

SECTION V

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Pressure Vessel Code
An International Code

**Nondestructive
Examination**

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ASME Boiler and Pressure Vessel Committee
on Nondestructive Examination



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

INTERPRETATIONS

Interpretations of the Code have historically been posted in January and July at <http://cstools.asme.org/interpretations.cfm>. Interpretations issued during the previous two calendar years are included with the publication of the applicable Section of the Code in the 2015 Edition. Interpretations of Section III, Divisions 1 and 2 and Section III Appendices are included with Subsection NCA.

Following the 2015 Edition, interpretations will not be included in editions; they will be issued in real time in ASME's Interpretations Database at <http://go.asme.org/Interpretations>. Historical BPVC interpretations may also be found in the Database.

CODE CASES

The Boiler and Pressure Vessel Code committees meet regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2015 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2017 Code.

FOREWORD*

(15)

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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the committees. 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 committees 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 a committee's full understanding may result in the request being returned to the inquirer with no action.

2 INQUIRY FORMAT

Submittals to a 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.

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 committees 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
Two Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org or via our online tool at <http://go.asme.org/InterpretationRequest>.

(b) *Response.* The Secretary of the appropriate committee 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 committee.

PERSONNEL

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January 1, 2015

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L. Fridlund	R. Wink
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As of January 1, 2015

E07 ON NONDESTRUCTIVE TESTING

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SUMMARY OF CHANGES

After publication of the 2015 Edition, Errata to the BPV Code may be posted on the ASME Web site to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in the BPV Code. Such Errata shall be used on the date posted.

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

Changes given below are identified on the pages by a margin note, **(15)**, placed next to the affected area.

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

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
xv	List of Sections	Revised
xvii	Foreword	(1) Revised (2) New footnote added by errata (13-860)
xx	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	In last line of 6(a), URL revised
xxii	Personnel	Updated
xxxix	ASTM Personnel	Updated
1	T-120	(1) New subpara. (g) added, and original subparas. (g) through (j) redesignated as (h) through (k), respectively (12-1907) (2) In newly redesignated subpara. (h), “Manufacturer’s” revised to read “organization’s” (12-2049) (3) In newly redesignated subpara. (i), “Code User’s” revised to read “organization’s” (12-2049) (4) New last sentence added to newly redesignated subpara. (j) (12-1907)
2	T-150	Subparagraphs (b) and (c) revised (12-2049)
3	T-160	Subparagraph (a) revised (12-2049)
3	T-170	In subpara. (b), “Manufacturer’s” revised to read “organization’s” (12-2049)
3	T-190	In subpara. (b), “qualifications” corrected by errata from plural to singular (13-1765)
4	Mandatory Appendix I (Article 1)	(1) I-110 and I-120 revised (06-484) (2) I-130 redesignated as I-121 and revised in its entirety (06-484, 10-1364) (3) New I-121.1 through I-121.11 added as incorporation of glossary of terms from throughout Subsection A of this book (06-484)
22	Mandatory Appendix II (Article 1)	Added (12-1907)
27	T-210	Last sentence of first paragraph revised (06-484)
27	T-224	(1) First sentence revised (13-270) (2) In second sentence, “Manufacturer’s” revised to read “organization’s” (12-2049)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
27	T-231.2	Revised (10-1576)
35	T-291	First paragraph and subpara. (j) revised (12-2049)
44	Mandatory Appendix V (Article 2)	Deleted (06-484, 13-1766, 14-10)
45	Mandatory Appendix VI (Article 2)	(1) Title revised (13-1984) (2) VI-210, VI-222, VI-232, VI-250, VI-261, VI-271, VI-272, VI-282, VI-283, VI-291(e), VI-291(f), and VI-292 revised (13-1984)
48	VI-A-210	Second paragraph revised (13-1984)
52	VIII-210	In second paragraph, title of ASTM E2007 corrected by errata (13-1767)
52	VIII-277	(1) VIII-277.1 revised (13-269) (2) VIII-277.3 revised (13-269)
53	VIII-280	(1) VIII-282 revised (13-269) (2) VIII-287 revised in its entirety (14-639) (3) VIII-288(a) revised (13-269)
54	VIII-291	First paragraph revised (12-2049)
55	IX-277	(1) IX-277.1(a) revised (13-269) (2) IX-277.3 revised (13-269)
56	IX-280	(1) IX-282 revised (13-269) (2) IX-287 revised in its entirety (14-639) (3) IX-288 revised (13-269)
57	IX-291	First paragraph revised (12-2049)
69	T-410	Paragraph below (h) revised (06-484)
71	T-434.3	Second sentence corrected by errata to include missing reference for T-434.1.7 (14-592)
74	Figure T-434.3-1	General Note (b) revised (14-704)
78	T-462.7	Added (10-1214)
82	T-471.4.1	Revised (12-1886)
82	T-471.6	Added (12-1886)
87	II-440	In text-tabular, entries in last column revised (12-893)
91	Figure III-434.2.1(b)	Revised editorially
90	III-470	Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V
93	Mandatory Appendix IV (Article 4)	Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V
94	Mandatory Appendix V (Article 4)	Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V
96	Mandatory Appendix VII (Article 4)	(1) In Table VII-421, second entry in first column and last entries in second and third columns were revised (12-1987) (2) Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V
98	Mandatory Appendix VIII (Article 4)	(1) In Table VIII-421, second entry in first column and last entries in second and third columns were revised (12-1987)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
		(2) Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V
100	Mandatory Appendix IX (Article 4)	(1) Paragraph heads were added editorially to establish proper paragraph hierarchy used in Section V (2) IX-435.4 revised (13-670)
102	Mandatory Appendix X (Article 4)	Added (12-2000)
115	Table D-490	In last column, last entry, hyphen added to “through wall” (13-1582)
168	Nonmandatory Appendix Q (Article 4)	Added (10-1214)
170	Nonmandatory Appendix R (Article 4)	Added (11-1528)
173	T-510	Paragraph below (h) revised (06-484)
181	Mandatory Appendix III (Article 5)	Deleted (06-484, 10-1214)
183	T-610	Second paragraph revised (06-484)
183	T-621	(1) T-621.1 and T-621.2 revised (09-400) (2) T-621.3 added (09-400)
184	Table T-621.1	Formerly Table T-621, redesignated (09-400)
184	Table T-621.3	Added (09-400)
185	T-672	Revised (09-400)
185	T-673.2	Subparagraph (b) revised (09-400)
187	T-676.3	Revised (14-1537)
187	T-692	Revised (12-2046)
188	Mandatory Appendix I (Article 6)	Deleted (06-484)
192	T-710	Second paragraph revised (06-484)
196	T-762	Subparagraph (a) revised (11-251)
200	Figure T-766.1	Editorially revised
201	T-777.1	Revised (14-1537)
202	T-793	Revised (12-2047)
205	I-791	Revised (12-2047)
206	Mandatory Appendix II (Article 7)	Deleted (06-484)
208	III-791	Revised (12-2047)
213	V-760	Editorially added to establish proper paragraph hierarchy used in Section V
215	T-810	Subparagraph (c) revised (06-484)
216	Mandatory Appendix I (Article 8)	Deleted (06-484)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
238	Mandatory Appendix VIII (Article 8)	(1) Title revised (14-1512) (2) VIII-810, VIII-820, VIII-821.1, VIII-834.1, VIII-850, VIII-862.1, VIII-862.2, VIII-864.1, VIII-864.2, VIII-864.4, Figure VIII-864.2, VIII-880.3, VIII-890.3.1, VIII-890.3.2, and VIII-890.3.3 revised (11-1371, 13-1582, 14-1512) (3) In Table VIII-821, first column, second entry revised (11-1371)
244	T-910	Subparagraph (c) revised (06-484)
244	T-922	In second sentence, “manufacturer” revised to read “organization” (12-2049)
245	T-952	Revised (14-1537)
246	Mandatory Appendix I (Article 9)	Deleted (06-484)
247	T-1010	Subparagraphs (b) and (c) revised (06-484)
247	T-1021.2	In first sentence, “manufacturer” revised to read “organization” (12-2049)
265	Mandatory Appendix VII (Article 10)	Deleted (06-484)
275	T-1120	Subparagraph (a) revised (06-484)
289	Mandatory Appendix III (Article 11)	Deleted (06-484)
296	T-1210	Paragraph below (e) revised (06-484)
296	T-1224.1	Second sentence revised (13-2151)
305	Mandatory Appendix III (Article 12)	Deleted (06-484)
312	Article 13	Revised in its entirety (04-1472, 06-484)
335	T-1410	In first paragraph, second sentence revised (12-2049)
342	Mandatory Appendix I (Article 14)	Deleted (06-484)
354	T-1710	Subparagraph (c) revised (06-484)
355	Figure T-1762	Revised (13-1582)
356	Figure T-1763.1(a)	Title and callout revised to hyphenate “through wall” and “through hole” (13-1582)
356	Figure T-1763.1(b)	Title and callout revised to hyphenate “through wall” and “through hole” (13-1582)
359	Article 18	Added (10-1813, 14-1072)
364	Article 19	Added (11-1194)
403	SE-999	Revised in its entirety (10-1576)
477	S A - 4 3 5 / SA-435M	Revised in its entirety (12-1986)
481	S A - 5 7 7 / SA-577M	Revised in its entirety (13-904)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
485	S A - 5 7 8 / SA-578M	Revised in its entirety (13-905)
493	S A - 6 0 9 / SA-609M	Revised in its entirety (13-906)
503	S A - 7 4 5 / SA-745M	Revised in its entirety (12-1989)
535	S E - 7 9 7 / SE-797M	Parenthetical statement corrected by errata (14-2345)
543	SE-2491	Revised in its entirety (13-1981)
575	SD-129	Revised in its entirety (12-1995)
581	SD-516	Revised in its entirety (12-1996)
587	SD-808	Revised in its entirety (12-1997)
593	S E - 1 6 5 / SE-165M	Revised in its entirety (12-1998)
677	S E - 2 0 9 6 / SE-2096M	Revised in its entirety (12-1999)
689	S E - 6 5 0 / SE-650M	Revised in its entirety (12-2042)
693	SE-750	Added (11-1196)
715	S E - 1 0 6 7 / SE-1067M	Added (11-1197)
731	S E - 1 1 1 8 / SE-1118M	Added (11-1198)
745	S E - 1 1 3 9 / SE-1139M	Added (11-1199)
753	S E - 1 2 1 1 / SE-1211M	Revised in its entirety (12-2043)

NOTE: Volume 63 of the Interpretations to Section V of the ASME Boiler and Pressure Vessel Code follows the last page of Section V.

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
04-1472 06-484	Article 13 and its appendices have been reformatted to be consistent with the rest of Section V. Mandatory Appendices containing Glossary of Terms for Articles 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 deleted and terms incorporated alphabetically, by Method, into Article 1, Mandatory Appendix I, I-121.1 through I-121.11. Revised the Scope in T-210, T-410, T-510, T-610, T-710, T-810(c), T-910(c), T-1010(b), T-1120(a), T-1210(e), T-1310(e), and T-1710 to reflect Mandatory Appendix changes.
09-400	Added new Table T-621.3. Added new paragraph T-621.3 to require any penetrant procedure to have time limits on various steps as provided in Table 621.3. Redesignated existing Table T-621 as Table T-621.1 and updated references in text accordingly. Added revisions to T-672 to provide a maximum dwell time limit and so that, for any dwell time, the penetrant is not allowed to dry during the dwell time. Added words to cover the situation if the penetrant is allowed to dry. Revised T-673.2(b) to include options for using a pre-rinse before either immersion or emulsifier spray emulsification and the direct use of water-emulsifier immersion and water-emulsifier spray without a pre-rinse. Provided spray pressure limitations for water or water-emulsifier combinations and temperature limits for water baths, water spray, water-emulsifier spray and water-emulsifier baths. Limited time of various applications unless time is qualified.
10-1214	In Article 4, new paragraph T-462.7 added. Added new Nonmandatory Appendix Q to Article 4.
10-1364	Added definition for <i>examination</i> to Article 1, Mandatory Appendix I, I-130.
10-1576	Revised T-231.2 to incorporate ASTM E 999-10 to more clearly reference SE-999 as an optional guideline (not mandatory; “shall” has been changed to “may”).
10-1813	Added new Article 18.
11-251	Changed the existing wording in T-762(a) to clarify the required frequency of yoke lifting power verification.
11-1194	Added new Article 19.
11-1196	Adopted ASTM E750-10 as SE-750.
11-1197	Adopted ASTM E1067/E1067M-11 as SE-1067.
11-1198	Adopted ASTM E1118/E1118M-11 as SE-1118.
11-1199	Adopted ASTM E1139/E1139M-12 as SE-1139.
11-1371	Revised the calibration standard requirements, clarified instrument sample rate, and acquisition pull speeds, as well as several other minor changes in Article 8, Mandatory Appendix VIII.
11-1528	Added new Nonmandatory Appendix R to Article 4.
11-1975	Adopted ASTM E1647-09 in Article 22 to replace current SE-1647.
12-893	Revised the values in the Indication Limits column in the textabular material in II-440.
12-1886	Added text to T-471.4.1 to explain that when using semi-automatic or automatic scanning to record data, the scanning level may be equal to the reference level. Also added new T-471.6 that states recorded data shall not have thresholding and shall be in an unprocessed form.
12-1907	Revised T-120 to state the 2006 editions of ASNT's SNT-TC-1A and CP-189 are applicable except for defined minimum requirements for qualification to the various techniques for radiographic and ultrasonic examinations in new paragraph (g) and redesignated existing subparagraph accordingly. Added new Mandatory Appendix II for Article 1 which details the requirements for the new ultrasonic and radiography technique requirements for training, experience, and examinations for certification. Revised endnote 3 to reflect changes.
12-1986	Adopted ASTM A435/A435M-90 (R2012) in Article 23 to replace current SA-435/SA-435M.
12-1987	Updated Tables VII-421 and VIII-421 to mandate that the scanner being used to qualify the examination in Article 4, Mandatory Appendices VII and VIII, be used in the field as well. The change is to update Tables VII-421 and VIII-421 to show the scanner adhering and guiding mechanism as an essential variable. Record 14-591 addresses the comment made about separating scanners into manual, semi-automated and automated configurations.
12-1989	Adopted ASTM A745/A745M-12 in Article 23 to replace current SA-745/SA-745M.
12-1995	Adopted ASTM D129-11 in Article 24 to replace current SD-129.

Record Number	Change
12-1996	Adopted ASTM D516-11 in Article 24 to replace current SD-516.
12-1997	Adopted ASTM D808-11 in Article 24 to replace current SD 808.
12-1998	Adopted ASTM E165/E165M-12 in Article 24 to replace current SE-165.
12-1999	Adopted ASTM E2096/E2096M-10 in Article 26 to replace current SE-2096.
12-2000	Added new Mandatory Appendix X to Article 4.
12-2042	Adopted ASTM E650/E650M-12 in Article 29 to replace current SE-650.
12-2043	Adopted ASTM E1211/E1211M-12 in Article 29 to replace current SE-1211.
12-2046	Revised T-692.
12-2047	Revised T-793, I-791, and III-791.
12-2049	Globally replaced references to a Manufacturer, Contractor, Fabricator, Installer, Assembler and Code User within the text of Section V with the generic term “organization” where appropriate for greater clarity of intent. Revised endnote 4 in Article 1 to define the term “organization” as used in Section V.
13-269	Revised VIII-277.1(a), VIII-277.3, VII-282, IX-277.1(a), IX-277.3, and IX-282 to add the wording “if verified by measurement, a pixel intensity tolerance up to 2% is permitted in the determination equal to”. Also revised VIII-288(a) to add wording “in accordance with VIII-277.1, VIII-277.3, and VIII-282”.
13-270	Revised T-224 to clarify that the required identification is to appear on each radiograph.
13-670	Added an exclusion to IX-435.4 stating that IX-435.4 is not applicable to TOFD examinations for welds with the same thickness and configuration.
13-860	In the Foreword, the subtitle has been deleted and replaced with an ANSI disclaimer as a footnote.
13-904	Adopted ASTM A577/A577M-90 (R2012) in Article 23 to replace current SA-577/SA-577M.
13-905	Adopted ASTM A578/A578M-07 (R2012) in Article 23 to replace current SA-578/SA-578M.
13-906	Adopted ASTM A609/A609M-12 in Article 23 to replace current SA-609/SA-609M.
13-1582	Revised Table D-490, VIII-864.1(b), VIII-864.2(b), Figure VIII-864.2, Figure T-1762, Figure T-1763.1(a), Figure T-1763.1(b), and T-1763.1(a), (b), and (c) to hyphenate “through-hole,” “through-wall hole,” and “flat-bottom holes.”
13-1765	Errata correction. See Summary of Changes for details.
13-1766	Errata correction. See Summary of Changes for details.
13-1767	Errata correction. See Summary of Changes for details.
13-1981	Adopted ASTM E2491-13 in Article 23 to replace current SE-2491.
13-1984	Revised Mandatory Appendix VI to clarify that it pertains to digitization of radiographic film.
13-2151	Revised T-1224.1 for clarification.
14-10	Editorially corrected definition of <i>radiograph</i> to replace “media” (plural) with “medium” (singular).
14-592	Errata correction. See Summary of Changes for details.
14-639	Revised VIII-287 and IX-287 to include an alternative comparator. Proposing as an alternative to a measuring scale comparator, a dimensional calibration of the measuring function based upon a verifiable scanned pixel size may be used.
14-704	Revised General Note (b) in Figure T-434.3-1 to delete “270 deg” and insert “75% of the circumference.”
14-1072	Incorporated hyphens between “through-wall” and “signal-to-noise ratio.” Added “-wall” to callouts in Figures T-1832 and T-1865.1, and to title of Figure T-1865.2. Added subparas. (a) and (b) to T-1832 for types of blockage. Added “inside” to equations in T-1832 to clarify diameter. Added brackets to equation and added dimensions to the area, radius, and height definitions. Added nomenclature for \cos^{-1} . Revised title and added new first sentence to T-1841. Reversed order of paragraphs of T-1850. Added new requirement for calibration of the instrument. Changed indication of sizing requirements in T-1864 to “within 10%.” Revised first sentence of T-1870 to include “in accordance with written procedure.” Revised definitions of “noise level” and “signal-to-noise ratio” in I-121.10.
14-1512	Changed “nonmagnetic” to “nonferromagnetic” in the title and VIII-810 of Article 8, Mandatory Appendix VIII.
14-1537	Revised paras. T-676.3, T-777.1, and T-952 to clarify that the light intensity (natural or supplemental) shall be verified prior to the evaluation of indications or a verified light source used.

Record Number	Change
14-2345	Errata correction. See Summary of Changes for details.

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

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

Subparagraph Breakdowns/Nested Lists Hierarchy

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

Footnotes

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

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

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

Cross-References

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

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

SUBSECTION A

NONDESTRUCTIVE METHODS OF EXAMINATION

ARTICLE 1

GENERAL REQUIREMENTS

T-110 SCOPE

(a) This Section of the Code contains requirements and methods for nondestructive examination (NDE), which are Code requirements to the extent they are specifically referenced and required by other Code Sections or referencing document. These NDE methods are intended to detect surface and internal imperfections in materials, welds, fabricated parts, and components. They include radiographic examination, ultrasonic examination, liquid penetrant examination, magnetic particle examination, eddy current examination, visual examination, leak testing, and acoustic emission examination. See Nonmandatory Appendix A of this Article for a listing of common imperfections and damage mechanisms, and the NDE methods that are generally capable of detecting them.

(b) For general terms such as *Inspection*, *Flaw*, *Discontinuity*, *Evaluation*, etc., refer to [Mandatory Appendix I](#).

(15) T-120 GENERAL

(a) Subsection A describes the methods of nondestructive examination to be used if referenced by other Code Sections or referencing documents.

(b) [Subsection B](#) lists Standards covering nondestructive examination methods which have been accepted as standards. These standards are nonmandatory unless specifically referenced in whole or in part in [Subsection A](#) or as indicated in other Code Sections or referencing document.

(c) Any reference to a paragraph of any Article in [Subsection A](#) of this Section includes all of the applicable rules in the paragraph.¹ In every case, reference to a paragraph includes all the subparagraphs and subdivisions under that paragraph.

(d) Reference to a standard contained in [Subsection B](#) is mandatory only to the extent specified.²

(e) For those documents that directly reference this Article for the qualification of NDE personnel, the qualification shall be in accordance with their employer's written practice which shall be in accordance with one of the following documents:

(1) SNT-TC-1A,³ Personnel Qualification and Certification in Nondestructive Testing; or

(2) ANSI/ASNT CP-189,³ ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

(f) National or international central certification programs, such as the ASNT Central Certification Program (ACCP) or ISO 9712:2012-based programs, may be alternatively used to fulfill the training, experience, and examination requirements of the documents listed in (e) as specified in the employer's written practice.

(g) In addition to the requirements described in (e) or (f) above, if the techniques of computed radiography (CR), digital radiography (DR), phased-array ultrasonic technology (PAUT), or ultrasonic time-of-flight diffraction (TOFD) are to be used, the training, experience, and examination requirements found in Article 1, Mandatory Appendix II shall also be included in the employer's written practice for each technique as applicable.

(h) When the referencing Code Section does not specify qualifications or does not reference directly [Article 1](#) of this Section, qualification may simply involve a demonstration to show that the personnel performing the nondestructive examinations are competent to do so in accordance with the organization's established procedures.

(i) The user of this Article is responsible for the qualification and certification of NDE Personnel in accordance with the requirements of this Article. The organization's⁴ Quality Program shall stipulate how this is to be accomplished. Qualifications in accordance with a prior edition of SNT-TC-1A, or CP-189 are valid until recertification.