-286) (2) Subparagraph (b)(5) revised (BC05-1228)
	Table UW-12	For Type No. 2, under Limitations, second cross-reference revised (BC01-286)
	Fig. UW-13.1	Sketch (d) deleted and subsequent sketches redesignated (BC01-286)
121, 122	Fig. UW-16.1	Sketch (f-2) revised (BC04-912)
126–129	UW-16(e)	Subparagraphs (1) and (2) revised (BC97-311)
	UW-16(f)	(1) First paragraph revised (BC97-311) (2) Subparagraph (3)(a)(6) added (BC97-311) (3) In subpara. (6), revised reference to UW-16(e)(2) to read UW-(16)(e)(1) (BC97-311)
	Fig. UW-16.2	Caption revised (BC97-311)
140	UW-51(a)(1)	Subparagraphs (a) and (b) added (BC99-586)
158	Table UCS-23	Revised (BC00-380)
160	UCS-56(d)(5)	Corrected by errata to read 280°C/h (BC06-1380)
169	Table UCS-57	Revised (BC05-474)
175	UCS-66(i)	(1) First paragraph revised (BC05-1484) (2) Subparagraphs (4) and (5) added (BC05-1484)
180, 181	Fig. UCS-66.2	Note (9) corrected by errata (BC06-1380)
188	UNF-19(e)	Temperature of 1,500°F corrected by errata to read 1,650°F (BC06-1380)
189	Table UNF-23.1	SB-928 added (BC04-1010)
190, 191	Table UNF-23.3	(1) Under SB-462, N20033 corrected by errata to read R20033 (BC06-1380) (2) N10242 added to SB-366, SB-434, SB-564, SB-573, SB-619, SB-622, and SB-626 (BC03-1424)
194	UNF-78	Revised (BC06-461)
195	Table UNF-79	Grade 600 added (BC05-1043)
200–202	Table UHA-23	(1) Under SA-182, UNS No. S31050 added (BC99-005) (2) Under SA-182, UNS No. S31277 deleted (BC06-1299) (3) Under SA-182, UNS No. S39274 added (BC03-753) (4) SA-336 revised to read SA-965 and set following SA-815 (BC00-433)

<i>Page</i>	<i>Location</i>	<i>Change (BC Number)</i>
		(5) Under SA-479, UNS No. S32906 added (BC00-309)
		(6) Under SA-789, UNS No. S32906 added (BC04-309)
		(7) Under SA-789, UNS No. S39274 added (BC03-753)
		(8) Under SA-790, UNS No. S32906 added (BC04-309)
		(9) Under SA-790, UNS No. S39274 added (BC03-753)
204, 205	Table UHA-32	For P-No. 10H, S39274 added (BC03-752)
207–211	UHA-51	Revised (BC04-1484, BC05-822)
	Table UHA-44	Metric values in third and last columns corrected by errata (BC06-917)
239	ULW-5	Last two sentences deleted by errata (BC06-917)
249	Fig. ULW-17.6	Sketch (h) deleted by errata (BC06-917)
254, 257	ULW-52	Subparagraph (e) deleted by errata, and former subpara. (f) redesignated (e) (BC06-917)
260, 261	ULW-77	Paragraph (f) deleted by errata (BC06-917)
	ULW-78	Paragraph (d) deleted by errata (BC06-917)
268	ULT-82(c)	Revised; subparas. (1) through (3) deleted (BC05-822)
274–276	Fig. UHX-3	In sketch (a), arrow for tubes corrected by errata (BC06-917)
	UHX-9.3	First three subentries under <i>G</i> revised (BC05-483)
	UHX-9.4	Revised (BC05-483)
	UHX-9.5	Revised (BC05-483)
	Fig. UHX-9	Added (BC05-483)
284	UHX-12.4(d)	Added (BC05-217)
286, 287	UHX-12.6	Added (BC05-217)
290	UHX-13.4(g)	Added (BC05-217)
299	UHX-13.9	Added (BC05-217)
305	UHX-14.4(h)	Added (BC05-217)
309, 310	UHX-14.7	Added (BC05-217)
	UHX-17	Revised (BC05-482)
310	Table UHX-17	Added (BC05-482)
333	1-6(d)(3)	Reference to 2-7 revised to read 2-8 (BC05-1228)
335	Fig. 1-6	(1) Sketch (a) revised (BC05-1228) (2) Note added (BC05-1228)
336	1-7	(1) Title revised (BC06-44) (2) Subparagraph (b)(1) revised (BC06-44)
341–346	1-10	Added (BC05-1346)
367, 368	2-14(b)	K_I entry revised (BC06-161)
	2-14(c)	$J = 1$ revised to read $J \leq 1$ (BC06-161)
	Table 2-14	Revised (BC06-161)
371	Definition of <i>spiral weld</i>	Added (BC05-1150)

<i>Page</i>	<i>Location</i>	<i>Change (BC Number)</i>
381	5-1(a)	Revised (BC05-482)
	5-3(a)	Revised (BC05-482)
	5-5(b)	Revised (BC05-482)
382	5-5(c)	Revised (BC05-482)
383	5-5(e)	Reference to Fig. 5-1 deleted (BC05-482)
391	9-1(c)	In the first line, "design" inserted by errata (BC06-1380)
401, 402	10-13	Revised (BC99-586, BC06-525)
407	12-4	First sentence revised (BC99-586)
429	13-11(e)(2)	In eq. (5), denominator corrected by errata to insert a coefficient of 6 (BC06-650)
487	26-6.3.3(a)(1)	Denominator revised (BC04-205)
488	26-6.4	Revised (BC04-205)
	26-6.5.2	Reference to UG-29 revised to read UG-28 (BC06-262)
492	26-6.6.3.2	Revised (BC04-205)
494	26-7.6.3.2	Revised (BC04-205)
495, 496, 498	26-8.3.3(b)	Denominator of equation revised (BC06-262)
	26-8.6.3.2	Revised (BC04-205)
	26-9.4	First equation revised (BC06-262)
499	26-12(a)	Revised (BC04-205)
500, 501	26-14.1.1	L_c and t_c entries added (BC04-205)
	26-14.1.2(h)	Denominator revised (BC04-205)
	26-14.1.2(m)	Revised (BC04-205)
509	27-3(a)	Last sentence deleted (BC04-96)
513	Fig. 28-1	In the General Note and the table in sketch (b), X corrected by errata to read α (BC06-560)
517	31-2(a)	Revised to include 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca (BC00-380)
	31-4(a)	Revised (BC00-380)
518	Table 31-1	Revised to include 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca (BC00-380)
596	Nonmandatory Appendix P	Title revised (BC06-91)
602	W-2(e)	Added by errata (BC06-1380)
603, 604	Form U-1	Units of measure deleted by errata (BC06-1380)
605	Form U-1A	Units of measure deleted by errata (BC06-1380)
606, 607	Form U-2	Units of measure deleted by errata (BC06-1380)
608	Form U-2A	Units of measure deleted by errata (BC06-1380)
609	Form U-3	Units of measure deleted by errata (BC06-1380)
611, 613, 614	Table W-3	(1) In Note No. 42, "in inches" deleted by errata (BC06-1380) (2) General Note added by errata (BC06-1380)
616	Table W-3.1	General Note added by errata (BC06-1380)
617	Form UV-1	In the "Size" column, "(NPS)" deleted by errata (BC06-1380)
618	Form UD-1	In the "Size" column, "(NPS)" deleted by errata (BC06-1380)
619	Table W-3.2	(1) In Note No. 7, "(NPS)" deleted by errata (BC06-1380) (2) General Note added by errata (BC06-1380)
633, 634	Nonmandatory Appendix DD	UD Code Symbol Stamp information moved from Items 7, 8 to Item 2 by errata (BC06-1380)
657–663	Nonmandatory Appendix JJ	Added (BC05-821)

NOTE: Volume 57 of the Interpretations to Section VIII-1 of the ASME Boiler and Pressure Vessel Code follows the last page of this Edition.

LIST OF CHANGES IN BC ORDER

BC Number	Change
BC97-311	Revised UW-16(f) to more accurately define the type of standard fittings and to Fig. UW-16.2. Revised UW-16(f)(3)(a) to specify a minimum wall thickness. Revised UW-16(e)(1) and (2) to allow, with limitations, pipe, tube, and welding necks to be attached to vessels by a fillet weld deposited from the outside only.
BC99-005	Added SA-182 F310MoLN, UNS S31050, to appropriate tables in Section II, Part D; Section VIII, Divisions 1 and 2; and Section IX; incorporating Code Case 2038-5.
BC99-586	Revised Section VIII, Division 1, UG-90(b)(19); UG-117(f); UG-120(a); UW-51(a)(1); UW-51(c)(1); Appendix 10, para. 10-13; Appendix 12, para. 12-4 for document retention and availability to review teams.
BC00-380	The following materials were added: SA-182 Gr F3Vcb-SA-336, Gr F3Vcb-SA-508, Gr 3Vcb-SA-541, Gr 3Vcb-SA-542, Gr E Cl 4a-SA-832, Gr 23V. This leads to: Updated Tables UCS-23 and 31-1; added 3Cr-1Mo-0.25V-Cb-Ca to welding restrictions (SAW and SMAW) in §31-4(a)
BC00-433	Revised Sections I, II, III, VIII, IX, and XII; and Code Cases 21-217-1, 2224-1, N-201-4, and N-253 to change references to SA-336 for stainless steel forgings to SA-965.
BC01-286	Deleted sketch (d) of Fig. UW-13.1 and revised UW-13(b)(1).
BC02-2707	Paragraph (h) added to para. UG-37.
BC02-3580	UG-136(d)(2) — Revised hydrostatic test requirements. UG-136(d)(3) — Added footnote. UG-137(d)(2) — Revised hydrostatic test requirements.
BC03-753	Incorporated Section VIII, Division 1 Code Case 2316 by adding lines to Tables 1A, U, and Y-1 for SA-182, SA-789, and SA-790 for UNS S39274. Added lines to SC IX Table QW/QB-422 and Appendix D. Completed incorporation of CC-2452 by adding lines to Tables U and Y-1 for SA-182 and SA-240 for UNS S32750.
BC03-1424	In Section II, Part D, incorporated Code Case 2319-2 for UNS N10242 stress allowables into Table 1B, and U and Y-1 tensile and yield values, NFN-6 EPC, P-No.44, and add specifications to SC VIII, Division 1 Table UNF 23.3 and P-No. 44 to Section IX Tables QB/QW-422 and Appendix D. Adopt ASTM B 366-04b as SB-366. Annul Code Case.
BC04-96	Revise 27-3 to delete the statement that shape deviations have to be symmetric about the axial centerline of the head.
BC04-205	Paragraph 26-6.3.3: revised formula $S_{2,E}$ to account for the effect of the collar in U-shape unreinforced bellows. Paragraph 26-6.4.1: deleted the two options concerning instability due to internal pressure. Paragraph 26-6.3.2 revised the fatigue formulae for unreinforced bellows, reinforced bellows (para. 26-7.3.2), and toroidal bellows (para. 26-8.3.2) to limit the calculated allowable number of cycles to 1 million cycles. Paragraph 26-12: revised to limit the test pressure to prevent instability of the bellows during the pressure test, as required by B31.3 and EJMA.
BC04-309	Included UNS S32906 in Table UHA-23.
BC04-912	Revise Fig. UW-16-1, (f-2) dimension " $\frac{1}{2} t_{min}$ " to "minimum of $1\frac{1}{2} t$ ".
BC04-1010	Addition of SB-928 UNS A95083, A95086, and A95456 to UNF-23.1.
BC04-1041	Revised U-1(g).
BC04-1295	UG-11(c)(5) added to clarify that the vessel Manufacturer is to verify that welded standard pressure parts comply with the rules of this Division.
BC04-1310	Revised UG-136(c)(3) to require pressure relief valves with adjustable blowdown to have control elements positioned typical of production methods prior to conducting the capacity flow test.
BC04-1311	Revised heading of UG-134 to read, "Pressure Setting and Performance Requirements." Added new para. UG-134(f) clarifying requirements regarding pressure relief valve chatter and flutter. Referenced UG-134 within UG-136(c)(3)(c).
BC04-1455	Required vessel markings regarding the use of ultrasonic examination using Code Case 2235-6. Revised UG-116(e) and UG-116(e)(1).
BC05-217	UHX-12.4(d): Added note that states a U-tube tubesheet may be designed as simply supported. UHX-12.6: Provided rules to design a U-tube tubesheet as simply supported. UHX-13.4(g): Added note that states a fixed tubesheet may be designed as simply supported. UHX-13.9: Provided rules to design a fixed tubesheet as simply supported. UHX-14.4(g): Added note that states a floating tubesheet may be designed as simply supported. UHX-14.7: Provided rules to design a floating tubesheet as simply supported.
BC05-474	Table UCS-57: P-No 5B 2, 5C 1 and P-No 5A Gr2 added, 10B and 10F grades changed to 1.

BC Number	Change
BC05-482	5-1(a): Combined last two sentences 5-3(a): Revised 5-3(b): Revised 5-5(c): Revised 5-5(e): Revised UHX-17: Revised
BC05-483	UHX-9.3: Revised UHX-9.4(a): Revised UHX-9.4(b): Revised UHX-9.4(c): Added UHX-9.5(a): Revised Fig. UHX-9: Added
BC05-597	Revised Fig. UG-84.1 regarding the 5F (3C) tolerance on specification impact tested material.
BC05-821	A new Appendix JJ is added, consisting of an introduction page and six flow charts that illustrate how to apply the UHA-51 Impact Test requirements for high alloy vessels.
BC05-822	UG-84(b)(1) is revised to add ISO-148 (Parts 1, 2, and 3) as acceptable for impact test procedures and apparatus in addition to SA-370. UG-84(a) is revised to ensure that Charpy V-notch impact testing is used exclusively. Table U-3 is revised to include a reference to ISO-148 (Parts 1, 2, and 3). UHA-51(a)(4) is revised to add Plasma Arc Welding (PAW) and to require pre-use testing of consumables. Also now permits a ferritoscope or magna gauge to be used in addition to Fig. ULT-82 for determination of ferrite. UHA-51(f) is revised to mandate preuse testing of austenitic stainless steel welding consumables and to editorially clarify wording of present requirements. UHA-51(h) is added to include requirements for vessel (production) impact tests [relocated from previous UHA-51(f)]. UHA-51(i) is added concerning Production Impact Tests for Autogenous Welds in Stainless steels. ULT-82 (c) is revised to reference UHA-51 requirements applicable to Type 304 stainless steel vessels and to delete previous requirements for welding processes, welding consumables, and determination/control of delta ferrite.
BC05-1043	Table UNF-79 was revised to add postfabrication strain limits and required heat treatment for UNS N06600 material.
BC05-1150	Added definition of <i>spiral weld</i> to Appendix 3-2.
BC05-1228	Revised UW-13(b)(5), 1-6(d)(3), and Fig. 1-6.
BC05-1249	Revised UG-37(a) to include a provision for ERW or autogenously welded pipe or tube in the definition of “ E_1 ”
BC05-1346	Add new appendix 1-10 for alternative method for design of large openings and revised UG-36(b)(1) to refer to it.
BC05-1438	Errata
BC05-1484	Revised UCS-66(i) and UHA-51(g) to clarify that the MDMT low stress adjustment is also applicable to the WPS and production welds.
BC06-161	Paragraph 2-14 of Appendix 2 is revised to make editorial corrections and provide additional information for applying the flange rigidity index.
BC06-262	The following editorial errors corrected: -Clause 26-6.5.2, in third line: replace UG-29 by UG-28. -Clause 26-8.3.3(b), in formula giving S_3 : in the denominator, replace “ $2nt_p$ ” by “ nt_p ”. -Clause 26-9.4, in formula giving Δq_θ : theta is a subscript of Δq These corrections do not affect the numerical examples contained in Clause 26-14
BC06-32	Revision of UG-35.2(d)(1) to clarify the design requirements for manually operated closures.
BC06-44	Revisions to UG-36, UG-42, and Appendix 1-7 to clarify the applicability of code rules for design of nozzles in conical shells.
BC06-91	Revised the title of Appendix P.
BC06-461	Revision to UNF-78 clarifying that the welding qualification requirements of both Section IX and Appendix 17 are applicable for resistance-welding titanium.
BC06-525	Revised UG-120(a)(3) to maintain filing with National Board. Add 10-13(c) for maintenance of UM and UG-90(c)(2) vessel records.
BC06-560	Errata
BC06-561	Revised UG-120(a)(3) so that it will not be necessary to submit the Manufacturer’s Data Report (MDR) to the jurisdiction in which the vessel is to be installed and where required by law if the vessel is registered and the MDR filed with the National Board of Boiler and Pressure Vessel Inspectors and where acceptable to the enforcement authority of the jurisdiction.
BC06-917	Errata
BC06-1299	Deleted SA-182 and SA-480 S31277.
BC06-1322	Revised UG-14(b) to read “machined from rolled or forged bar.”
BC06-1380	Errata

INTRODUCTION

SCOPE

07 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, and ULT 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, and low temperature materials, respectively. Section II, Part D also contains tables of maximum allowable stress values for these classes of materials.

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 Code U Symbol:

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

- (1) a design pressure of 300 psi (2 MPa);
- (2) a design temperature of 210°F (99°C);

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

- (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);

A08 (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.²

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 Code symbol.

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

¹ 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.

² Requirements for pressure vessels for human occupancy are covered by ASME PVHO-1.

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;³

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)].

³ 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.



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 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 m³) in volume and 250 psi (1.7 MPa) design pressure; or

U-1(j)(2) 3 cu ft (0.08 m³) in volume and 350 psi (2.4 MPa) design pressure;

U-1(j)(3) 1½ cu ft (0.04 m³) 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).

U-1(k) The degree of nondestructive examination(s) and the acceptance standards beyond the requirements of this Division shall be a matter of prior agreement between the Manufacturer and user or his designated agent.

GENERAL

U-2 GENERAL

A08 (a) The user or his designated agent⁴ 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,

⁴ 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.

valves, instruments, and fittings to perform the functions covered by PG-59 through PG-61 of Section I.

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

(b) Responsibilities⁵

(1) The Manufacturer of any vessel or part to be marked with the Code Symbol 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 Code stamped by the appropriate Code stamp 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 Code Symbol;

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

