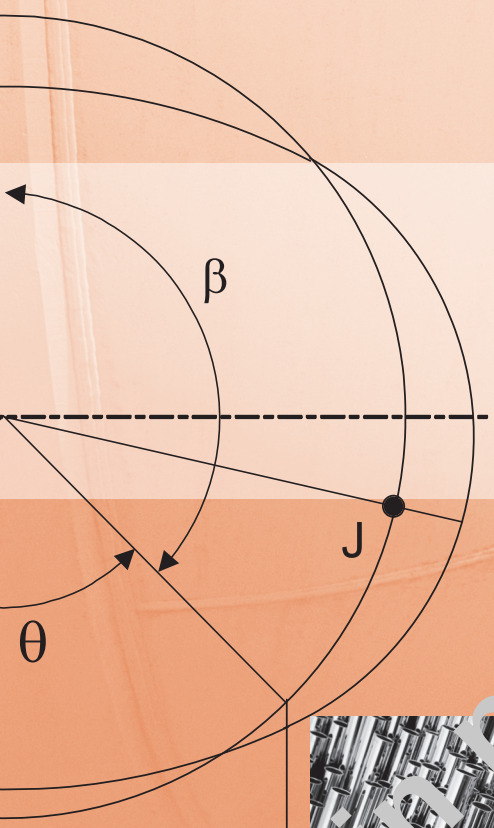
2010 ASME Boiler and Pressure Vessel Code

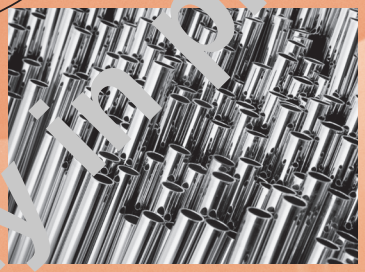
AN INTERNATIONAL CODE

II

Part D
Properties (Metric)

Materials





ASME
SETTING THE STANDARD

AN INTERNATIONAL CODE

2010 ASME Boiler & Pressure Vessel Code

2010 Edition July 1, 2010

II

Part D

Properties (Metric)

MATERIALS

ASME Boiler and Pressure Vessel Committee on Materials

ASME SETTING THE STANDARD

Three Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2010
(Includes all Addenda dated July 2009 and earlier)

This international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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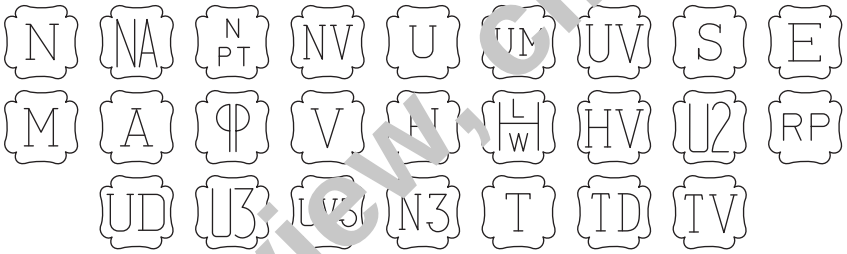

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Three Park Avenue, New York, NY 10016-5990

AN INTERNATIONAL CODE

2010 ASME Boiler & Pressure Vessel Code

2011a Addenda July 1, 2011

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Properties (Metric)

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ASME Boiler and Pressure Vessel Committee on Materials

The American Society of Mechanical Engineers
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ADDENDA

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

INTERPRETATIONS

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. The Interpretations for each individual Section will be published separately and will be included as part of the update service to that Section. Interpretations of Section III, Divisions 1 and 2, will be included with the update service to Subsection NCA.

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

CODE CASES

The Boiler and Pressure Vessel Committee meets regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2010 Code Cases book: "Boilers and Pressure Vessels" and "Nuclear Components." Supplements will be sent automatically to the purchasers of the Code Cases books up to the publication of the 2013 Code.

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

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

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and they are responsible for the application of these programs to their design.

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

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

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

The Boiler and Pressure Vessel Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Boiler and Pressure Vessel Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee). Proposed revisions to the Code resulting from inquiries will be presented to the Standards Committees for appropriate action. The action of the Standards Committees becomes effective only after confirmation by letter ballot of the Committees and approval by ASME.

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

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

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

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

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

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

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

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

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

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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.

(a)

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.

SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL COMMITTEE — MANDATORY (a)

1 INTRODUCTION

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

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

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

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

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

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

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

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

(c) Inquiries that do not comply with these provisions or that do not provide sufficient information for the Committee's full understanding may result in the request being returned to the inquirer with no action.

2 INQUIRY FORMAT

Submittals to the Committee shall include:

(a) Purpose. Specify one of the following:

(1) revision of present Code rules

(2) new or additional Code rules

(3) Code Case

(4) Code Interpretation

(b) Background. Provide the information needed for the Committee's understanding of the inquiry, being sure to include reference to the applicable Code Section, Division, Edition, Addenda (if applicable), paragraphs, figures, and tables. Preferably, provide a copy of the specific referenced portions of the Code.

(c) Presentations. The inquirer may desire or be asked to attend a meeting of the Committee to make a formal presentation or to answer questions from the Committee members with regard to the inquiry. Attendance at a Committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the Committee.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

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

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

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

4 CODE CASES

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined in 3(b) and 3(c), respectively, for Code revisions or additions. The urgency of the Code Case (e.g., project underway or imminent, new procedure, etc.) must be defined and it must be confirmed that the request is in connection with equipment that will bear the Certification Mark, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and be written as a *Question* and a *Reply* in the same format as existing Code Cases. Requests for Code Cases should also indicate the applicable Code Editions and Addenda (if applicable) to which the proposed Code Case applies.

5 CODE INTERPRETATIONS

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

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

(2) Reply. Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the *Reply* should be "yes" or "no," with brief provisos if needed.

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

(b) Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The Committee cannot consider consulting type requests such as the following:

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

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

(3) a request seeking the rationale for Code requirements.

6 SUBMITTALS

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

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

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

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

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

PERSONNEL

(a)

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As of January 1, 2011

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SUMMARY OF CHANGES

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

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

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

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

Changes in this Addenda, given below, are identified on the pages by a margin note, **(a)**, placed next to the affected area, except that in stress tables, changes affecting the table, columns, or a large number of lines are identified by **†**. Revisions to the 2010 Edition are indicated by **(10)** or **#**. For the listing below, the *Page* references the affected area. A margin note, **(a)** or **†**, 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.

Page	*Location*	*Change (Record Number)*
x, xi	Foreword	Tenth and fourteenth paragraphs revised
xii	Statement of Policy on the Use of the Certification Mark and Code Authorization in Advertising	Revised
	Statement of Policy on the Use of ASME Marking to Identify Manufactured Items	Revised
xiii, xiv	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee — Mandatory	Moved from Mandatory Appendix 4 and revised
xv–xxvii	Personnel	Updated
3	2.3	Revised *(10-63)*
14–17	Table 1A, Line 20	For Section I and Section VIII, Division 1, Carbon steel SA/AS 1548 7-430A deleted *(08-1531)*
	Table 1A, Line 21	For I and VIII-1, for SA/AS 1548 PT430N, Grade and Group No. revised *(08-1531)*

Page	Location	Change (Record Number)
	Table 1A, Line 22	For I and VIII-1, for SA/AS 1548 PT430NR, Grade, Condition, Size/Thickness, and Group No. revised *(08-1531)*
	Table 1A, Line 38	For I and VIII-1, SA/AS 1548 7-460A deleted *(08-1531)*
	Table 1A, Line 39	For I and VIII-1, for SA/AS 1548 PT460N, Grade and Group No. revised *(08-1531)*
	Table 1A, Line 40	For I and VIII-1, for SA/AS 1548 PT460NR, Grade, Condition, Size/Thickness, and Group No. revised *(08-1531)*
18–21	Table 1A, Line 34	For VIII-1 and Section XII, for SA-537 Class 3, Note G21 deleted *(10-825)*
	Table 1A, Lines 42 & 43	For Sections III, VIII-1, and XII, for SA-537 Class 2 and SA-738 C, Note 21 deleted *(10-825)*
22–25	Table 1A, Line 5	For VIII-1, SA-841 A added *(09-1349)*
	Table 1A, Lines 6–8	For I and VIII-1, SA/AS 1548 7-490A, 7-490N, and 7-490R deleted *(08-1531)*
	Table 1A, Line 26	For III, VIII-1, and XII, for SA-738 C, Note G21 deleted *(10-825)*
	Table 1A, Line 36	For VIII-1, SA-841 B added *(09-1349)*
	Table 1A, Line 39	For III, VIII-1, and XII, for SA-738 B, Note G20 deleted *(10-825)*
26–29	Table 1A, Line 1	For III, VIII-1, and XII, for C–Mn–Si–Cb SA-737 B, Note G19 deleted *(10-825)*
	Table 1A, Line 2	For I, SA/AS 1548 5-490A deleted *(08-1531)*
	Table 1A, Line 3	(1) For I, for SA/AS 1548 PT490N, Grade revised *(08-1531)* (2) For VIII-1, SA/AS 1548 PT490N added *(08-1531)*
	Table 1A, Line 4	For I and VIII-1, SA/AS 1548 PT490NR added *(08-1531)*
	Table 1A, Line 5	For III, VIII-1, and XII, for C–Mn–Si–V SA-737 C, Note G20 deleted *(10-825)*
46–49	Table 1A, Line 21	For VIII-1, for 17Cr–4Ni–3Cu SA-747 CB7Cu-1, External Pressure Chart No. revised *(09-935)*
	Table 1A, Line 22	For III and VIII-1, for 17Cr–4Ni–4Cu SA-564 630 H1150, External Pressure Chart No. revised *(09-935)*
	Table 1A, Lines 23 & 24	For III, for SA-693 630 H1150 and SA-705 630 H1150, External Pressure Chart No. revised *(09-935)*
	Table 1A, Line 25	For III and VIII-1, for SA-564 630 H1100, External Pressure Chart No. revised *(09-935)*
	Table 1A, Lines 26–30	For III, for SA-693 630 H1100 and H1075, SA-705 630 H1100 and H1075, and SA-564 630 H1075, External Pressure Chart No. revised *(09-935)*
70–73	Table 1A, Lines 13 & 16	For VIII-1, 16Cr–12Ni–2Mo SA-451 CPF3M and CPF8M added *(10-387)*
102–105	Table 1A, Lines 12–15	For VIII-1, 18Cr–10Ni–Cb SA-213 TP347LN and SA-312 TP347LN added *(10-794)*
146	Table 1A	Notes G19, G20, and G21 deleted *(10-825)*
178–181	Table 1B, Line 23	For III and VIII-1, for C12200 H55 SB-359, Min. Tensile Strength, Min. Yield Strength, External Pressure Chart No., Notes, and stress values revised *(10-478)*

Page	*Location*	*Change (Record Number)*
	Table 1B, Line 42	For I, III, VIII-1, and XII, for C23000 H58 SB-43, Note G7 deleted *(10-827)*
	Table 1B, Line 44	For III, VIII-1, and XII, for O60 SB-135, Note G7 deleted *(10-827)*
182–185	Table 1B, Line 1	For I, III, VIII-1, and XII, for O61 SB-43, Note G7 deleted *(10-827)*
	Table 1B, Lines 2 & 3	For III, VIII-1, and XII, for O61 SB-111 and SB-395, Note G7 deleted *(10-827)*
268–322	Table 2A	Title revised *(10-63)*
276–278	Table 2A, Line 14	Carbon steel SA-738 B added *(10-63)*
288–290	Table 2A, Lines 11–19	For 17Cr–4Ni–4Cu SA-564 630, SA-693 630, and SA-705 630, External Pressure Chart No. revised *(09-935)*
380–383	Table 5A, Lines 20 & 34	Carbon steel SA-841 A and B added *(09-1349)*
462, 463	Table U, Line 40	For Carbon steel SA/AS 1548 PT430, Grade revised *(08-1531)*
464, 465	Table U, Line 10	For SA/AS 1548 PT460, Grade revised *(08-1531)*
466, 467	Table U, Line 9	SA-841 A added *(09-1349)*
	Table U, Line 10	SA/AS 1548 7-490 deleted *(08-1531)*
	Table U, Line 38	SA-841 B added *(09-1349)*
468, 469	Table U, Line 11	For C–Mn–Si–Cb SA/AS 1548 PT490, Grade revised *(08-1531)*
496, 497	Table U, Lines 28 & 29	18Cr–10Ni–Cb SA-213 TP347LN and SA-312 TP347LN added *(10-794)*
510, 511	Table U, Line 22	For C12200 H55 SB-359, Min. Tensile Strength and tensile strength values revised *(10-478)*
540–543	Table Y-1, Lines 43–46	For Carbon steel SA/AS 1548 PT430, Grade revised *(08-1531)*
544–547	Table Y-1, Lines 16, 17, 21 & 23	For SA/AS 1548 PT460, Grade revised *(08-1531)*
548–551	Table Y-1, Line 22	SA-841 A added *(09-1349)*
	Table Y-1, Lines 23–26	SA/AS 1548 7-490 deleted *(08-1531)*
552–555	Table Y-1, Line 10	SA-841 B added *(09-1349)*
	Table Y-1, Lines 39–42	For C–Mn–Si–Cb SA/AS 1548 PT490, Grade revised *(08-1531)*
620–623	Table Y-1, Lines 6 & 7	18Cr–10Ni–Cb SA-213 TP347LN and SA-312 TP347LN added *(10-794)*
652–655	Table Y-1, Line 33	For C12200 H55 SB-359, Min. Tensile Strength, Min. Yield Strength, and yield strength values revised *(10-478)*
770	Fig. NFC-7	(1) Values for E deleted *(07-1193)* (2) General Note (b) added *(07-1193)*
813	Table NFC-7	Three values added for B = 7.00 *(07-1193)*
850	Mandatory Appendix 4	Moved to the front matter and revised

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
07-1193	–Deleted E (modulus) from Fig. NFC-7. –Added General Note (b) to Fig. NFC-7. –Added tabular values for A to Table NFC-7 where B = 7.00 MPa.
08-1531	–Deleted Grade 7-490 for SA/AS 1548. –Deleted all other grades with "A" designation. –Corrected Group No. for Grades PT430 and PT460, to be consistent with Section IX, Table QW/QB-422. –Increased the maximum thickness for normalized rolled (NR) plates to 150 mm from 40 mm for as-rolled plates. –Changed Applicability column for Grade PT490N from NP to 538°C for Section VIII, Division 1 use. –Added Grade PT490NR for Sections I and VIII, Division 1 use.
09-935	EPC reassigned from HA-7 to HT-1 for UNS S17400 in Tables 1A and 2A.
09-1349	Added SA-841, Grade A Class 1 and Grade B Class 2 to Tables 1A, 5A, U, and Y-1.
10-63	–Added SA-738 Grade B to Table 2A. –Added the designation "MC" to the title of Table 2A.
10-387	Incorporation of SA-451 J92800 (CPF3M) and J92900 (CPF8M) from Code Case 2456.
10-478	–In Table 1B, revised minimum tensile strength from 205 MPa to 250 MPa and minimum yield strength from 62 MPa to 205 MPa, to be consistent with H55 temper values listed in SB-359. –Revised allowable stress values to be the same as those listed for H55 SB-111 seamless tube. –Revised the EPC to NFC-6. –Corrected the Notes in Table 1B. –Tensile and yield strength values corrected in Tables U and Y-1.
10-794	Revised Tables 1A, U, and Y-1 to incorporate SA-213 TP347LN and SA-312 TP347LN, S34751.
10-825	Deleted Notes G19, G20, and G21 from Table 1A.
10-827	Deleted references to Note G7 in Table 1B for five C23000 stress lines.

SUBPART 1
STRESS TABLES

STATEMENT OF POLICY ON INFORMATION PROVIDED IN THE STRESS TABLES

The purpose of this Statement of Policy is to clarify which information in the stress tables is mandatory and which is not. The information and restrictions provided in the Notes found throughout the various stress tables provided in Subpart 1 of Section II, Part D are mandatory. It is vital to recognize that lines of information in Tables 1A, 1B, 2A, 2B, 3, and 4 frequently have essential information referenced in the Notes column. These Notes are organized as follows:

(a) EXX: defining onset of values based on successful experience in service

(b) GXX: general requirements

(c) HXX: heat treatment requirements

(d) SXX: size requirements

(e) TXX: defining onset of time-dependent behavior

(f) WXX: welding requirements

The specifications and grades or types, coupled with the assigned Notes for each line, provide the complete description of material in the context of the allowable stresses or design stress intensities. Additional requirements for particular types of construction must also be obtained from the rules governing the construction.

In Tables 1A and 2A, the information in the Nominal Composition column is nonmandatory and is for information only. However, these nominal compositions are the primary sorting used in these two tables. See Appendix A. The information in the Alloy Designation/UNS Number column is nonmandatory for specifications for which a grade or type is provided. This is primarily true for the nonstainless-steel alloys in these tables. For specifications for which no type or grade is listed, the UNS number is mandatory. Particularly for the stainless steels, for which no type or grade is listed, the UNS number is the grade.

The only difference between Tables 1A and 2A, and Tables 1B and 2B, with regard to the mandatory/nonmandatory nature of the information, is that in Tables 1B and 2B, the UNS number information is used as the basis of the sorting scheme for materials and is almost always mandatory.

Where provided, the information in the columns for Product Form, Specification Number, Type/Grade, Class/Condition/Temper, Size/Thickness, and External Pressure Chart Number is mandatory. The information in the P-Number and Group Number columns is also mandatory; however, the primary source for this information is Table QW/QB-422 in Section IX. When there is a conflict between the P-number and Group number information in these stress tables and that in Section IX, the numbers in Section IX shall govern.

The information in the Minimum Tensile Strength and Minimum Yield Strength columns is nonmandatory. These values are a primary basis for establishing the allowable stresses and design stress intensities. When there is a conflict between the tensile and yield strength values in the stress tables and those in the material specifications in Section II, Parts A and B, the values in Parts A and B shall govern.

The information in the Applicability and Maximum Temperature Limits columns is mandatory. Where a material is permitted for use in more than one Construction Code, and in the SI units version of these tables, the maximum use temperature limit in these columns is critical. The temperature to which allowable stress or design stress intensity values are listed is not necessarily the temperature to which use is permitted by a particular Construction Code. Different Construction Codes often have different use temperature limits for the same material and condition. Further, in the SI units version of the stress tables, values may be listed in the table at temperatures above the maximum use temperature limit. These stress values are provided to permit interpolation to be used to determine the allowable stress or design stress intensity at temperatures between the next lowest temperature for which stress values are listed and the maximum-use temperature limit listed in these columns.