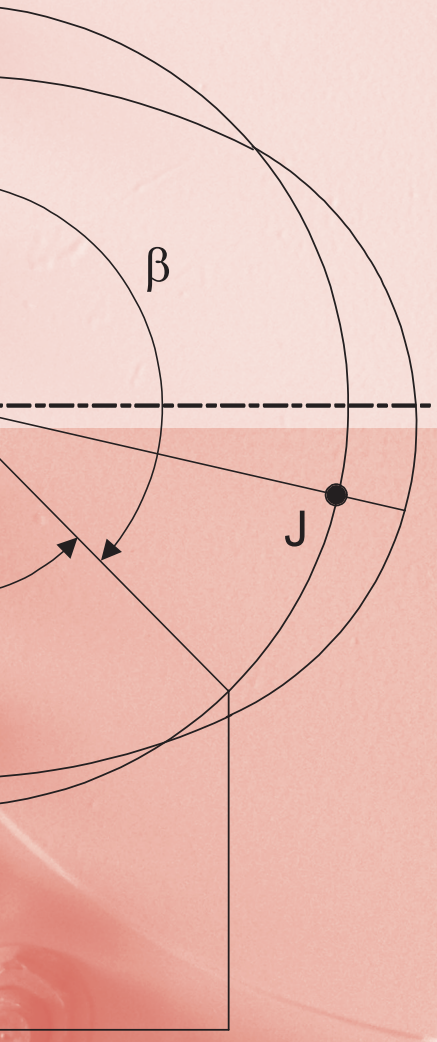
2013 ASME Boiler and Pressure Vessel Code

AN INTERNATIONAL CODE

II

Materials



Part D

Properties (Metric)

ASME

SETTING THE STANDARD

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AN INTERNATIONAL CODE

2013 ASME Boiler & Pressure Vessel Code

2013 Edition July 1, 2013

II

MATERIALS

Part D

Properties (Metric)

ASME Boiler and Pressure Vessel Committee
on Materials

The American Society of Mechanical Engineers

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INTERPRETATIONS

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code.

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

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 2013 Code Cases book: “Boilers and Pressure Vessels” or “Nuclear Components.” Supplements will be sent automatically to the purchasers of the Code Cases books up to the publication of the 2015 Code.

(13)

FOREWORD

(This Foreword is provided as an aid to the user and is not part of the rules of this Code.)

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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees: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)

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. 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 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.

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

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://cstools.asme.org/csconnect/public/index.cfm?PublicReview=Revisions 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.

(13) 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.

(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.

(13)

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January 1, 2013

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SUMMARY OF CHANGES

The 2013 Edition of this Code contains revisions in addition to the 2010 Edition with 2011 Addenda.

After publication of the 2013 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 on the ASME Web site under the BPVC Resources page at http://www.asme.org/kb/standards/publications/bpvc-resources.

Changes given below are identified on the pages by a margin note, **(13)**, 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.

Page	*Location*	*Change (Record Number)*
x	List of Sections	Revised *(12-749)*
xii	Foreword	Revised in its entirety *(09-760)*
xv	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Revised *(12-1716)*
xvii	Personnel	Updated
xlviii	Cross-Referencing and Stylistic Changes in the Boiler and Pressure Vessel Code	Added
1	Statement of Policy on Information Provided in the Stress Tables	Revised *(11-1500)*
6–9	Table 1A, Line 36	For Section VIII, Division 1, Carbon steel SA/EN 10028-2 P235GH added *(10-388)*
	Table 1A, Line 37	For Sections I and VIII-1, SA/EN 10216-2 P235GH added *(01-632)*
	Table 1A, Lines 39 & 40	For I and VIII-1, SA/EN 10216-2 P235GH added *(01-632)*
10–13	Table 1A, Line 1	For VIII-1, for SA/EN 10028-3 P275NH, Size/Thickness revised *(12-16)*
	Table 1A, Line 19	For VIII-1 and Section XII, for SA/EN 10028-3 P275NH, Size/Thickness revised, Min. Yield Strength deleted, and Note G18 added *(12-16)*
	Table 1A, Lines 23 & 24	For VIII-1 and XII, SA/IS 2062 E250A and E250B added *(08-1257)*
	Table 1A, Line 25	For VIII-1, SA/IS 2062 E250C added *(08-1257)*
	Table 1A, Lines 26–28	For VIII-1 and XII, SA/IS 2062 E250A, E250B, and E250C added *(08-1257)*
	Table 1A, Line 29	For VIII-1, SA/EN 10028-2 P265GH added *(10-388)*
	Table 1A, Line 30	For I and VIII-1, SA/EN 10216-2 P265GH added *(01-632)*
	Table 1A, Lines 31–33	For VIII-1 and XII, SA/IS 2062 E250A, E250B, and E250C added *(08-1257)*
	Table 1A, Lines 34 & 35	For I and VIII-1, SA/EN 10216-2 P265GH added *(01-632)*
14–17	Table 1A, Line 31	For Sections III, VIII-1, and XII, SA-695 B/35 deleted *(05-508)*

Page	*Location*	*Change (Record Number)*
18–21	Table 1A, Line 15	For VIII-1, SA/GB 6654 16MnR deleted *(09-599)*
	Table 1A, Lines 18 & 19	For I, VIII-1, and XII, SA/CSA-G40.21 44W and 50W added *(09-772)*
	Table 1A, Line 24	For VIII-1, SA/GB 6654 16MnR deleted *(09-599)*
	Table 1A, Line 25	For I and VIII-1, SA/GB 713 Q345R added *(09-599)*
	Table 1A, Line 26	For I and VIII-1, SA/EN 10028-2 P355GH added *(07-663)*
	Table 1A, Line 27	For VIII-1, SA/GB 6654 16MnR deleted *(09-599)*
	Table 1A, Line 28	For I and VIII-1, SA/GB 713 Q345R added *(09-599)*
	Table 1A, Line 29	For I and VIII-1, SA/EN 10028-2 P355GH added *(07-663)*
	Table 1A, Lines 37 & 38	For I, SA-350 LF2 added *(11-1773)*
22–25	Table 1A, Line 25	For III, VIII-1, and XII, SA-695 B/40 deleted *(05-508)*
	Table 1A, Line 36	For I and VIII-1, SA/GB 713 Q345R added *(09-599)*
	Table 1A, Line 37	For I and VIII-1, SA/EN 10028-2 P355GH added *(07-663)*
	Table 1A, Line 38	For I and VIII-1, SA/GB 713 Q345R added *(09-599)*
	Table 1A, Line 39	For VIII-1, SA/GB 6654 16MnR deleted *(09-599)*
26–29	Table 1A, Lines 1 & 3	For I and VIII-1, SA/GB 713 Q345R added *(09-599)*
	Table 1A, Line 4	For VIII-1, SA/GB 6654 16MnR deleted *(09-599)*
	Table 1A, Line 5	For I and VIII-1, SA/EN 10028-2 P355GH added *(07-663)*
30–33	Table 1A, Lines 1–3	For I, C–Mn–Si–Cb SA/GB 713 Q370R added *(09-1811)*
	Table 1A, Lines 15–17	For I and VIII-1, C–0.3Mo SA/EN 10216-2 16Mo3 added *(01-632)*
38–41	Table 1A, Lines 1 & 2	For I and VIII-1, 1Cr–$\frac{1}{2}$Mo SA/EN 10028-2 13CrMo4-5 added *(07-665)*
	Table 1A, Line 3	For I, SA/GB 713 15CrMoR added *(09-1811)*
	Table 1A, Line 4	For I and VIII-1, SA/EN 10028-2 13CrMo4-5 added *(07-665)*
	Table 1A, Lines 5 & 6	For I and VIII-1, SA/EN 10216-2 13CrMo4-5 added *(01-632)*
	Table 1A, Line 9	For I, SA/GB 713 15CrMoR added *(09-1811)*
	Table 1A, Line 10	For I and VIII-1, SA/EN 10028-2 13CrMo4-5 added *(07-665)*
	Table 1A, Line 11	For I, SA/GB 713 15CrMoR added *(09-1811)*
	Table 1A, Line 12	For I and VIII-1, SA/EN 10028-2 13CrMo4-5 added *(07-665)*
	Table 1A, Line 37	For III, for $1\frac{3}{4}$Cr–$\frac{1}{2}$Mo–Ti SA-517 E, Class MC applicability added *(11-1831)*
	Table 1A, Line 38	For III, for SA-517 E, Class MC applicability and stress value for 375°C added *(11-1831)*
42–45	Table 1A, Lines 8–10	For I and VIII-1, $2\frac{1}{4}$Cr–1Mo SA/EN 10028-2 10CrMo9-10 added *(12-882)*
	Table 1A, Lines 11 & 12	For I and VIII-1, SA/EN 10216-2 10CrMo9-10 added *(01-632)*
	Table 1A, Line 13	For I and VIII-1, SA/EN 10028-2 10CrMo9-10 added *(12-882)*
58–61	Table 1A, Lines 38 & 40	For VIII-1, Mn–$\frac{1}{2}$Mo–$\frac{3}{4}$Ni SA-533 E added *(12-187)*
66–69	Table 1A, Line 6	For III, VIII-1, and XII, for $2\frac{1}{2}$Ni SA-203 B, Note S1 deleted *(02-3159)*
	Table 1A, Line 30	For III, for $3\frac{1}{2}$Ni SA-203 E, Note S1 deleted *(02-3159)*
70–73	Table 1A, Lines 5–10	For VIII-1 and XII, 9Ni SA/EN 10028-4 X8Ni9 and X7Ni9 added *(06-664)*
94–97	Table 1A, Line 30	For I, III, VIII-1, and XII, for 18Cr–8Ni SA-376 TP304, Note S11 added *(12-754)*

Page	*Location*	*Change (Record Number)*
	Table 1A, Line 31	For I, VIII-1, and XII, for SA-376 TP304, Note S11 added *(12-754)*
98–101	Table 1A, Lines 18–30	For VIII–1, 18Cr–8Ni–N SA-182 F304LN, SA-965 F304LN, SA-213 TP304LN, SA-240 304LN, SA-249 TP304LN, SA-312 TP304LN, SA-376 TP304LN, SA-403 304LN, SA-479 304LN, SA-688 TP304LN, SA-813 TP304LN, and SA-814 TP304LN added *(09-211)*
130–133	Table 1A, Lines 37–41	For VIII-1, 22Cr–2Ni–Mo–N SA-182 F66, SA-240, SA-479, and SA-789 S32202 added *(11-676)*
134–137	Table 1A, Lines 1–4	For VIII-1, SA-790 and SA-815 S32202 added *(11-676)*
	Table 1A, Line 15	For III, VIII-1, and XII, 22Cr–5Ni–3Mo–N SA-240 S32205 added *(09-1095, 10-1328)*
	Table 1A, Line 16	For III and VIII-1, SA-479 S32205 added *(09-1095, 10-1328)*
	Table 1A, Line 17	For III, SA-790 S32205 added *(10-1328)*
	Table 1A, Lines 18 & 19	For VIII-1 and XII, SA-790 S32205 added *(09-1095)*
	Table 1A, Line 20	For III, SA-815 S32205 added *(10-1328)*
	Table 1A, Lines 21 & 22	For VIII-1 and XII, SA-815 S32205 added *(09-1095)*
	Table 1A, Line 23	For III, VIII-1, and XII, SA-182 F60 S32205 added *(09-1095, 10-1328)*
	Table 1A, Line 24	For III, SA-789 S32205 added *(10-1328)*
	Table 1A, Lines 25 & 26	For VIII-1 and XII, SA-789 S32205 added *(09-1095)*
146–149	Table 1A, Lines 1–8	For VIII-1, 25Cr–7.5Ni–3.5Mo–N–Cu–W SA-182 F55, SA-240, SA-479, SA-789, SA-790, and SA-815 S32760 added *(09-1609)*
150–153	Table 1A, Lines 36 & 37	For VIII-1 and XII, for 25Cr–22Ni–2Mo–N SA-240 310MoLN, Size/Thickness added and Min. Tensile Strength, Min. Yield Strength, and stress values revised *(08-169)*
154–157	Table 1A, Lines 3 & 4	For VIII-1 and XII, SA-240 310MoLN added *(08-169)*
158, 159	Table 1A	*(1)* General Note (i) added *(05-1652)* *(2)* Notes G30 through G34 redesignated as G7, G8, G19, G20, and G21, respectively *(3)* Note H3 added *(09-1811)* *(4)* Note H4 added *(09-1609)* *(5)* Note S11 added *(12-754)* *(6)* Note T11 added *(10-388)*
166–169	Table 1B, Line 27	For III, VIII-1, and XII, for A92014 T6 SB-247, stress value for 125°C revised *(09-432)*
186–189	Table 1B, Line 1	For III, VIII-1, and XII, for C10200 O60 SB-187, Min. Yield Strength added, and Notes and stress values revised *(08-224)*
	Table 1B, Line 10	For I, III, VIII-1, and XII, for H55 SB-42, Note G9 added *(10-1924)*
	Table 1B, Line 13	For III, VIII-1, and XII, for H55 SB-395, Note G9 added *(10-1924)*
	Table 1B, Line 14	For I, III, VIII-1, and XII, for H80 SB-42, Note G5 deleted and Note G9 added *(10-1924)*
	Table 1B, Line 15	For I, III, VIII-1, and XII, for H80 SB-75, Note G6 added *(10-1924)*
	Table 1B, Line 16	For III, VIII-1, and XII, for H80 SB-111, Note G6 added *(10-1924)*
	Table 1B, Lines 35 & 36	For III, VIII-1, and XII, for C11000 H04 and O60 SB-187, Min. Yield Strength added, and Notes and stress values revised *(08-224)*
190–193	Table 1B, Line 1	For I, III, VIII-1, and XII, for C12000 H55 SB-42, Note G9 added *(10-1924)*
	Table 1B, Line 4	For III, VIII-1, and XII, for H55 SB-395, Note G9 added *(10-1924)*
	Table 1B, Line 5	For I, III, VIII-1, and XII, for H80 SB-42, Note G9 added *(10-1924)*
	Table 1B, Line 6	For I, III, VIII-1, and XII, for H80 SB-75, Note G6 added *(10-1924)*

Page	Location	Change (Record Number)
	Table 1B, Line 7	For III, VIII-1, and XII, for H80 SB-111, Note G6 added *(10-1924)*
	Table 1B, Line 20	For I, III, VIII-1, and XII, for C12200 H55 SB-42, Note G9 added *(10-1924)*
	Table 1B, Line 24	For III, VIII-1, and XII, for H55 SB-395, Note G9 added *(10-1924)*
	Table 1B, Line 25	For I, III, VIII-1, and XII, for H80 SB-42, Note G9 added *(10-1924)*
	Table 1B, Line 26	For I, III, VIII-1, and XII, for H80 SB-75, Note G6 added *(10-1924)*
	Table 1B, Line 27	For III, VIII-1, and XII, for H80 SB-111, Note G6 added *(10-1924)*
	Table 1B, Line 36	For III, VIII-1, and XII, for C14200 H55 SB-395, Note G9 added *(10-1924)*
	Table 1B, Line 37	For III, VIII-1, and XII, for H80 SB-111, Note G6 added *(10-1924)*
202–205	Table 1B, Line 16	For VIII-1, C70600 H55 SB-466 added *(12-49)*
206–209	Table 1B, Lines 17 & 18	For III, VIII-1, and XII, for N02200 Stress rel. SB-161 and SB-163, Note G33 added *(12-445)*
	Table 1B, Lines 27–32	For III, VIII-1, and XII, for N04400 Annealed SB-164, SB-165, SB-564, SB-127, SB-163, and SB-165, Notes revised and corresponding stress value italicized *(07-1766)*
	Table 1B, Line 33	For VIII-1 and XII, for Annealed SB-366, Notes revised and corresponding stress value italicized *(07-1766)*
242–245	Table 1B, Line 1	For III, N08367 Solution ann. SB-366 added *(11-687)*
266–269	Table 1B, Lines 1 & 2	For VIII-1, for R50400 Annealed SB-265 2H and SB-338 2H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Line 3	For VIII-1, for Annealed SB-338 2H, Max. Temperature Limit and stress values for 200°C and 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Lines 4–9	For VIII-1, for Annealed SB-348 2H, SB-363 WPT2H and WPT2HW, SB-381 F-2H, SB-861 2H, and SB-862 2H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Lines 32 & 33	For VIII-1, for R52400 Annealed SB-265 7H and SB-338 7H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Line 34	For VIII-1, for Annealed SB-338 7H, Max. Temperature Limit and stress values for 200°C and 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Lines 35–40	For VIII-1, for Annealed SB-348 7H, SB-363 WPT7H and WPT7HW, SB-381 F-7H, SB-861 7H, and SB-862 7H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
270–273	Table 1B, Lines 1 & 2	For VIII-1, for R52402 Annealed SB-265 16H and SB-338 16H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Line 3	For VIII-1, for Annealed SB-338 16H, Max. Temperature Limit and stress values for −30 to 40°C, 65°C, and 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Lines 4–9	For VIII-1, for Annealed SB-348 16H, SB-363 WPT16H and WPT16HW, SB-381 F-16H, SB-861 16H, and SB-862 16H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
	Table 1B, Lines 19 & 20	For VIII-1, for R52404 Annealed SB-265 26H and SB-338 26H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*

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	Table 1B, Lines 22–27	For VIII-1, for Annealed SB-348 26H, SB-363 WPT26H and WPT26HW, SB-381 F-26H, SB-861 26H, and SB-862 26H, Max. Temperature Limit and stress value for 275°C revised, and stress values for 300°C and 325°C added *(08-1064)*
278, 279	Table 1B	*(1)* General Note (e) revised *(07-1766)* *(2)* General Note (h) added *(05-1652)* *(3)* Note G9 revised *(10-1924)* *(4)* Note G33 added *(12-445)* *(5)* Note T19 added *(07-1766)*
286–288	Table 2A, Line 1	Carbon steel SA-695 B/35 deleted *(05-508)*
	Table 2A, Line 38	SA-695 B/40 deleted *(05-508)*
290–292	Table 2A, Lines 2 & 4	For SA-299, Grade added *(11-1153)*
	Table 2A, Lines 15 & 16	Ductile cast iron SA-874 and SA/JIS G5504 FCD 300 LT added *(09-1682)*
294–296	Table 2A, Lines 32 & 33	For $1\frac{3}{4}$Cr–$\frac{1}{2}$Mo–Ti SA-517 E, Class MC applicability added *(11-1831)*
302–304	Table 2A, Line 16	13Cr–4Ni SA-479 added *(08-1526)*
310–312	Table 2A, Line 17	For 16Cr–12Ni–2Mo SA-358 316L, Class added *(10-1752)*
	Table 2A, Lines 18 & 19	SA-358 316L added *(10-1752)*
	Table 2A, Lines 40 & 41	SA-358 316 added *(10-1752)*
314–316	Table 2A, Lines 13 & 14	SA-358 316H added *(10-1752)*
	Table 2A, Line 29	For 16Cr –12Ni–2Mo–N SA-358 316LN, Class added *(10-1752)*
	Table 2A, Lines 30 & 31	SA-358 316LN added *(10-1752)*
318–320	Table 2A, Line 1	For SA-358 316N, Class added *(10-1752)*
	Table 2A, Lines 2 & 3	SA-358 316N added *(10-1752)*
	Table 2A, Lines 20 & 21	18Cr–8Ni SA-358 304L added *(10-1752)*
322–324	Table 2A, Lines 3 & 4	SA-358 304 added *(10-1752)*
	Table 2A, Line 5	For SA-376 TP304, Notes revised *(12-754)*
	Table 2A, Lines 18 & 19	SA-358 304H added *(10-1752)*
	Table 2A, Line 39	For 18Cr–8Ni–N SA-358 304LN, Class added *(10-1752)*
	Table 2A, Lines 40 & 41	SA-358 304LN added *(10-1752)*
326–328	Table 2A, Lines 13 & 14	SA-358 304N added *(10-1752)*
	Table 2A, Lines 36 & 37	18Cr–10Ni–Cb SA-358 347 added *(10-1752)*
330–332	Table 2A, Lines 18 & 19	SA-358 348 added *(10-1752)*
334–336	Table 2A, Lines 7 & 8	18Cr–10Ni–Ti SA-358 321 added *(10-1752)*
	Table 2A, Lines 40 & 41	22Cr–13Ni–5Mn SA-358 XM-19 added *(10-1752)*
338–340	Table 2A, Line 7	For 23Cr–12Ni SA-358 309S, Class added *(10-1752)*
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	Table 2A, Lines 20 & 21	25Cr–20Ni SA-358 310S added *(10-1752)*
341, 342	Table 2A	*(1)* General Note (f) added *(05-1652)* *(2)* Note G17 added *(09-1682)* *(3)* Note S5 added *(12-754)*

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	Table 3, Lines 28 & 29	For VIII-1, VIII-2, and XII, for SA-193 B7M and SA-320 L7M, Note added and corresponding stress values italicized *(10-917)*
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638–641	Table Y-1, Line 14	SA-193 B8MA added *(08-1264)*
	Table Y-1, Lines 22 & 23	SA-358 316 added *(10-1752)*
	Table Y-1, Line 33	SA-193 B8M2 added *(08-1053)*
642–645	Table Y-1, Lines 17 & 18	SA-358 316H added *(10-1752)*
	Table Y-1, Lines 33 & 34	SA-358 316LN added *(10-1752)*
646–649	Table Y-1, Lines 7 & 8	SA-358 316N added *(10-1752)*
	Table Y-1, Lines 38 & 39	18Cr–8Ni SA-358 304L added *(10-1752)*
650–653	Table Y-1, Line 18	SA-193 B8A added *(08-1264)*
	Table Y-1, Lines 31 & 32	SA-358 304 added *(10-1752)*
	Table Y-1, Lines 34 & 35	SA-358 304H added *(10-1752)*
	Table Y-1, Lines 37 & 38	SA-358 304LN added *(10-1752)*
654–657	Table Y-1, Line 17	SA-193 B8 added *(08-1053)*
	Table Y-1, Line 18	For SA-320 B8, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 19	SA-193 B8 added *(08-1053)*
	Table Y-1, Line 20	For SA-320 B8, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 21	SA-193 B8 added *(08-1053)*
	Table Y-1, Line 22	For SA-320 B8, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 23	SA-193 B8 added *(08-1053)*
	Table Y-1, Line 24	For SA-320 B8, stress values for 65°C through 525°C added *(08-1053)*
658–661	Table Y-1, Lines 4 & 5	18Cr–8Ni–N SA-358 304N added *(10-1752)*
	Table Y-1, Lines 17 & 18	18Cr–8Ni–4Si–N SA-193 B8S and B8SA added *(08-1053)*
	Table Y-1, Lines 39 & 40	18Cr–10Ni–Cb SA-358 347 added *(10-1752)*
662–665	Table Y-1, Lines 22 & 23	SA-358 348 added *(10-1752)*

Page	*Location*	*Change (Record Number)*
666–669	Table Y-1, Line 1	SA-193 B8C added *(08-1053)*
	Table Y-1, Line 2	For SA-320 B8C, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 3	SA-193 B8C added *(08-1053)*
	Table Y-1, Line 4	For SA-320 B8C, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 5	SA-193 B8C added *(08-1053)*
	Table Y-1, Line 6	For SA-320 B8C, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 7	SA-193 B8C added *(08-1053)*
	Table Y-1, Line 8	For SA-320 B8C, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Lines 26 & 27	18Cr–10Ni–Ti SA-358 321 added *(10-1752)*
670–673	Table Y-1, Line 1	SA-193 B8T added *(08-1053)*
	Table Y-1, Line 2	For SA-320 B8T, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 3	SA-193 B8T added *(08-1053)*
	Table Y-1, Line 4	For SA-320 B8T, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 5	SA-193 B8T added *(08-1053)*
	Table Y-1, Line 6	For SA-320 B8T, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 7	SA-193 B8T added *(08-1053)*
	Table Y-1, Line 8	For SA-320 B8T, stress values for 65°C through 525°C added *(08-1053)*
	Table Y-1, Line 9	18Cr–11Ni SA-193 B8P added *(08-1053)*
	Table Y-1, Lines 11–14	SA-193 B8P added *(08-1053)*
674–677	Table Y-1, Lines 26–31	22Cr–2Ni–Mo–N SA-182 F66, SA-240, SA-479, SA-789, SA-790, and SA-815 added *(11-676)*
	Table Y-1, Lines 38–43	22Cr–5Ni–3Mo–N SA-240, SA-479, SA-790, SA-815, SA-182 F60, and SA-789 added *(09-1095)*
678–681	Table Y-1, Lines 10 & 11	22Cr–13Ni–5Mn SA-358 XM-19 added *(10-1752)*
	Table Y-1, Lines 30 & 31	23Cr–12Ni SA-358 309S added *(10-1752)*
682–685	Table Y-1, Lines 27–32	25Cr–7.5Ni–3.5Mo–N–Cu–W SA-182 F55, SA-240, SA-479, SA-789, SA-790, and SA-815 added *(09-1609)*
686–689	Table Y-1, Lines 2 & 3	25Cr–20Ni SA-358 310S added *(10-1752)*
	Table Y-1, Line 24	For 25Cr–22Ni–2Mo–N SA-240 310MoLN, Size/Thickness added, and Min. Tensile Strength, Min. Yield Strength, and yield strength values revised *(08-169)*
	Table Y-1, Line 28	SA-240 310MoLN added *(08-169)*
694–697	Table Y-1, Lines 3 & 4	A96061 T6 and T651 SB-211 added *(08-1053)*
702–705	Table Y-1, Lines 13, 16, 18 & 19	C61400 HR50 SB-150 added *(08-1053)*
	Table Y-1, Lines 22, 23, 25 & 26	C63000 HR50 and M20 SB-150 added *(08-1053)*
	Table Y-1, Lines 29–35	C64200 M20, M30, M10, and HR50 added *(08-1053)*
	Table Y-1, Lines 37–39	C65500 O60, H01, and H02 added *(08-1053)*

Page	*Location*	*Change (Record Number)*
706–709	Table Y-1, Line 13	C70600 H55 SB-466 added *(12-49)*
	Table Y-1, Lines 27, 29 & 30	N02200 Annealed, Hot fin./ann., and Cold drawn SB-160 added *(08-1053)*
710–713	Table Y-1, Lines 1 & 3	N04400 Hot worked SB-164 deleted *(08-1053)*
722–725	Table Y-1, Line 20	N06975 Solution ann. SB-581 added *(08-1053)*
734–737	Table Y-1, Line 6	For N10001 Annealed SB-335, Size/Thickness added *(08-1053)*
	Table Y-1, Line 7	Annealed SB-335 added *(08-1053)*
750	Table Y-1	*(1)* General Note (a) revised *(09-1811)* *(2)* General Note (g) added *(05-1652)*
751	Table Y-2	*(1)* Title revised *(11-1880)* *(2)* General Note revised *(11-1880)*
752	Subpart 2 Introduction	Revised *(10-348)*
753	Table TE-1	Note (2) revised *(11-676)*
770	Table TE-5	Grade 38 added *(12-958)*
771	Table TCD	*(1)* Ductile cast iron added *(09-1682)* *(2)* Titanium Grade 38 added *(12-958)* *(3)* Note (10) revised *(11-676)*
785	Table TM-1	*(1)* Ductile cast iron added *(09-1682)* *(2)* Note (8) [formerly Note (14)] revised *(11-676)*
791	Table TM-5	Titanium Grade 38 added *(12-958)*
791	Table PRD	*(1)* S32202 added *(11-676)* *(2)* High alloy steels (duplex /austenitic–ferritic) added *(12-878)* *(3)* R54250 added *(12-958)*
812	Figure HA-9	Added *(09-1609)*
815	Figure CD-2	Added *(09-1682)*
823	Figure NFA-8	Revised *(11-771)*
853	Figure NFN-17	Callouts revised *(11-103)*
885	Table HA-9	Added *(09-1609)*
886	Table CD-2	Added *(09-1682)*
892	Table NFA-8	Revised *(11-771)*
933	3-200	Revised *(08-1587)*
933	3-400	Revised *(08-1587)*
933	3-500	Cross-reference in subparagraph (d)(3) revised *(08-1587)*
936	3-700	Revised in its entirety *(08-1587)*
938	Figure 3-700.1	Added *(08-1587)*
939	3-800	Added *(08-1587)*
939	3-900	Paragraph 3-800 redesignated as 3-900 and previous seventh reference deleted *(08-1587)*
940	Mandatory Appendix 4	Deleted *(12-1716)*
941	Mandatory Appendix 5	Revised in its entirety *(09-1925)*
949	10-110	Subparagraph (a) revised *(11-1880)*

Page	*Location*	*Change (Record Number)*
950	Table 10-100	Revised *(11-1880)*
951	Nonmandatory Appendix A	Revised in its entirety *(08-845)*
971	Nonmandatory Appendix B	Added *(09-1766)*
977	Nonmandatory Appendix D	Added *(11-1020)*

NOTE: Volume 62 of the Interpretations to Section II, Part D (Metric) of the ASME Boiler and Pressure Vessel Code follows the last page of Section II, Part D (Metric).

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
01-632	In Tables 1A, U, and Y-1, added stress lines for SA/EN 10216-2, Grades P235GH, P265GH, 16Mo3, 13CrMo4-5, and 10CrMo9-10.
02-3159	Deleted note S1 from SA-203 stress lines where Section I use is not permitted in Table 1A. Corrected reference in note G11 of Table 3.
05-508	Withdrew specification SA-695, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, for Fluid Power Applications.
05-1652	Added General Note to Tables 1A, 1B, 2A, 2B, 3, 4, 5A, 5B, U, and Y-1 for Size/Thickness columns.
06-664	Approved SA/EN 10028-4, Grades X8Ni9 and X7Ni9 for Section VIII, Division 1 and Section XII construction.
07-663	Updated Tables 1A, 5A, U, and Y-1.
07-665	Updated Tables 1A, U, and Y-1.
07-1766	Added T note to Table 1B for N04400 and in Notes section, and italicized one temperature column lower at 450°C.
08-169	Updated SA-240 UNS S31050 stress lines in Tables 1A, U, and Y-1.
08-224	Revised the UTS, YS, and allowable stress values in Table 3 for SB-187 C10200 and C11000 O60 temper. In Table 1B, added YS values to the SB-187 C10200 and C11000 entries, and corrected an allowable stress entry. In Table 1B, corrected note to read T3.
08-845	Revised Nonmandatory Appendix A, Metallurgical Phenomena.
08-1053	Added bolting materials in Table Y-1.
08-1064	Added allowable stresses to Table 1B (300°C and 325°C) and Table U (325°C). Corrected some Table 1B values that did not match the MPC provided allowable stresses.
08-1257	Added stress lines in Tables 1A, U, and Y-1.
08-1264	Added stress lines for SA-193 Grade B8A and B8MA Cl. 1 in Table 4.
08-1526	In Tables 2A, U, and Y-1, added stress line for SA-479 UNS S41500.
08-1587	Revised Appendix 3 paragraphs 3-200, 3-400, 3-700, and 3-800, and added new paragraph.
09-211	Incorporated Code Case 2127-2 into Tables 1A, U, and Y-1.
09-432	Corrected Table 1B stress value for SB-247 UNS A92014 at 125°C.
09-599	Deleted SA/GB 6654 Grade 16MnR from Tables 1A, U, and Y-1, and added SA/GB 713 Grade Q345R.
09-674	Added lines in Tables U, Y-1, and 5A for SA/EN 10028-2 Grade 13CrMoSi5-5 and QT.
09-760	Added an introductory subtitle clarifying the purpose and limitations of the Foreword. Revised history paragraph to recognize the realignment of the BPV into several BPVs. Deleted the paragraph on tolerances. Made editorial changes to recognize the new committee structure. Deleted words addressing governing code editions. Deleted paragraph concerning materials. Deleted the paragraph dealing with what the committee considers in the formulation of its rules.
09-772	Added SA/CSA-G40.21 Grades 44W and 50W to Tables 1A, U, and Y-1.
09-1095	UNS S32205 material properties for use in Section VIII, Divisions 1 and 2 incorporated.
09-1609	Incorporated Code Case 2245-1 to allow use of duplex stainless steel corresponding to UNS S32760 in various product forms for temperature range up to 316°C.
09-1682	Revised Subparts 1 and 3 to incorporate Code Case N670-1 with ASTM A874/A874M as SA-874/SA-874M and JIS G5504-2005 as SA/JIS G5504 for SC III applications.
09-1766	Added a Nonmandatory Appendix to serve as a guideline for establishing the nominal compositions used to order listings of ferrous materials in the tables of Section II, Part D and in other Sections of the Code containing stress tables and other lists of materials.
09-1811	Added Q370R and 15CrMoR stress lines in Tables 1A, U, and Y-1.
09-1925	Mandatory Appendix 5 was revised in its entirety.
10-348	Revised the Introduction of Section II, Part D, Subpart 2 to provide that the values in the Subpart are for information only unless invoked by a construction or in-service inspection code, and to clarify that use of alternative values is permitted.
10-388	SA/EN 10028-2 Grade P235GH and P265GH added to Tables 1A, U, and Y-1 for SC VIII-1 applications up to 371°C.
10-622	Added SA/NF A 36-215 Grade P440NJ4 to Tables 5A, U, and Y-1.

Record Number	Change
10-686	Added SA-841, Grade F, Cl. 6 and 7 material to Tables U and Y-1 for SC VIII-3 applications.
10-917	Revised Table 3 to add appropriate creep allowables and T notes.
10-1328	Revised Subpart 1 to include UNS S32205 product forms for Section III, Division 1, Class 2 and 3 construction.
10-1681	Added SA-564 Type 630 Condition H1150M bar to Tables U and Y-1.
10-1752	Revised Table 2A to permit use of SA-358 Class 3 and 4 welded pipe in addition to Class 1.
10-1924	Added G6 to H80 tempers of SB-75 C10200, C12000, and C12200, and SB-111 C10200, C12000, C12200, and C14200. Added G9 to H55 tempers of SB-42 C10200, C12000, and C12200, and SB-395 C10200, C12000, C12200, and C14200. Added G9 to H80 tempers of SB-42 C10200, C12000, and C12200. Deleted G5 from SB-42 C10200 H80.
11-103	In Figure NFN-17, corrected E values for 3rd & 4th curves.
11-623	Added SB-164 UNS N04400 and SB-166 UNS N06600 to Table U.
11-676	Added values for UNS S32202 to Tables 1A and Y-1. Added reference to Figure HA-5 in Table 1A. Added reference to UNS S32202 to physical properties tables. Editorially added note H6 to Table 1A (so it matches the U.S. Customary Table). Added note H7 to Table 1A.
11-687	Permitted use of SB-366 N08367 for Section III applications up to 427°C in Table 1B.
11-771	Replaced Fig. NFA-8 and Table NFA-8.
11-1020	Added Nonmandatory Appendix D.
11-1153	Revised Table 5A to show that the lines for SA-299 are for Grade A only.
11-1500	Revised the Statement of Policy on Information Provided in the Stress Tables to address Tables 5A and 5B, and revised the obsolete reference to Appendix A to reference the Guideline on Locating Materials.
11-1773	Changed the SC I applicability column in Table 1A from NP to 454°C.
11-1831	Added SA-517 Grade E to Applicability column for SC III, Cl. MC construction in Tables 1A and 2A. Added values in Table 1A for use of SA-517, Grade E for Class MC construction up to 371°C for plate ≤ 64 mm.
11-1847	Added Grade A designation for the 515 MPa tensile strength grade of SA-299 and added two lines for SA-299 Grade B.
11-1880	Revised Appendix 10 yield strength criterion for austenitic stainless steels and specific nonferrous materials, and Note (1) to Table 10-100. Revised title and General Note of Table Y-2.
12-16	Corrected thickness ranges in Table 1A. Stress values added up to the maximum temperature when missing in Tables U and Y-1.
12-49	In Table 1B, added a stress line for SB-466 C70600 H55 for SC VIII-1 applications.
12-187	Added SA-533 Type E to the stress tables for use in Section VIII Div. 1 and 2 for Classes 1 and 2.
12-193	Added lines in Table Y-1 for SA-307 bolting.
12-445	Added note G33 to stress-relieved N02200 pipe and tube, permitting external pressure design using chart NFN-2 above 205°C.
12-649	Revised Table 5B to add SB-564 N08825 forgings and revise SB-425 notes.
12-754	Added note to Tables 1A, 2A, and 5A as note S11, S5, and S4, respectively. The note is referenced in the 515 MPa tensile strength line of stresses in Tables 1A, 2A, and 5A.
12-878	Duplex stainless steels added to Table PRD.
12-882	Updated Tables 1A, 5A, U, and Y-1.
12-958	Physical properties for titanium Grade 38 added to Subpart 2.
12-1716	Deleted the term “mandatory” from the Submittal of Technical Inquiries and the reference to the term in the table of contents, and deleted Appendix 4.
12-2163	Approved intent interpretation and deleted note G4 from the SA-540 Class 3 stress line in Table 4.

(13) 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).

SUBPART 1
STRESS TABLES

(13) 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, 4, 5A, and 5B 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, 2A, and 5A, 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 three tables. See the Guideline on Locating Materials in Stress Tables, and in Tables of Mechanical and Physical Properties. 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 non-stainless 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, 2A, and 5A, and Tables 1B, 2B, and 5B, with regard to the mandatory/nonmandatory nature of the information, is that in Tables 1B, 2B, and 5B, 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.

GUIDELINE ON LOCATING MATERIALS IN STRESS TABLES, AND IN TABLES OF MECHANICAL AND PHYSICAL PROPERTIES

1 INTRODUCTION

The goal of this Guideline is to assist the users of Section II, Part D in locating materials in stress tables (Tables 1A, 1B, 2A, 2B, 3, 4, 5A, and 5B), tables of mechanical properties (Tables U, U-2, and Y-1), and tables of physical properties (Tables TE-1 through TE-5, TCD, Tables TM-1 through TM-5, and PRD). This Guideline defines the logic used to place materials within these tables.

2 STRESS TABLES

Stress tables are all found within Subpart 1 of Section II, Part D. Tables 1A, 1B, 3, 5A, and 5B cover allowable stresses, while Tables 2A, 2B, and 4 cover design stress intensities. Although Subpart 1 also covers ultimate tensile strength and yield strength, the organization of those mechanical property tables will be discussed separately in para. 3. A table-by-table listing of the materials-organization logic used to place materials within the designated tables follows.

2.1 TABLE 1A

Table 1A provides allowable stresses for ferrous[1] materials used in Section I; Section III, Division 1, Classes 2 and 3; Section VIII, Division 1; and Section XII construction. Within Table 1A, the first step in ordering materials is to use their nominal compositions. These nominal compositions are nothing more than accepted compositional fingerprints or widely recognized designators for each alloy or alloy class. These nominal compositions are arranged in Table 1A as follows:

(a) carbon steels

(b) carbon steels with small additions of Cb, Ti, and V (microalloyed steels)

(c) C–½Mo steels

(d) chromium steels, including ferritic stainless steels, by increasing Cr content [½Cr, ¾Cr, 1Cr, 1¼Cr, 2¼Cr, 3Cr, 5Cr, 9Cr, 11Cr, 12Cr, 13Cr, 15Cr, 17Cr (including 17Cr–4Ni–4Cu and 17Cr–7Ni–1Al), 18Cr, 26Cr, 27Cr, and 29Cr]

(e) manganese steels (Mn–¼Mo, Mn–½Mo, Mn–½Ni, and Mn–V)

(f) silicon steel (1½Si–½Mo)

(g) nickel steels (½Ni, ¾Ni, 1Ni, 1¼Ni, 2Ni, 2½Ni, 2¾Ni, 3Ni, 3½Ni, 4Ni, 5Ni, 8Ni, and 9Ni)

(h) other high nickel steels [25Ni–15Cr–2Ti (Grade 660) and 29Ni–20Cr–3Cu–2Mo (CN7M)]

(i) high alloy steels, including the duplex stainless steels, in order of increasing chromium content [beginning with 16Cr–9Mn–2Ni–N, then 16Cr–12Ni–2Mo (316L), etc.], then by increasing nickel content within a given chromium or other alloy content [18Cr–8Ni, 18Cr–8Ni–N, 18Cr–8Ni–4Si–N, 18Cr–10Ni–Cb (first S34700, then S34709, S34800, and S34809), 18Cr–10Ni–Ti, 18Cr–11Ni, etc., ending with 25Cr–22Ni–2Mo–N].

Unfortunately, most specifications for materials do not give nominal compositions — and without that information, one may not know the nominal composition for a particular material in Table 1A. If the specification number and alloy grade or type designation are known, then one can go to Table QW/QB-422 of Section IX of the Code and find the corresponding nominal composition.

Now, for a given nominal composition, Table 1A is arranged by increasing tensile strength. For a given nominal composition and tensile strength, stress listings are provided in order of increasing specification number. Sometimes, for a given nominal composition, tensile strength, yield strength, and specificaiton number/grade or type, there may be more than one line of stresses. At this point, the Notes referenced on the second page of each page set within Table 1A will define why there are two or more lines of stresses and when each applies.

2.2 TABLE 1B

Table 1B provides allowable stresses for nonferrous materials used in Section I; Section III, Division 1, Classes 2 and 3; Section VIII, Division 1; and Section XII construction. Aluminum alloys (UNS AXXXXX materials) are the first materials covered in Table 1B, followed by copper alloys (UNS CXXXXX), nickel alloys (UNS NXXXXX), and the reactive and refractory metals and alloys (UNS RXXXXX). Within this latter category there are the following:

(a) chromium alloys (R2XXXX)

(b) cobalt alloys (R3XXXX)

(c) titanium alloys (R5XXXX)

(d) zirconium alloys (R6XXXX)

Within each of these material class groupings, stress lines are first organized by increasing UNS (Unified Numbering System) number. The nonferrous specifications now show these numbers in association with grade designations. Then, for a given UNS number, stress lines are next ordered by strength — first tensile strength and then yield strength. Finally, for a given UNS number, tensile strength, and yield strength, stress lines are ordered by increasing specification number. Again, some materials may

have two or more stress lines even if their UNS number, tensile strength, yield strength, and specification number are the same. The Notes provide direction for the applicability of each line.

For those material specifications that may not show UNS numbers associated with alloy grades, one again can refer to Section IX's Table QW/QB-422 for that information.

For Table 1B, nominal compositions are shown only for the NXXXXX and RXXXXX materials, but they have no influence on the location of alloys in the table. In this table, the nominal compositions are simply for information.

2.3 TABLE 2A

Table 2A provides design stress intensities for ferrous materials for Section III, Division 1, Classes 1, TC, and SC construction. This table is organized in the same manner as Table 1A. Refer back to para. 2.1 for that description.

2.4 TABLE 2B

Table 2B provides design stress intensities for nonferrous materials for Section III, Division 1, Classes 1, TC, and SC construction. Table 2B materials are ordered in the same manner as in Table 1B. Refer back to para. 2.2 for that description.

2.5 TABLE 3

Table 3 provides allowable stresses for bolting materials for use in Section III, Division 1, Classes 2 and 3; Section VIII, Division 1; Section VIII, Division 2 (using Part 4.16 of Section VIII, Division 2); and Section XII construction. The table first covers ferrous materials and then nonferrous materials. For the ferrous materials, the ordering logic parallels that used in Tables 1A and 2A — first by nominal composition, then by increasing ultimate tensile strength, then by increasing yield strength, and finally by increasing specification number. Again, refer back to para. 2.1 for a discussion on nominal composition.

Nonferrous materials are presented using the same logic as in Tables 1B and 2B; see para. 2.2 for that discussion.

2.6 TABLE 4

Table 4 provides design stress intensities for bolting materials used in Section III, Division 1, Classes 1, TC, and SC; and in Section VIII, Division 2 (using Part 5 and Annex 5.F of Section VIII, Division 2).

Table 4 is organized in the same manner as Table 3 — first covering ferrous materials and then nonferrous materials — except that Table 4 covers far fewer materials. For the ordering logic, again refer to paras. 2.1 and 2.2 for ferrous and nonferrous materials, respectively.

2.7 TABLE 5A

Table 5A provides allowable stresses for ferrous materials for Section VIII, Division 2 construction. This table is organized in the same manner as Table 1A. Refer back to para. 2.1 for that description.

2.8 TABLE 5B

Table 5B provides allowable stresses for nonferrous materials for Section VIII, Division 2 construction. This table is organized in the same manner as Table 1B. Refer back to para. 2.2 for that description.

3 MECHANICAL PROPERTY TABLES

Ultimate tensile strength values and yield strength values are to be used in design calculations according to the rules of the Construction Codes. However, they are not to be construed as minimum strength values at temperature. This is explained in the General Notes to these tables. Paragraphs 3.1 through 3.3 provide a table-by-table listing of the materials-organization logic.

3.1 TABLE U

Table U provides tensile strength values for ferrous and nonferrous materials, in that order. The ordering logic for ferrous materials is the same as used in Table 1A, except yield strength level is not shown. Using the logic described in para. 2.1, stress lines are organized by nominal composition, then by increasing tensile strength level, and then by increasing specification number.

Nonferrous materials coverage begins following the last of the high alloy steels (25Cr–22Ni–2Mo–N). Coverage of nonferrous alloys begins with the UNS CXXXXX alloys, followed by NXXXXX and RXXXXX alloys. No tensile strength values are available at this time for the aluminum alloys. The ordering of materials within these three groups has been previously described in para. 2.2.

3.2 TABLE U-2

Table U-2 provides ultimate tensile strengths for special ferrous materials used in Section VIII, Division 3 construction. The only material covered is wire produced to either SA-231 or SA-232, and lines are arranged in order of decreasing tensile strength, resulting from increasing wire diameter.

3.3 TABLE Y-1

Table Y-1 provides yield strength values for ferrous and nonferrous materials, in that order. Again, the ordering of yield strength lines parallels the logic described for ferrous and nonferrous materials in paras. 2.1 and 2.2, respectively. Unlike Table U, for ferrous materials, the tensile strength level does enter into the ordering process, again following nominal composition designation. And, unlike Table U, Table Y-1's nonferrous materials listings do begin with the aluminum-base alloys (UNS AXXXXX).

These are followed by the copper materials (CXXXXX), nickel-base materials (NXXXXX), and the reactive and refractory metals and alloys (RXXXXX).

4 PHYSICAL PROPERTY TABLES

Since physical properties (thermal conductivity, thermal diffusivity, thermal expansion, and density), Young's modulus, and Poisson's ratio values can be shown for numerous materials with a single set of property values, most of the tables found in Subpart 2 of Section II, Part D are based on nominal composition. Paragraphs 4.1 through 4.4 describe how these tables are organized.

4.1 TABLE TE

Table TE covers thermal expansion behavior, presented in terms of A (instantaneous coefficient of thermal expansion), B (mean coefficient of thermal expansion), and C (linear thermal expansion). This table is split into five parts as follows:

(a) Table TE-1 covers numerous individual ferrous materials and ferrous material groupings. Notes at the end of Table TE-1 list the nominal compositions covered by the designated groupings. Again, knowledge of the nominal composition for a given material is essential, and it was noted previously that these can be extracted from Table QW/QB-422 of Section IX, given the specification number and grade or type designation.

(b) Table TE-2 covers aluminum alloys. One set of A/B/C values covers all of the aluminum-base materials listed in General Note (a) of Table TE-2.

(c) Table TE-3 covers copper alloys, currently in five general groupings: C1XXXX alloys, bronze alloys, brass alloys, 70Cu–30Ni, and 90Cu–10Ni. According to an article in ASM International's "Advanced Materials & Processes" (December 1999), the general terms of bronze and brass cover the following alloys:

(1) wrought copper-base alloys

(-a) C20500–C28580 — brasses (Cu–Zn)

(-b) C31200–C38590 — leaded brasses (Cu–Zn–Pb)

(-c) C40400–C49080 — tin brasses (Cu–Zn–Sn–Pb)

(-d) C60600–C64400 — aluminum bronzes (Cu–Al–Ni–Fe–Si–Sn)

(-e) C64700–C66100 — silicon bronzes (Cu–Si–Sn)

(2) cast copper-base alloys

(-a) C83300–C85800 — red and leaded red brasses (Cu–Zn–Sn–Pb)

(-b) C86100–C86800 — manganese bronzes and leaded manganese bronzes (Cu–Zn–Mn–Fe–Pb)

(-c) C90200–C94500 — tin bronzes and leaded tin bronzes (Cu–Sn–Zn–Pb)

(-d) C95300–C95810 — aluminum bronzes (Cu–Al–Fe–Ni)

This guidance should help define which group of A/B/C values of thermal expansion to select for a given brass or bronze.

(d) Table TE-4 provides thermal expansion values for nickel alloys and refractory alloys. The thermal expansion value sets for the nickel alloys are arranged by increasing UNS NXXXXX numbers.

(e) Table TE-5 provides thermal expansion values for two groupings of titanium-base alloys. One group covers only Grade 9; the other group covers the other alloys. In this table, there is no reference to the UNS number, just to the grade number.

4.2 TABLE TCD

Table TCD provides both thermal conductivity (TC) and thermal diffusivity (TD) values for numerous ferrous and nonferrous materials and material groupings. The table begins with ferrous materials, split into groups of carbon and low alloy steels, followed by groups of high chromium steels and groups of high alloy steels. For each of these groups, there is a listing of nominal composition designations found at the end of the table, defining the extent of coverage.

The next series of materials are the nickel-base alloys, covered by TC/TD listings for nickel alloys (arranged by increasing UNS number) and refractory alloys. Then there are TC/TD listings for individual titanium and aluminum alloys (arranged by increasing UNS number). Table TCD does not currently provide values for copper or zirconium alloys.

4.3 TABLE TM

Table TM provides moduli of elasticity for five categories of materials, as follows:

(a) Table TM-1 covers ferrous materials in nine general categories and with additional lines for specific materials. Groups A through G are subdivided by nominal composition; see the Notes at the end of Table TM-1.

(b) Table TM-2 covers aluminum alloys, listed by UNS number designation.

(c) Table TM-3 covers copper alloys, listed by UNS number designation.

(d) Table TM-4 covers nickel alloys, listed by UNS number designation.

(e) Table TM-5 covers titanium alloys, listed by increasing grade numbers, and zirconium-base alloys, listed by increasing UNS number (or grade) designation.

4.4 TABLE PRD

Table PRD provides Poisson's ratio and density for ferrous and nonferrous alloys.

5 REFERENCES

The official reference for UNS numbers is *Metals & Alloys in the Unified Numbering System*, ASTM DS-56. This document is periodically updated as various material specifications are revised, added, or deleted by their sponsoring organizations. Only UNS numbers published in this reference appear in Section II, Part A and Part B specifications, and in the various Section II, Part D stress tables, mechanical property tables, and physical property tables.

Nominal compositions are defined by various groups within the ASME Code committee structure and there are no published guidelines describing how these designations are developed. These designations have the greatest relevance in the arrangement of ferrous materials and, as indicated previously, the simplest way to obtain these designations is to look in Section IX of the ASME Boiler and Pressure Vessel Code and use Table QW/QB-422, which is arranged by increasing specification number. These start with the “SA” specification numbers, followed by the “SB” numbers.

Table 1A
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Sheet	SA–1008	CS–A	...	...	...	1	1
2	Carbon steel	Sheet	SA–1008	CS–B	...	...	...	1	1
3	Carbon steel	Bar	SA–675	45	...	...	...	1	1
4	Carbon steel	Wld. pipe	SA–134	A283A	...	...	...	1	1
5	Carbon steel	Plate	SA–283	A	...	...	...	1	1
6	Carbon steel	Plate	SA–285	A	K01700	...	...	1	1
7	Carbon steel	Wld. pipe	SA–672	A45	K01700	...	...	1	1
8	Carbon steel	Sheet	SA–414	A	K01501	...	...	1	1
9	Carbon steel	Wld. tube	SA–178	A	K01200	...	...	1	1
10	Carbon steel	Wld. tube	SA–178	A	K01200	...	...	1	1
11	Carbon steel	Smls. tube	SA–179	...	K01200	...	...	1	1
12	Carbon steel	Smls. tube	SA–192	...	K01201	...	...	1	1
13	Carbon steel	Wld. tube	SA–214	...	K01807	...	...	1	1
14	Carbon steel	Smls. tube	SA–556	A2	K01807	...	...	1	1
15	Carbon steel	Wld. tube	SA–557	A2	K01807	...	...	1	1
16	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...	...	1	1
17	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...	...	1	1
18	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...	...	1	1
19	Carbon steel	Wld. pipe	SA–53	F/A	...	...	...	1	1
20	Carbon steel	Smls. pipe	SA–53	S/A	K02504	...	...	1	1
21	Carbon steel	Smls. pipe	SA–53	S/A	K02504	...	...	1	1
22	Carbon steel	Smls. pipe	SA–106	A	K02501	...	...	1	1
23	Carbon steel	Wld. pipe	SA–135	A	...	...	...	1	1
24	Carbon steel	Forged pipe	SA–369	FPA	K02501	...	...	1	1
25	Carbon steel	Wld. pipe	SA–587	...	K11500	...	...	1	1
26	Carbon steel	Wld. pipe	SA–587	...	K11500	...	...	1	1
27	Carbon steel	Bar	SA–675	50	...	...	...	1	1
28	Carbon steel	Bar	SA–675	50	...	...	...	1	1
29	Carbon steel	Wld. pipe	SA–134	A283B	...	...	...	1	1
30	Carbon steel	Plate	SA–283	B	...	...	...	1	1
31	Carbon steel	Plate	SA–285	B	K02200	...	...	1	1
32	Carbon steel	Plate	SA–285	B	K02200	...	...	1	1
33	Carbon steel	Wld. pipe	SA–672	A50	K02200	...	...	1	1
34	Carbon steel	Sheet	SA–414	B	K02201	...	...	1	1
35	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	150 < t ≤ 250	1	1
(**13**) 36	Carbon steel	Plate	SA/EN 10028–2	P235GH	...	...	≤60	1	1
(**13**) 37	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...	40 < t ≤ 60	1	1
38	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	100 < t ≤ 150	1	1
(**13**) 39	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...	16 < t ≤ 40	1	1
(**13**) 40	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...	t ≤ 16	1	1

Table 1A
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	275	140	NP	NP	343	NP	CS-6	...
2	275	140	NP	NP	343	NP	CS-6	...
3	310	155	NP	343 (Cl. 3 only)	482	343	CS-6	G10, G22, T10
4	310	165	NP	149 (Cl. 3 only)	NP	NP	CS-1	W12
5	310	165	NP	149 (Cl. 3 only)	343	343	CS-1	...
6	310	165	482	371	482	343	CS-1	G10, T2
7	310	165	NP	371	NP	NP	CS-1	S6, W10, W12
8	310	170	NP	NP	482	343	CS-1	G10, T2
9	325	180	538	NP	NP	NP	CS-1	G4, G10, S1, T2, W13
10	325	180	538	NP	538	343	CS-1	G3, G10, G24, S1, T2, W6
11	325	180	NP	NP	482	343	CS-1	G10, T2
12	325	180	538	NP	538	343	CS-1	G10, S1, T2
13	325	180	NP	NP	538	343	CS-1	G24, T2, W6
14	325	180	NP	NP	538	343	CS-1	G10, T2
15	325	180	NP	NP	538	343	CS-1	G24, T2, W6
16	330	205	482	NP	NP	NP	CS-2	G3, G10, S1, T2
17	330	205	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T2, W12, W13
18	330	205	NP	NP	482	343	CS-2	G24, T2, W6
19	330	205	399	NP	NP	NP	CS-2	G2, G10, S10, T2, W15
20	330	205	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T2
21	330	205	NP	371 (SPT)	482	343	CS-2	G10, T2
22	330	205	538	371	538	343	CS-2	G10, S1, T1
23	330	205	NP	NP	482	343	CS-2	G24, T2, W6
24	330	205	538	NP	NP	NP	CS-2	G10, S1, T1
25	330	205	NP	149 (Cl. 3 only)	NP	NP	CS-2	...
26	330	205	NP	NP	454	343	CS-2	G24, T2, W6
27	345	170	NP	343 (Cl. 3 only)	NP	NP	CS-1	...
28	345	170	454	371 (SPT)	482	343	CS-1	G10, G15, G22, S1, T2
29	345	185	NP	149 (Cl. 3 only)	NP	NP	CS-1	W12
30	345	185	NP	149 (Cl. 3 only)	343	343	CS-1	...
31	345	185	482	NP	NP	NP	CS-1	G10, S1, T1
32	345	185	NP	371	482	343	CS-1	G10, T1
33	345	185	NP	371	NP	NP	CS-1	S6, T1, W10, W12
34	345	205	NP	NP	482	343	CS-2	G10, T1
35	350	215	NP	NP	204	NP	CS-2	G10
36	360	215	NP	NP	371	NP	CS-2	T11
37	360	215	538	NP	538	NP	CS-2	G10, S1, T2, W14
38	360	225	NP	NP	204	NP	CS-2	G10
39	360	225	538	NP	538	NP	CS-2	G10, S1, T2, W14
40	360	235	538	NP	538	NP	CS-2	G10, S1, T2, W14

Table 1A
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	78.6	78.6	78.6	78.6	78.6	78.6	76.0	71.6	69.6	67.8	...	...	...	...	...
2	78.6	78.6	78.6	78.6	78.6	78.6	76.0	71.6	69.6	67.8	...	...	...	...	...
3	88.9	88.9	88.9	88.9	88.9	88.4	85.0	80.7	78.4	75.8	73.5	71.5	*64.0*	*56.1*	*44.5*
4	88.9	88.9	88.9	88.9	88.9	...	...	...	...	...	...	...	...	...	...
5	88.9	88.9	88.9	88.9	88.9	88.9	88.9	86.3	83.8	81.4	...	...	...	...	...
6	88.9	88.9	88.9	88.9	88.9	88.9	88.9	86.3	83.8	81.4	78.8	*73.4*	*64.0*	*56.1*	*44.5*
7	88.9	88.9	88.9	88.9	88.9	88.9	88.9	86.3	83.8	81.4	78.8	...	...	...	...
8	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.5	87.5	84.8	81.2	*73.4*	*64.0*	*56.1*	*44.5*
9	92.4	92.4	92.4	92.4	92.4	92.4	92.4	91.9	90.7	87.8	84.3	*73.3*	*63.9*	*56.2*	*44.5*
10	78.6	78.6	78.6	78.6	78.6	78.6	78.6	78.1	77.1	74.7	71.4	*62.3*	*54.2*	*47.6*	*37.7*
11	92.4	92.4	92.4	92.4	92.4	92.4	92.4	91.9	90.7	87.8	84.3	*73.3*	*63.9*	*56.2*	*44.5*
12	92.4	92.4	92.4	92.4	92.4	92.4	92.4	91.9	90.7	87.8	84.3	*73.3*	*63.9*	*56.2*	*44.5*
13	78.6	78.6	78.6	78.6	78.6	78.6	78.6	78.1	77.1	74.7	71.4	*62.3*	*54.2*	*47.6*	*37.7*
14	92.4	92.4	92.4	92.4	92.4	92.4	92.4	91.9	90.7	87.8	84.3	*73.3*	*63.9*	*56.2*	*44.5*
15	78.6	78.6	78.6	78.6	78.6	78.6	78.6	78.1	77.1	74.7	71.4	*62.3*	*54.2*	*47.6*	*37.7*
16	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	79.8	71.6	*62.3*	*53.7*	*43.9*	*32.9*
17	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	93.5	84.5	*73.3*	*62.8*	*51.2*	*38.3*
18	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	79.8	71.6	*62.4*	*54.9*	*47.5*	*40.1*
19	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.0	50.7	*43.8*	...	...	...
20	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	93.5	84.5	*73.3*	*62.8*	*51.2*	*38.3*
21	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	93.6	84.4	*73.3*	*64.7*	*56.0*	*47.6*
22	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	93.6	*84.4*	*73.3*	*64.7*	*56.0*	*47.6*
23	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	79.8	71.6	*62.4*	*54.9*	*47.5*	*40.1*
24	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	93.5	*84.5*	*73.3*	*62.8*	*51.2*	*38.3*
25	94.5	94.5	94.5	94.5	94.5	...	...	...	...	...	...	...	...	...	...
26	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	80.7	79.8	71.6	*62.4*	*54.9*	*47.5*	*40.1*
27	98.6	98.6	98.6	98.6	98.6	98.1	94.7	89.8	87.3	84.9	...	...	...	...	...
28	98.6	98.6	98.6	98.6	98.6	98.1	94.7	89.8	87.3	84.9	81.2	*73.4*	*64.7*	*56.0*	*47.3*
29	98.6	98.6	98.6	98.6	98.6	...	...	...	...	...	...	...	...	...	...
30	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.6	94.1	90.6	...	...	...	...	...
31	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.6	94.1	90.7	*85.0*	*75.4*	*65.6*	*52.8*	*38.6*
32	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.6	94.1	90.6	*85.1*	*76.8*	*66.8*	*57.8*	*44.9*
33	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.6	94.1	90.6	*85.1*	...	...	...	...
34	98.6	98.6	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.9	*84.5*	*76.8*	*66.8*	*57.7*	*44.9*
35	100	100	100	100	100	100	...	...	...	...	...	...	...	...	...
36	103	103	103	103	103	103	103	103	103	*96.8*	*85.0*	...	...	...	...
37	103	103	103	103	103	103	103	103	103	103	102	*89.1*	*75.4*	*62.6*	*45.5*
38	103	103	103	103	103	103	...	...	...	...	...	...	...	...	...
39	103	103	103	103	103	103	103	103	103	103	102	*89.1*	*75.4*	*62.6*	*45.5*
40	103	103	103	103	103	103	103	103	103	103	102	*89.1*	*75.4*	*62.6*	*45.5*

Table 1A
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	*31.9*	*21.8*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	*27.1*	*18.5*	*10.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	*31.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	*31.9*	*21.8*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	*27.1*	*18.5*	*10.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	*31.9*	*21.8*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	*27.1*	*18.5*	*10.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	*21.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	*25.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	*32.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	*25.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	*36.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	*36.2*	*23.5*	*11.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	*32.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	*25.3*	*14.9*	*5.88*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*38.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	*24.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	*30.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	*30.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)
37	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)
40	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(**13**)	1	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	60 < *t* ≤ 100	1	1
	2	Carbon steel	Bar	SA–675	55	...	...	...	1	1
	3	Carbon steel	Bar	SA–675	55	...	...	...	1	1
	4	Carbon steel	Wld. pipe	SA–134	A283C	K02401	...	...	1	1
	5	Carbon steel	Plate	SA–283	C	K02401	...	...	1	1
	6	Carbon steel	Plate	SA–285	C	K02801	...	...	1	1
	7	Carbon steel	Smls. & wld. pipe	SA–333	1	K03008	...	...	1	1
	8	Carbon steel	Smls. & wld. tube	SA–334	1	K03008	...	...	1	1
	9	Carbon steel	Wld. tube	SA–334	1	K03008	...	...	1	1
	10	Carbon steel	Plate	SA–516	55	K01800	...	...	1	1
	11	Carbon steel	Smls. pipe	SA–524	II	K02104	...	...	1	1
	12	Carbon steel	Wld. pipe	SA–671	CA55	K02801	...	...	1	1
	13	Carbon steel	Wld. pipe	SA–671	CE55	K02202	...	...	1	1
	14	Carbon steel	Wld. pipe	SA–672	A55	K02801	...	...	1	1
	15	Carbon steel	Wld. pipe	SA–672	B55	K02001	...	...	1	1
	16	Carbon steel	Wld. pipe	SA–672	C55	K01800	...	...	1	1
	17	Carbon steel	Wld. pipe	SA–672	E55	K02202	...	...	1	1
	18	Carbon steel	Sheet	SA–414	C	K02503	...	...	1	1
(**13**)	19	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	≤60	1	1
	20	Carbon steel	Bar	SA–36	...	K02600	...	...	1	1
	21	Carbon steel	Plate, sheet	SA–36	...	K02600	...	...	1	1
	22	Carbon steel	Plate, sheet	SA–662	A	K01701	...	...	1	1
(**13**)	23	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	*t* > 40	1	1
(**13**)	24	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...	*t* > 40	1	1
(**13**)	25	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	*t* > 40	1	1
(**13**)	26	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	20 < *t* ≤ 40	1	1
(**13**)	27	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...	20 < *t* ≤ 40	1	1
(**13**)	28	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	20 < *t* ≤ 40	1	1
(**13**)	29	Carbon steel	Plate	SA/EN 10028–2	P265GH	...	...	≤60	1	1
(**13**)	30	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...	40 < *t* ≤ 60	1	1
(**13**)	31	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	*t* ≤ 20	1	1
(**13**)	32	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...	*t* ≤ 20	1	1
(**13**)	33	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	*t* ≤ 20	1	1
(**13**)	34	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...	16 < *t* ≤ 40	1	1
(**13**)	35	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...	*t* ≤ 16	1	1
	36	Carbon steel	Forgings	SA–181	...	K03502	60	...	1	1
	37	Carbon steel	Castings	SA–216	WCA	J02502	...	...	1	1
	38	Carbon steel	Forgings	SA–266	1	K03506	...	...	1	1
	39	Carbon steel	Forgings	SA–350	LF1	K03009	1	...	1	1
	40	Carbon steel	Castings	SA–352	LCA	J02504	...	...	1	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	370	235	NP	NP	204	NP	CS–2	G10
2	380	190	454	371 (SPT)	482	343	CS–1	G10, G15, G22, S1, T2
3	380	190	NP	343 (Cl. 3 only)	NP	NP	CS–1	...
4	380	205	NP	149 (Cl. 3 only)	NP	NP	CS–2	W12
5	380	205	NP	149 (Cl. 3 only)	343	343	CS–2	...
6	380	205	482	371	482	343	CS–2	G10, S1, T2
7	380	205	NP	371	343	343	CS–2	W12, W14
8	380	205	NP	371	343	343	CS–2	W12, W14
9	380	205	NP	NP	343	343	CS–2	G24, W6
10	380	205	454	371	538	343	CS–2	G10, S1, T2
11	380	205	NP	NP	538	343	CS–2	G10, T2
12	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
13	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
14	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
15	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
16	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
17	380	205	NP	371	NP	NP	CS–2	S6, W10, W12
18	380	230	NP	371	482	343	CS–2	G10, T1
19	390	...	NP	NP	204	204	CS–2	G10, G18
20	400	250	343	343 (SPT)	482	343	CS–2	G10, G15, T1
21	400	250	NP	371	343	343	CS–2	G9, G10, T1
22	400	275	NP	NP	371	343	CS–2	T1
23	410	230	NP	NP	343	343	CS–2	...
24	410	230	NP	NP	343	343	CS–2	...
25	410	230	NP	NP	343	NP	CS–2	...
26	410	240	NP	NP	343	343	CS–2	...
27	410	240	NP	NP	343	343	CS–2	...
28	410	240	NP	NP	343	343	CS–2	...
29	410	245	NP	NP	371	NP	CS–2	T1
30	410	245	538	NP	538	NP	CS–2	G10, S1, T1
31	410	250	NP	NP	343	343	CS–2	...
32	410	250	NP	NP	343	343	CS–2	...
33	410	250	NP	NP	343	343	CS–2	...
34	410	255	538	NP	538	NP	CS–2	G10, S1, T1
35	410	265	538	NP	538	NP	CS–2	G10, S1, T1
36	415	205	538	371	538	343	CS–2	G10, S1, T2
37	415	205	538	371	538	343	CS–2	G1, G10, G17, S1, T2
38	415	205	538	371	538	343	CS–2	G10, S1, T2
39	415	205	NP	371	538	343	CS–2	G10, T2
40	415	205	NP	371	NP	NP	CS–2	G17

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	105	105	105	105	105	105	...	...	...	...	...	...	...	...	...
2	108	108	108	108	108	108	104	98.8	96.1	92.9	89.9	*87.3*	*75.4*	*62.5*	*46.0*
3	108	108	108	108	108	108	104	98.8	96.1	92.9	...	...	...	...	...
4	108	108	108	108	108	...	...	...	...	...	...	...	...	...	...
5	108	108	108	108	108	108	108	107	104	101	...	...	...	...	...
6	108	108	108	108	108	108	108	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
7	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
8	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
9	92.4	92.4	92.4	92.4	92.4	92.4	92.4	90.8	88.7	86.2	...	...	...	...	...
10	108	108	108	108	108	108	108	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
11	108	108	108	108	108	108	108	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
12	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
13	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
14	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
15	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
16	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
17	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
18	108	108	108	108	108	108	108	108	108	108	*106*	*88.8*	*75.2*	*62.6*	*45.9*
19	111	111	111	111	111	111	...	...	...	...	...	...	...	...	...
20	114	114	114	114	114	114	114	114	114	114	*105*	*88.9*	*75.3*	*62.6*	*45.9*
21	114	114	114	114	114	114	114	114	114	114	*105*	...	...	...	...
22	114	114	114	114	114	114	114	114	114	114	*105*	...	...	...	...
23	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
24	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
25	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
26	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
27	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
28	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
29	117	117	117	117	117	117	117	117	117	117	*106*	...	...	...	...
30	117	117	117	117	117	117	117	117	117	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
31	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
32	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
33	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
34	117	117	117	117	117	117	117	117	117	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
35	117	117	117	117	117	117	117	117	117	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
36	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
37	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
38	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
39	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
40	118	118	118	118	118	118	114	107	104	101	97.8	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
2	*28.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	*28.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
20	*28.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
30	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
35	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
36	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Cast pipe	SA–660	WCA	J02504	...	...	1	1
2	Carbon steel	Bar	SA–675	60	...	...	...	1	1
3	Carbon steel	Bar	SA–675	60	...	...	...	1	1
4	Carbon steel	Forgings	SA–765	I	K03046	...	...	1	1
5	Carbon steel	Plate	SA–515	60	K02401	...	...	1	1
6	Carbon steel	Plate	SA–516	60	K02100	...	...	1	1
7	Carbon steel	Wld. pipe	SA–671	CB60	K02401	...	...	1	1
8	Carbon steel	Wld. pipe	SA–671	CC60	K02100	...	...	1	1
9	Carbon steel	Wld. pipe	SA–671	CE60	K02402	...	...	1	1
10	Carbon steel	Wld. pipe	SA–672	B60	K02401	...	...	1	1
11	Carbon steel	Wld. pipe	SA–672	C60	K02100	...	...	1	1
12	Carbon steel	Wld. pipe	SA–672	E60	K02402	...	...	1	1
13	Carbon steel	Wld. pipe	SA–134	A283D	K02702	...	...	1	1
14	Carbon steel	Plate	SA–283	D	K02702	...	...	1	1
15	Carbon steel	Wld. pipe	SA–53	E/B	K03005	...	...	1	1
16	Carbon steel	Wld. pipe	SA–53	E/B	K03005	...	...	1	1
17	Carbon steel	Smls. pipe	SA–53	S/B	K03005	...	...	1	1
18	Carbon steel	Smls. pipe	SA–53	S/B	K03005	...	...	1	1
19	Carbon steel	Smls. pipe	SA–106	B	K03006	...	...	1	1
20	Carbon steel	Wld. pipe	SA–135	B	...	...	...	1	1
21	Carbon steel	Smls. & wld. fittings	SA–234	WPB	K03006	...	...	1	1
22	Carbon steel	Smls. & wld. pipe	SA–333	6	K03006	...	...	1	1
23	Carbon steel	Wld. pipe	SA–333	6	K03006	...	...	1	1
24	Carbon steel	Smls. & wld. tube	SA–334	6	K03006	...	...	1	1
25	Carbon steel	Wld. tube	SA–334	6	K03006	...	...	1	1
26	Carbon steel	Forged pipe	SA–369	FPB	K03006	...	...	1	1
27	Carbon steel	Forgings	SA–372	A	K03002	...	...	1	1
28	Carbon steel	Sheet	SA–414	D	K02505	...	...	1	1
29	Carbon steel	Smls. & wld. fittings	SA–420	WPL6	...	...	...	1	1
30	Carbon steel	Smls. pipe	SA–524	I	K02104	...	...	1	1
(**13**) 31	...	...	...	...	...	...	...	...	...
32	Carbon steel	Bar	SA–696	B	K03200	...	...	1	1
33	Carbon steel	Forgings	SA–727	...	K02506	...	...	1	1
34	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	1	1
35	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	1	1
36	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	1	1
37	Carbon steel	Smls. tube	SA–210	A–1	K02707	...	...	1	1
38	Carbon steel	Smls. tube	SA–556	B2	K02707	...	...	1	1
39	Carbon steel	Wld. tube	SA–557	B2	K03007	...	...	1	1
40	Carbon steel	Plate, bar	SA/CSA–G40.21	38W	...	...	...	1	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	415	205	538	371	NP	NP	CS–2	G1, G10, G17, S1, T2
2	415	205	454	371 (SPT)	NP	NP	CS–2	G10, G15, S1, T2
3	415	205	NP	343 (Cl. 3 only)	482	343	CS–2	G10, G22, T2
4	415	205	NP	NP	538	343	CS–2	G10, T2
5	415	220	538	371	538	343	CS–2	G10, S1, T2
6	415	220	454	371	538	343	CS–2	G10, S1, T2
7	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
8	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
9	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
10	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
11	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
12	415	220	NP	371	NP	NP	CS–2	S6, W10, W12
13	415	230	NP	149 (Cl. 3 only)	NP	NP	CS–2	W12
14	415	230	NP	149 (Cl. 3 only)	343	343	CS–2	...
15	415	240	482	149 (Cl. 3 only)	NP	NP	CS–2	G10, S1, T1, W12, W13
16	415	240	482	NP	482	343	CS–2	G3, G10, G24, S1, T1, W6
17	415	240	482	149 (Cl. 3 only)	NP	NP	CS–2	G10, S1, T1
18	415	240	NP	371 (SPT)	482	343	CS–2	G10, T1
19	415	240	538	371	538	343	CS–2	G10, S1, T1
20	415	240	NP	NP	482	343	CS–2	G24, T1, W6
21	415	240	538	371	538	343	CS–2	G10, S1, T1
22	415	240	371	371	538	343	CS–2	G10, T1, W12, W13, W14
23	415	240	371	NP	NP	NP	CS–2	T1
24	415	240	NP	371	343	343	CS–2	T1, W12, W14
25	415	240	NP	NP	343	343	CS–2	G24, W6
26	415	240	538	NP	NP	NP	CS–2	G10, S1, T1
27	415	240	NP	NP	343	343	CS–2	...
28	415	240	NP	NP	482	343	CS–2	G10, T1
29	415	240	NP	371	454	343	CS–2	G10, T1, W14
30	415	240	NP	NP	538	343	CS–2	G10, T1
31	...	...	...	...	...	...	...	...
32	415	240	NP	371	NP	NP	CS–2	T1
33	415	250	NP	371	538	343	CS–2	G10, G22, T1
34	415	255	538	NP	NP	NP	CS–2	G4, G10, S1, T2
35	415	255	538	371	NP	NP	CS–2	G10, S1, T1, W13
36	415	255	538	NP	538	343	CS–2	G3, G10, G24, S1, T2, W6
37	415	255	538	371	538	343	CS–2	G10, S1, T1
38	415	255	NP	NP	538	343	CS–2	G10, T1
39	415	255	NP	NP	538	343	CS–2	G24, T1, W6
40	415	260	NP	NP	343	343	CS–2	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
2	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
3	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
4	118	118	118	118	118	118	114	107	104	101	97.8	*89.1*	*75.4*	*62.6*	*45.5*
5	118	118	118	118	118	118	118	115	112	108	104	*88.9*	*75.3*	*62.7*	*45.5*
6	118	118	118	118	118	118	118	115	112	108	104	*88.9*	*75.3*	*62.7*	*45.5*
7	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
8	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
9	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
10	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
11	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
12	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
13	118	118	118	118	118	...	...	...	...	...	...	...	...	...	...
14	118	118	118	118	118	118	118	118	115	111	...	...	...	...	...
15	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
16	101	101	101	101	101	101	101	101	101	99.7	*89.7*	*75.9*	*64.1*	*53.3*	*38.6*
17	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
18	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
19	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
20	101	101	101	101	101	101	101	101	101	99.7	*89.7*	*75.9*	*64.1*	*53.3*	*38.6*
21	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
22	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
23	101	101	101	101	101	101	101	101	101	99.7	*89.7*	...	...	...	...
24	118	118	118	118	118	118	118	118	118	117	*105*	...	...	...	...
25	101	101	101	101	101	101	101	101	101	101	...	...	...	...	...
26	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
27	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
28	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
29	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
30	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	118	118	118	118	118	118	118	118	118	117	*105*	...	...	...	...
33	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
34	118	118	118	118	118	118	118	118	118	117	105	*88.9*	*75.2*	*63.2*	*40.5*
35	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
36	101	101	101	101	101	101	101	101	101	99.7	89.7	*75.9*	*64.1*	*53.3*	*38.6*
37	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
38	118	118	118	118	118	118	118	118	118	117	*105*	*88.9*	*75.3*	*62.7*	*45.5*
39	101	101	101	101	101	101	101	101	101	99.7	*89.7*	*75.9*	*64.1*	*53.3*	*38.6*
40	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	*26.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	*26.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*31.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	*26.2*	*18.8*	*10.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	*26.8*	*18.6*	*10.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	*31.6*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	*26.8*	*18.6*	*10.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	Carbon steel	Plate	SA/AS 1548	PT430N	...	Normalized	≤150	1	1
	2	Carbon steel	Plate	SA/AS 1548	PT430NR	...	Norm. rld.	≤150	1	1
	3	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	150 < *t* ≤ 250	1	1
	4	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	100 < *t* ≤ 150	1	1
	5	Carbon steel	Bar	SA–675	65	...	...	...	1	1
	6	Carbon steel	Castings	SA–352	LCB	J03003	...	...	1	1
	7	Carbon steel	Plate	SA–515	65	K02800	...	...	1	1
	8	Carbon steel	Plate	SA–516	65	K02403	...	...	1	1
	9	Carbon steel	Wld. pipe	SA–671	CB65	K02800	...	...	1	1
	10	Carbon steel	Wld. pipe	SA–671	CC65	K02403	...	...	1	1
	11	Carbon steel	Wld. pipe	SA–672	B65	K02800	...	...	1	1
	12	Carbon steel	Wld. pipe	SA–672	C65	K02403	...	...	1	1
	13	Carbon steel	Sheet	SA–414	E	K02704	...	...	1	1
	14	Carbon steel	Plate	SA–662	B	K02203	...	...	1	1
(**13**)	15	...	...	...	...	...	...	...	...	...
	16	Carbon steel	Plate	SA–537	...	K12437	1	64 < *t* ≤ 100	1	2
	17	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	64 < *t* ≤ 100	1	2
(**13**)	18	Carbon steel	Plate, bar	SA/CSA–G40.21	44W	...	...	*t* ≤ 200	1	1
(**13**)	19	Carbon steel	Plate, bar	SA/CSA–G40.21	50W	...	...	*t* ≤ 150	1	1
	20	Carbon steel	Plate	SA/AS 1548	PT460N	...	Normalized	≤150	1	1
	21	Carbon steel	Plate	SA/AS 1548	PT460NR	...	Norm. rld.	≤150	1	1
	22	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	60 < *t* ≤ 100	1	1
	23	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	≤60	1	1
(**13**)	24	...	...	...	...	...	...	...	...	...
(**13**)	25	Carbon steel	Plate	SA/GB 713	Q345R	...	...	150 < *t* ≤ 200	1	2
(**13**)	26	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	150 < *t* ≤ 250	1	2
(**13**)	27	...	...	...	...	...	...	...	...	...
(**13**)	28	Carbon steel	Plate	SA/GB 713	Q345R	...	...	100 < *t* ≤ 150	1	2
(**13**)	29	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	100 < *t* ≤ 150	1	2
	30	Carbon steel	Plate	SA–455	...	K03300	...	15 < *t* ≤ 19	1	2
	31	Carbon steel	Bar	SA–675	70	...	...	...	1	2
	32	Carbon steel	Forgings	SA–105	...	K03504	...	...	1	2
	33	Carbon steel	Forgings	SA–181	...	K03502	70	...	1	2
	34	Carbon steel	Castings	SA–216	WCB	J03002	...	...	1	2
	35	Carbon steel	Forgings	SA–266	2	K03506	...	...	1	2
	36	Carbon steel	Forgings	SA–266	4	K03017	...	...	1	2
(**13**)	37	Carbon steel	Forgings	SA–350	LF2	K03011	1	...	1	2
(**13**)	38	Carbon steel	Forgings	SA–350	LF2	K03011	2	...	1	2
	39	Carbon steel	Forgings	SA–508	1	K13502	...	...	1	2
	40	Carbon steel	Forgings	SA–508	1A	K13502	...	...	1	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	430	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
2	430	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
3	430	220	454	NP	538	NP	CS-2	G10, S1, T2
4	440	235	454	NP	538	NP	CS-2	G10, S1, T2
5	450	225	454	343 (Cl. 3 only)	538	343	CS-2	G10, G15, G22, S1, T2
6	450	240	NP	371	343	343	CS-2	G1, G17
7	450	240	538	371	538	343	CS-2	G10, S1, T2
8	450	240	454	371	538	343	CS-2	G10, S1, T2
9	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
10	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
11	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
12	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
13	450	260	NP	NP	482	343	CS-2	G10, T1
14	450	275	NP	NP	371	343	CS-2	T1
15	...	...	...	...	...	...	...	...
16	450	310	NP	371	343	343	CS-2	T1
17	450	310	NP	371	NP	NP	CS-2	G26, T1, W10, W12
18	450	...	343	NP	343	343	CS-2	G18
19	450	...	343	NP	343	343	CS-2	G18
20	460	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
21	460	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
22	460	260	454	NP	538	NP	CS-2	G10, S1, T1
23	460	...	454	NP	538	343	CS-2	G10, G18, S1, T1
24	...	...	...	...	...	...	...	...
25	470	265	427	NP	427	NP	CS-2	T1
26	470	280	454	NP	538	NP	CS-2	G10, S1, T1
27	...	...	...	...	...	...	...	...
28	480	285	427	NP	427	NP	CS-2	T1
29	480	295	454	NP	538	NP	CS-2	G10, S1, T1
30	485	240	NP	204 (Cl. 3 only)	343	343	CS-2	...
31	485	240	454	343 (Cl. 3 only)	538	343	CS-2	G10, G15, G22, S1, T2
32	485	250	538	371	538	343	CS-2	G10, S1, T2
33	485	250	538	371	538	343	CS-2	G10, S1, T2
34	485	250	538	371	538	343	CS-2	G1, G10, G17, S1, T2
35	485	250	538	371	538	343	CS-2	G10, S1, T2
36	485	250	NP	NP	538	343	CS-2	G10, T2
37	485	250	454	371	538	343	CS-2	G10, T2
38	485	250	454	371	538	343	CS-2	G10, T2
39	485	250	NP	371	538	343	CS-2	G10, T2
40	485	250	NP	371	538	343	CS-2	G10, T2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	123	123	123	123	123	123	123	123	123	123	*114*	*95.0*	*79.6*	*63.2*	*45.3*
2	123	123	123	123	123	123	123	123	123	123	*114*	*95.0*	*79.6*	*63.2*	*45.3*
3	123	123	123	123	123	123	121	114	111	108	105	*96.2*	*79.1*	*62.1*	*46.0*
4	126	126	126	126	126	126	126	122	119	115	112	*96.2*	*79.1*	*62.1*	*46.0*
5	128	128	128	128	128	128	123	117	113	110	106	*95.2*	*79.6*	*63.8*	*39.2*
6	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
7	128	128	128	128	128	128	128	125	122	118	114	*95.0*	*79.6*	*63.2*	*45.3*
8	128	128	128	128	128	128	128	125	122	118	114	*95.0*	*79.6*	*63.2*	*45.3*
9	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
10	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
11	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
12	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
13	128	128	128	128	128	128	128	128	128	127	*114*	*95.1*	*79.6*	*63.1*	*45.7*
14	128	128	128	128	128	128	128	128	128	127	*114*	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	128	128	128	128	128	128	128	128	128	127	*114*	...	...	...	...
17	128	128	128	128	128	128	128	128	128	127	*114*	...	...	...	...
18	128	128	128	128	128	128	128	128	128	128	...	...	...	...	...
19	128	128	128	128	128	128	128	128	128	128	...	...	...	...	...
20	131	131	131	131	131	131	131	131	131	129	*114*	*95.1*	*79.6*	*63.2*	*45.3*
21	131	131	131	131	131	131	131	131	131	129	*114*	*95.1*	*79.6*	*63.2*	*45.3*
22	131	131	131	131	131	131	131	131	131	127	*112*	*96.2*	*79.1*	*62.1*	*46.0*
23	131	131	131	131	131	131	131	131	131	127	*112*	*96.2*	*79.1*	*62.1*	*46.0*
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	134	134	134	134	134	134	134	134	134	130	*123*	*101*	*83.8*	*67.1*	...
26	134	134	134	134	134	134	134	134	134	134	*123*	*101*	*83.8*	*67.1*	*51.0*
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	137	137	137	137	137	137	137	137	137	137	*123*	*101*	*83.8*	*67.1*	...
29	137	137	137	137	137	137	137	137	137	137	*123*	*101*	*83.8*	*67.1*	*51.0*
30	138	138	138	138	138	137	132	126	122	119	...	...	...	...	...
31	138	138	138	138	138	137	132	126	122	119	114	*101*	*83.9*	*67.0*	*51.1*
32	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
33	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
34	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
35	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
36	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
37	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
38	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
39	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
40	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	*32.1*	*21.2*	*14.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	*32.1*	*21.2*	*14.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	*30.1*	*22.4*	*12.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	*28.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
20	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	*31.7*	*21.9*	*12.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	*32.1*	*21.2*	*14.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	*32.1*	*21.2*	*14.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
29	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
39	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	Carbon steel	Forgings	SA–541	1	K03506	...	...	1	2
	2	Carbon steel	Forgings	SA–541	1A	K03020	...	...	1	2
	3	Carbon steel	Cast pipe	SA–660	WCB	J03003	...	...	1	2
	4	Carbon steel	Forgings	SA–765	II	K03047	...	...	1	2
	5	Carbon steel	Plate	SA–515	70	K03101	...	...	1	2
	6	Carbon steel	Plate	SA–516	70	K02700	...	...	1	2
	7	Carbon steel	Wld. pipe	SA–671	CB70	K03101	...	...	1	2
	8	Carbon steel	Wld. pipe	SA–671	CC70	K02700	...	...	1	2
	9	Carbon steel	Wld. pipe	SA–672	B70	K03101	...	...	1	2
	10	Carbon steel	Wld. pipe	SA–672	C70	K02700	...	...	1	2
	11	Carbon steel	Plate	SA/JIS G3118	SGV480	...	...	...	1	2
	12	Carbon steel	Smls. pipe	SA–106	C	K03501	...	...	1	2
	13	Carbon steel	Wld. tube	SA–178	D	...	...	...	1	2
	14	Carbon steel	Wld. tube	SA–178	D	...	...	...	1	2
	15	Carbon steel	Wld. tube	SA–178	D	...	...	...	1	2
	16	Carbon steel	Smls. tube	SA–210	C	K03501	...	...	1	2
	17	Carbon steel	Castings	SA–216	WCC	J02503	...	...	1	2
	18	Carbon steel	Smls. & wld. fittings	SA–234	WPC	K03501	...	...	1	2
	19	Carbon steel	Castings	SA–352	LCC	J02505	...	...	1	2
	20	Carbon steel	Castings	SA–487	16	...	A	...	1	2
	21	Carbon steel	Plate	SA–537	...	K12437	3	100 < *t* ≤ 150	1	3
	22	Carbon steel	Smls. tube	SA–556	C2	K03006	...	...	1	2
	23	Carbon steel	Wld. tube	SA–557	C2	K03505	...	...	1	2
	24	Carbon steel	Cast pipe	SA–660	WCC	J02505	...	...	1	2
(**13**)	25	...	...	...	...	...	...	...	...	...
	26	Carbon steel	Bar	SA–696	C	K03200	...	...	1	2
	27	Carbon steel	Sheet	SA–414	F	K03102	...	...	1	2
	28	Carbon steel	Plate	SA–662	C	K02007	...	...	1	2
	29	Carbon steel	Plate	SA–537	...	K12437	2	100 < *t* ≤ 150	1	3
	30	Carbon steel	Plate	SA–738	C	K02008	...	100 < *t* ≤ 150	1	3
	31	Carbon steel	Plate	SA–537	...	K12437	1	≤64	1	2
	32	Carbon steel	Wld. pipe	SA–671	CD70	K12437	...	≤64	1	2
	33	Carbon steel	Wld. pipe	SA–672	D70	K12437	...	≤64	1	2
	34	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	≤64	1	2
	35	Carbon steel	Plate	SA–841	A	...	1	≤64	1	2
(**13**)	36	Carbon steel	Plate	SA/GB 713	Q345R	...	...	60 < *t* ≤ 100	1	2
(**13**)	37	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	60 < *t* ≤ 100	1	2
(**13**)	38	Carbon steel	Plate	SA/GB 713	Q345R	...	...	36 < *t* ≤ 60	1	2
(**13**)	39	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	485	250	NP	371	538	343	CS-2	G10, T2
2	485	250	NP	371	538	343	CS-2	G10, T2
3	485	250	538	371	NP	NP	CS-2	G1, G10, G17, S1, T2
4	485	250	NP	NP	538	343	CS-2	G10, T2
5	485	260	538	371	538	343	CS-2	G10, S1, T2
6	485	260	454	371	538	343	CS-2	G10, S1, T2
7	485	260	NP	371	NP	NP	CS-2	S5, W10, W12
8	485	260	NP	371	NP	NP	CS-2	S6, W10, W12
9	485	260	NP	371	NP	NP	CS-2	S5, W10, W12
10	485	260	NP	371	NP	NP	CS-2	S6, W10, W12
11	485	260	454	NP	NP	NP	CS-2	G10, S1, T2
12	485	275	538	371	538	343	CS-2	G10, S1, T1
13	485	275	538	NP	NP	NP	CS-2	G10, S1, T1, W13
14	485	275	538	NP	NP	NP	CS-2	G4, G10, S1, T4
15	485	275	538	NP	NP	NP	CS-2	G3, G10, S1, T2
16	485	275	538	NP	538	343	CS-2	G10, S1, T1
17	485	275	538	371	538	343	CS-2	G1, G10, G17, S1, T1
18	485	275	427	371	427	343	CS-2	G10, T1, W14
19	485	275	NP	371	NP	NP	CS-2	G17, T1
20	485	275	NP	371	NP	NP	CS-2	...
21	485	275	NP	NP	371	343	CS-2	G23, W11
22	485	275	NP	NP	427	343	CS-2	G10, T1
23	485	275	NP	NP	538	343	CS-2	G24, T2, W6
24	485	275	538	371	NP	NP	CS-2	G1, G10, G17, S1, T1
25	...	...	...	...	...	...	...	...
26	485	275	NP	371	NP	NP	CS-2	T1
27	485	290	NP	NP	482	343	CS-2	G10, T1
28	485	295	NP	NP	371	343	CS-3	T1
29	485	315	NP	371	371	343	CS-3	G23, T1, W11
30	485	315	NP	343	343	343	CS-3	G23, W11
31	485	345	NP	371	343	343	CS-3	G23, T1
32	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
33	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
34	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
35	485	345	NP	NP	343	NP	CS-3	...
36	490	305	427	NP	427	NP	CS-2	T1
37	490	315	454	NP	538	NP	CS-2	G10, S1, T1
38	490	315	427	NP	427	NP	CS-2	T1
39	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
2	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
3	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
4	138	138	138	138	138	138	136	129	125	122	117	*101*	*83.9*	*67.0*	*51.1*
5	138	138	138	138	138	138	138	136	132	128	123	*101*	*83.8*	*67.1*	*51.0*
6	138	138	138	138	138	138	138	136	132	128	123	*101*	*83.8*	*67.1*	*51.0*
7	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
8	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
9	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
10	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
11	138	138	138	138	138	138	138	136	132	128	123	*101*	*83.8*	*67.1*	*51.0*
12	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	*51.0*
13	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	*51.0*
14	138	138	138	138	138	138	138	138	138	135	123	101	83.7	67.6	45.5
15	117	117	117	117	117	117	117	117	117	115	104	*86.1*	*71.3*	*56.9*	*43.4*
16	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	*51.0*
17	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	*51.0*
18	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	...
19	138	138	138	138	138	138	138	138	138	135	*123*	...	...	...	...
20	138	138	137	133	129	125	123	123	123	123	123	...	...	...	...
21	138	138	138	137	136	135	131	126	123	121	118	...	...	...	...
22	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	...
23	117	117	117	117	117	117	117	117	117	115	104	*86.1*	*71.3*	*56.9*	*43.4*
24	138	138	138	138	138	138	138	138	138	135	*123*	*101*	*83.8*	*67.0*	*51.0*
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	138	138	138	138	138	138	138	138	138	135	*123*	...	...	...	...
27	138	138	138	138	138	138	138	138	138	137	*123*	*101*	*83.8*	*67.1*	*50.8*
28	138	138	138	138	138	138	138	138	138	137	*123*	...	...	...	...
29	138	138	138	137	136	134	134	134	134	133	*125*	...	...	...	...
30	138	138	138	137	136	134	134	134	134	133	...	...	...	...	...
31	138	138	138	137	136	134	134	134	134	133	*125*	...	...	...	...
32	138	138	138	137	136	134	134	134	134	133	*125*	...	...	...	...
33	138	138	138	137	136	134	134	134	134	133	*125*	...	...	...	...
34	138	138	138	137	136	134	134	134	134	133	*125*	...	...	...	...
35	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
36	140	140	140	140	140	140	140	140	140	140	*123*	*101*	*83.8*	*67.1*	...
37	140	140	140	140	140	140	140	140	140	140	*123*	*101*	*83.8*	*67.1*	*51.0*
38	140	140	140	140	140	140	140	140	140	140	*123*	*101*	*83.8*	*67.1*	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	*27.9*	*18.3*	*10.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	*28.6*	*18.1*	*10.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	*28.6*	*18.1*	*10.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	*34.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
37	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(**13**)	1	Carbon steel	Plate	SA/GB 713	Q345R	...	...	16 < *t* ≤ 36	1	2
	2	Carbon steel	Plate	SA–455	...	K03300	...	10 < *t* ≤ 15	1	2
(**13**)	3	Carbon steel	Plate	SA/GB 713	Q345R	...	...	3 ≤ *t* ≤ 16	1	2
(**13**)	4	...	...	...	...	...	...	...	...	...
(**13**)	5	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	≤60	1	2
	6	Carbon steel	Forgings	SA–266	3	K05001	...	...	1	2
	7	Carbon steel	Plate	SA–455	...	K03300	...	≤10	1	2
	8	Carbon steel	Plate	SA–299	A	K02803	...	>25	1	2
	9	Carbon steel	Wld. pipe	SA–671	CK75	K02803	...	>25	1	2
	10	Carbon steel	Wld. pipe	SA–672	N75	K02803	...	>25	1	2
	11	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	>25	1	2
	12	Carbon steel	Plate	SA–299	A	K02803	...	≤25	1	2
	13	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	≤25	1	2
	14	Carbon steel	Forgings	SA–372	B	K04001	...	...	1	2
	15	Carbon steel	Sheet	SA–414	G	K03103	...	...	1	2
	16	Carbon steel	Plate	SA–738	A	K12447	...	...	1	2
	17	Carbon steel	Plate	SA–537	...	K12437	3	64 < *t* ≤ 100	1	3
	18	Carbon steel	Plate	SA–537	...	K12437	2	64 < *t* ≤ 100	1	3
	19	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	64 < *t* ≤ 100	1	3
	20	Carbon steel	Plate	SA–738	C	K02008	...	64 < *t* ≤ 100	1	3
	21	Carbon steel	Plate	SA–299	B	K02803	...	>25	1	3
	22	Carbon steel	Plate	SA–299	B	K02803	...	≤25	1	3
	23	Carbon steel	Forgings	SA–765	IV	K02009	...	...	1	3
	24	Carbon steel	Plate	SA–537	...	K12437	3	≤64	1	3
	25	Carbon steel	Plate	SA–537	...	K12437	2	≤64	1	3
	26	Carbon steel	Wld. pipe	SA–671	CD80	K12437	...	≤64	1	3
	27	Carbon steel	Wld. pipe	SA–672	D80	K12437	...	≤64	1	3
	28	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	≤64	1	3
	29	Carbon steel	Plate	SA–738	C	K02008	...	≤64	1	3
	30	Carbon steel	Plate	SA–841	B	...	2	≤64	1	3
	31	Carbon steel	Plate	SA–612	...	K02900	...	13 < *t* ≤ 25	10C	1
	32	Carbon steel	Plate	SA–612	...	K02900	...	≤13	10C	1
	33	Carbon steel	Plate	SA–738	B	K12007	...	...	1	3
	34	Carbon steel	Forgings	SA–372	C	K04801	...	...	...	...
	35	Carbon steel	Plate	SA–724	A	K11831	...	...	1	4
	36	Carbon steel	Plate	SA–724	C	K12037	...	...	1	4
	37	Carbon steel	Plate	SA–724	B	K12031	...	...	1	4
	38	C–Mn–Si–Cb	Plate	SA–737	B	K12001	...	...	1	2
	39	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490N	...	Normalized	≤150	1	2
	40	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490NR	...	Norm. rld.	≤150	1	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	500	325	427	NP	427	NP	CS–2	T1
2	505	255	NP	204 (Cl. 3 only)	343	343	CS–2	...
3	510	345	427	NP	427	NP	CS–2	T1
4	...	...	...	...	...	...	...	...
5	510	...	454	NP	538	NP	CS–2	G10, G18, S1, T1
6	515	260	538	371	538	NP	CS–2	G10, S1, T2, W8, W11
7	515	260	NP	204 (Cl. 3 only)	343	343	CS–2	...
8	515	275	538	371	538	343	CS–2	G10, S1, T2
9	515	275	NP	371	NP	NP	CS–2	S6, W10, W12
10	515	275	NP	371	NP	NP	CS–2	S6, W10, W12
11	515	275	NP	371	NP	NP	CS–2	S6, W10, W12
12	515	290	538	371	538	343	CS–2	G10, S1, T1
13	515	290	NP	371	NP	NP	CS–2	T1, W10, W12
14	515	310	NP	NP	343	343	CS–3	W11
15	515	310	NP	NP	482	343	CS–3	G10, T1
16	515	310	NP	NP	371	343	CS–2	T1
17	515	345	NP	NP	371	343	CS–5	G23, T1, W11
18	515	380	NP	371	343	343	CS–5	G23, T1, W11
19	515	380	NP	371	NP	NP	CS–5	G26, T1, W10, W12
20	515	380	NP	343	343	343	CS–5	G23, W11
21	550	310	427	NP	538	343	CS–3	G10, S1, T1
22	550	325	427	NP	538	343	CS–3	G10, S1, T1
23	550	345	NP	NP	371	NP	CS–3	...
24	550	380	NP	NP	371	343	CS–5	G23, T1, W11
25	550	415	NP	371	343	343	CS–5	G23, S6, T1, W10, W11, W12
26	550	415	NP	371	NP	NP	CS–5	S6, T1, W10, W12
27	550	415	NP	371	NP	NP	CS–5	S6, T1, W10, W12
28	550	415	NP	371	NP	NP	CS–5	S6, T1, W10, W12
29	550	415	NP	343	343	343	CS–5	G23, W11
30	550	415	NP	NP	343	NP	CS–3	...
31	560	345	NP	371	343	343	CS–3	T1
32	570	345	NP	343	343	343	CS–3	...
33	585	415	NP	343	343	343	CS–5	...
34	620	380	NP	NP	343	343	CS–3	W11
35	620	485	NP	NP	371	343	CS–5	...
36	620	485	NP	NP	371	343	CS–5	...
37	655	515	NP	NP	371	343	CS–5	...
38	485	345	NP	371	371	343	CS–3	T1
39	490	...	538	NP	538	NP	CS–2	G10, G18, S1, T1
40	490	...	538	NP	538	NP	CS–2	G10, G18, S1, T1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	143	143	143	143	143	143	143	143	143	143	*123*	*101*	*83.8*	*67.1*	...
2	144	144	144	144	144	144	140	133	129	125	...	...	...	...	...
3	146	146	146	146	146	146	146	146	146	146	*123*	*101*	*83.8*	*67.1*	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	146	146	146	146	146	146	146	146	146	146	*123*	*101*	*83.8*	*67.1*	*51.0*
6	148	148	148	148	148	148	142	135	131	127	122	*107*	*88.3*	*67.5*	*50.9*
7	148	148	148	148	148	148	143	136	132	129	...	...	...	...	...
8	148	148	148	148	148	148	148	143	139	135	130	*107*	*88.1*	*67.5*	*50.8*
9	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...
10	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...
11	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...
12	148	148	148	148	148	148	148	148	147	141	*133*	*107*	*88.1*	*67.6*	*50.8*
13	148	148	148	148	148	148	148	148	147	141	*133*	...	...	...	...
14	148	148	148	148	148	148	148	148	148	148	...	...	...	...	...
15	148	148	148	148	148	148	148	148	148	146	*132*	*107*	*88.2*	*67.6*	*50.6*
16	148	148	148	148	148	148	148	148	148	146	*132*	...	...	...	...
17	148	148	147	147	145	144	144	144	144	142	*123*	...	...	...	...
18	148	148	147	147	145	144	144	144	144	143	*134*	...	...	...	...
19	148	148	147	147	145	144	144	144	144	143	*134*	...	...	...	...
20	148	148	147	147	145	144	144	144	144	143	...	...	...	...	...
21	158	158	158	158	158	158	158	158	157	152	*133*	*107*	*88.1*	*67.6*	*50.8*
22	158	158	158	158	158	158	158	158	158	158	*133*	*107*	*88.1*	*67.6*	*50.8*
23	158	158	158	158	158	156	156	156	156	155	153	...	...	...	...
24	158	158	158	157	156	154	154	154	154	151	*132*	...	...	...	...
25	158	158	158	157	156	154	154	154	154	151	*132*	...	...	...	...
26	158	158	158	157	156	154	154	154	154	151	*132*	...	...	...	...
27	158	158	158	157	156	154	154	154	154	151	*132*	...	...	...	...
28	158	158	158	157	156	154	154	154	154	151	*132*	...	...	...	...
29	158	158	158	157	156	154	154	154	154	151	...	...	...	...	...
30	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
31	159	159	159	158	157	156	156	155	155	149	*133*	...	...	...	...
32	163	163	163	162	161	160	160	157	154	151	...	...	...	...	...
33	168	168	168	168	168	168	168	167	165	163	...	...	...	...	...
34	177	177	177	177	177	177	177	177	175	166	...	...	...	...	...
35	177	177	177	176	175	173	173	173	173	165	148	...	...	...	...
36	177	177	177	176	175	173	173	173	173	165	148	...	...	...	...
37	187	187	187	186	185	183	183	183	179	165	158	...	...	...	...
38	138	138	138	138	138	138	138	138	138	138	*135*	...	...	...	...
39	140	140	140	140	140	140	140	140	140	139	*123*	*101*	*83.8*	*67.0*	*51.0*
40	140	140	140	140	140	140	140	140	140	139	*123*	*101*	*83.8*	*67.0*	*51.0*

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
5	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
6	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	*34.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	*33.6*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(**13**)	1	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized	36 < *t* ≤ 60	1	2
(**13**)	2	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized	16 < *t* ≤ 36	1	2
(**13**)	3	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized	10 ≤ *t* ≤ 16	1	2
	4	C–Mn–Si–V	Plate	SA–737	C	K12202	...	...	1	3
	5	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤50	1	1
	6	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤50	1	1
	7	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤40	1	2
	8	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤40	1	2
	9	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤25	1	3
	10	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤25	1	3
	11	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤20	1	4
	12	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤20	1	4
	13	C–Mn–Ti	Plate, sheet	SA–562	...	K11224	...	...	1	1
	14	C–Si–Ti	Forgings	SA–836	...	...	1	...	1	1
(**13**)	15	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...	40 < *t* ≤ 60	3	1
(**13**)	16	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...	16 < *t* ≤ 40	3	1
(**13**)	17	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...	*t* ≤ 16	3	1
	18	C–½Mo	Smls. tube	SA–209	T1b	K11422	...	...	3	1
	19	C–½Mo	Wld. tube	SA–250	T1b	K11422	...	...	3	1
	20	C–½Mo	Wld. tube	SA–250	T1b	K11422	...	...	3	1
	21	C–½Mo	Smls. tube	SA–209	T1	K11522	...	...	3	1
	22	C–½Mo	Smls. & wld. fittings	SA–234	WP1	K12821	...	...	3	1
	23	C–½Mo	Wld. tube	SA–250	T1	K11522	...	...	3	1
	24	C–½Mo	Wld. tube	SA–250	T1	K11522	...	...	3	1
	25	C–½Mo	Smls. pipe	SA–335	P1	K11522	...	...	3	1
	26	C–½Mo	Forged pipe	SA–369	FP1	K11522	...	...	3	1
	27	C–½Mo	Smls. tube	SA–209	T1a	K12023	...	...	3	1
	28	C–½Mo	Wld. tube	SA–250	T1a	K12023	...	...	3	1
	29	C–½Mo	Wld. tube	SA–250	T1a	K12023	...	...	3	1
	30	C–½Mo	Castings	SA–217	WC1	J12524	...	...	3	1
	31	C–½Mo	Castings	SA–352	LC1	J12522	...	...	3	1
	32	C–½Mo	Cast pipe	SA–426	CP1	J12521	...	...	3	1
	33	C–½Mo	Plate	SA–204	A	K11820	...	...	3	1
	34	C–½Mo	Wld. pipe	SA–672	L65	K11820	...	...	3	1
	35	C–½Mo	Wld. pipe	SA–691	CM–65	K11820	...	...	3	1
	36	C–½Mo	Wld. pipe	SA–691	CM–65	K11820	...	...	3	1
	37	C–½Mo	Forgings	SA–182	F1	K12822	...	...	3	2
	38	C–½Mo	Plate	SA–204	B	K12020	...	...	3	2
	39	C–½Mo	Forgings	SA–336	F1	K12520	...	...	3	2
	40	C–½Mo	Wld. pipe	SA–672	L70	K12020	...	...	3	2
	41	C–½Mo	Wld. pipe	SA–691	CM–70	K12020	...	...	3	2
	42	C–½Mo	Wld. pipe	SA–691	CM–70	K12020	...	...	3	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	520	340	427	NP	NP	NP	CS–3	T1
2	530	360	427	NP	NP	NP	CS–3	T1
3	530	370	427	NP	NP	NP	CS–3	T1
4	550	415	NP	371	371	343	CS–3	...
5	414	345	NP	NP	NP	343	...	...
6	414	345	NP	NP	NP	343	...	...
7	483	414	NP	NP	NP	343	...	...
8	483	414	NP	NP	NP	343	...	...
9	552	483	NP	NP	NP	343	...	...
10	552	483	NP	NP	NP	343	...	...
11	621	552	NP	NP	NP	343	...	...
12	621	552	NP	NP	NP	343	...	...
13	380	205	NP	NP	343	NP	CS–6	G7
14	380	170	NP	NP	343	343	CS–1	...
15	450	260	538	NP	538	NP	CS–2	G11, S2, T3
16	450	270	538	NP	538	NP	CS–2	G11, S2, T3
17	450	280	538	NP	538	NP	CS–2	G11, S2, T3
18	365	195	538	NP	538	343	CS–1	G11, S3, T5
19	365	195	538	NP	NP	NP	CS–1	G11, S2, T5, W13
20	365	195	538	NP	538	343	CS–1	G3, G11, G24, S2, T5
21	380	205	538	NP	538	343	CS–2	G11, S3, T4
22	380	205	538	371	538	343	CS–2	G11, T4, W14
23	380	205	538	NP	NP	NP	CS–2	G11, S2, T4, W13
24	380	205	538	NP	538	343	CS–2	G3, G11, G24, S2, T4
25	380	205	538	371	538	343	CS–2	G11, S2, T4
26	380	205	538	371	538	343	CS–2	G11, S2, T4
27	415	220	538	NP	538	343	CS–2	G11, S3, T4
28	415	220	538	NP	NP	NP	CS–2	G11, S2, T4, W13
29	415	220	538	NP	538	343	CS–2	G3, G11, G24, S2, T4
30	450	240	538	371	538	343	CS–2	G1, G11, G17, S2, T4
31	450	240	NP	371	343	343	CS–2	G1, G17
32	450	240	NP	371	NP	NP	CS–2	G17
33	450	255	538	371	538	343	CS–2	G11, S2, T4
34	450	255	NP	371	NP	NP	CS–2	G26, W10, W12
35	450	255	NP	371	NP	NP	CS–2	G26, W10, W12
36	450	255	NP	149 (Cl. 3 only)	NP	NP	CS–2	G27, W10, W12
37	485	275	538	371	538	343	CS–2	G11, S2, T4
38	485	275	538	371	538	343	CS–2	G11, S2, T4
39	485	275	538	371	538	343	CS–2	G11, S2, T4
40	485	275	NP	371	NP	NP	CS–2	G26, W10, W12
41	485	275	NP	371	NP	NP	CS–2	G26, W10, W12
42	485	275	NP	149 (Cl. 3 only)	NP	NP	CS–2	G27, W10, W12

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	149	149	149	149	149	149	149	149	149	149	*133*	*107*	*88.1*	*67.6*	...
2	151	151	151	151	151	151	151	151	151	151	*133*	*107*	*88.1*	*67.6*	...
3	151	151	151	151	151	151	151	151	151	151	*133*	*107*	*88.1*	*67.6*	...
4	158	158	158	158	158	158	158	158	158	155	135	...	...	...	...
5	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
6	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
7	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
8	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
9	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
10	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
11	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
12	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
13	88.9	84.0	78.3	75.1	73.0	71.7	71.7	71.7	71.7	71.7	...	...	...	...	...
14	108	103	97.6	94.1	91.6	89.7	89.6	89.4	88.5	87.2	...	...	...	...	...
15	129	129	129	129	129	129	129	129	129	129	129	129	129	126	*105*
16	129	129	129	129	129	129	129	129	129	129	129	129	129	126	*105*
17	129	129	129	129	129	129	129	129	129	129	129	129	129	126	*105*
18	104	104	104	104	104	104	104	104	104	103	101	98.5	96.7	93.6	90.7
19	104	104	104	104	104	104	104	104	104	103	101	98.5	96.7	93.6	90.7
20	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.6	87.2	85.9	84.0	82.2	79.7	77.4
21	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
22	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
23	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
24	92.4	92.4	92.4	92.4	92.4	92.4	92.4	92.4	92.4	92.4	92.2	90.2	87.7	85.4	81.4
25	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
26	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
27	118	118	118	118	118	118	118	118	118	118	115	113	110	107	100
28	118	118	118	118	118	118	118	118	118	118	115	113	110	107	100
29	101	101	101	101	101	101	101	101	101	100	98.2	95.8	93.9	90.9	84.9
30	128	128	128	128	128	128	128	128	128	128	126	123	120	117	103
31	128	128	128	128	128	128	128	128	128	128	126	...	...	...	...
32	128	128	128	128	128	128	128	128	128	128	126	...	...	...	...
33	128	128	128	128	128	128	128	128	128	128	128	128	127	124	105
34	128	128	128	128	128	128	128	128	128	128	128	...	...	...	...
35	128	128	128	128	128	128	128	128	128	128	128	...	...	...	...
36	128	128	128	128	128	...	...	...	...	...	...	...	...	...	...
37	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
38	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
39	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
40	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
41	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
42	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	*68.9*	*42.8*	*23.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
16	*68.9*	*42.8*	*23.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
17	*68.9*	*42.8*	*23.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
18	70.4	*42.2*	*23.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	70.4	*42.2*	*23.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	60.2	*36.0*	*20.0*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	*72.1*	*41.7*	*23.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	*72.1*	*41.7*	*23.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	*72.1*	*41.7*	*23.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	*61.3*	*35.7*	*20.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	*72.1*	*41.7*	*23.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	*72.1*	*41.7*	*23.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	*70.4*	*42.3*	*23.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	*70.4*	*42.3*	*23.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	*59.9*	*36.2*	*19.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	*69.5*	*42.6*	*23.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	*68.9*	*42.8*	*23.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	*68.1*	*43.1*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	*68.1*	*43.1*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	*68.1*	*43.1*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	C–½Mo	Plate	SA–204	C	K12320	...	...	3	2
2	C–½Mo	Wld. pipe	SA–672	L75	K12320	...	...	3	2
3	C–½Mo	Wld. pipe	SA–691	CM–75	K12320	...	...	3	2
4	C–½Mo	Wld. pipe	SA–691	CM–75	K12320	...	...	3	2
5	½Cr–⅕Mo	Forgings	SA–372	G	K13049	70	...	...	...
6	½Cr–⅕Mo	Forgings	SA–372	H	K13547	70	...	...	...
7	½Cr–⅕Mo–V	Plate	SA–517	B	K11630	...	≤32	11B	4
8	½Cr–¼Mo–Si	Plate	SA–517	A	K11856	...	≤32	11B	1
9	½Cr–¼Mo–Si	Forgings	SA–592	A	K11856	...	≤64	11B	1
10	½Cr–½Mo	Smls. pipe	SA–335	P2	K11547	...	...	3	1
11	½Cr–½Mo	Forged pipe	SA–369	FP2	K11547	...	...	3	1
12	½Cr–½Mo	Plate	SA–387	2	K12143	1	...	3	1
13	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	3	1
14	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	3	1
15	½Cr–½Mo	Smls. tube	SA–213	T2	K11547	...	...	3	1
16	½Cr–½Mo	Wld. tube	SA–250	T2	K11547	...	...	3	1
17	½Cr–½Mo	Wld. tube	SA–250	T2S1	K11547	...	...	3	1
18	½Cr–½Mo	Cast pipe	SA–426	CP2	J11547	...	...	3	1
19	½Cr–½Mo	Forgings	SA–182	F2	K12122	...	...	3	2
20	½Cr–½Mo	Plate	SA–387	2	K12143	2	...	3	2
21	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	3	2
22	½Cr–1¼Mn–Si	Plate	SA–202	A	K11742	...	...	4	1
23	½Cr–1¼Mn–Si	Plate	SA–202	B	K12542	...	...	4	1
24	¾Cr–½Ni–Cu	Smls. & wld. tube	SA–423	1	K11535	...	...	4	2
25	¾Cr–½Ni–Cu	Wld. tube	SA–423	1	K11535	...	...	4	2
26	¾Cr–¾Ni–Cu–Al	Pipe	SA–333	4	K11267	...	...	4	2
27	1Cr–⅕Mo	Forgings	SA–372	E	K13047	65	...	...	...
28	1Cr–⅕Mo	Forgings	SA–372	J	K13548	65	...	...	...
29	1Cr–⅕Mo	Forgings	SA–372	E	K13047	70	...	...	...
30	1Cr–⅕Mo	Forgings	SA–372	F	G41350	70	...	...	...
31	1Cr–⅕Mo	Forgings	SA–372	J	K13548	70	...	...	...
32	1Cr–⅕Mo	Forgings	SA–372	J	G41370	110	...	...	...
33	1Cr–½Mo	Plate	SA–387	12	K11757	1	...	4	1
34	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...	...	4	1
35	1Cr–½Mo	Cast pipe	SA–426	CP12	J11562	...	...	4	1
36	1Cr–½Mo	Forgings	SA–182	F12	K11562	1	...	4	1
37	1Cr–½Mo	Smls. tube	SA–213	T12	K11562	...	...	4	1
38	1Cr–½Mo	Smls. & wld. fittings	SA–234	WP12	K12062	1	...	4	1
39	1Cr–½Mo	Wld. tube	SA–250	T12	K11562	...	...	4	1
40	1Cr–½Mo	Wld. tube	SA–250	T12S1	K11562	...	...	4	1
41	1Cr–½Mo	Smls. pipe	SA–335	P12	K11562	...	...	4	1
42	1Cr–½Mo	Forged pipe	SA–369	FP12	K11562	...	...	4	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	295	538	371	538	343	CS–2	G11, S2, T4, W12
2	515	295	NP	371	NP	NP	CS–2	G26, W10, W12
3	515	295	NP	371	NP	NP	CS–2	G26, W10, W12
4	515	295	NP	149 (Cl. 3 only)	NP	NP	CS–2	G27, W10, W12
5	825	485	NP	NP	93	93	CS–3	W11
6	825	485	NP	NP	93	93	CS–3	W11
7	795	690	NP	343 (SPT)	343	343	HT–1	...
8	795	690	NP	343 (SPT)	343	343	HT–1	...
9	795	690	NP	343 (SPT)	343	343	HT–1	...
10	380	205	538	371	538	343	CS–2	T5
11	380	205	538	371	538	343	CS–2	T5
12	380	230	538	371	538	343	CS–2	T5
13	380	230	NP	371	NP	NP	CS–2	G26, W10, W12
14	380	230	NP	149 (Cl. 3 only)	NP	NP	CS–2	G27, W10, W12
15	415	205	538	371	538	343	CS–2	T5
16	415	205	538	NP	NP	NP	CS–2	G3, T5
17	415	205	538	NP	NP	NP	CS–2	T5, W13
18	415	205	NP	371	NP	NP	CS–2	G17
19	485	275	538	NP	538	343	CS–2	T5
20	485	310	NP	371	538	343	CS–3	T5
21	485	310	NP	371	NP	NP	CS–3	G26, W10, W12
22	515	310	538	NP	538	NP	CS–3	S1, T2
23	585	325	538	NP	538	NP	CS–3	S1, T2
24	415	255	371	NP	343	NP	CS–2	W13, W14
25	415	255	371	NP	343	NP	CS–2	G3, G24
26	415	240	NP	371	343	NP	CS–2	...
27	725	450	NP	NP	343	343	CS–2	W11
28	725	450	NP	NP	343	343	CS–2	W11
29	825	485	NP	NP	343	343	CS–5	W11
30	825	485	NP	NP	343	343	CS–5	W11
31	825	485	NP	NP	343	343	CS–5	W11
32	930	760	NP	NP	343	343	HT–1	W11
33	380	230	649	371	649	NP	CS–2	S4, T5
34	380	230	NP	371	NP	NP	CS–2	G26, W10, W12
35	415	205	NP	371	NP	NP	CS–2	G17
36	415	220	649	NP	649	NP	CS–2	T5
37	415	220	649	371	649	NP	CS–2	S4, T5
38	415	220	649	371	649	NP	CS–2	S4, T5, W14
39	415	220	649	NP	NP	NP	CS–2	G3, S4, T5
40	415	220	649	NP	NP	NP	CS–2	S4, T5, W13
41	415	220	649	371	649	NP	CS–2	S4, T5
42	415	220	649	371	649	NP	CS–2	S4, T5

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	148	148	148	148	148	148	148	148	148	148	148	148	148	144	109
2	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
3	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
4	148	148	148	148	148	...	...	...	...	...	...	...	...	...	...
5	236	236	236	...	...	...	...	...	...	...	...	...	...	...	...
6	236	236	236	...	...	...	...	...	...	...	...	...	...	...	...
7	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
8	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
9	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
10	108	108	108	108	108	108	108	108	108	108	108	106	103	100	97.1
11	108	108	108	108	108	108	108	108	108	108	108	106	103	100	97.1
12	108	108	108	108	108	108	108	108	108	108	108	108	108	106	103
13	108	108	108	108	108	108	108	108	108	108	108	...	...	...	...
14	108	108	108	108	108	...	...	...	...	...	...	...	...	...	...
15	118	118	118	118	118	118	117	114	112	110	108	106	103	100	97.1
16	100	100	100	100	100	100	99.6	96.7	95.5	93.8	91.5	90.2	87.7	85.3	82.4
17	118	118	118	118	118	118	117	114	112	110	108	106	103	100	97.1
18	118	118	118	118	118	118	117	114	112	110	108	...	...	...	...
19	138	138	138	138	138	138	138	138	138	138	138	138	137	134	130
20	138	138	138	138	138	138	138	138	138	138	138	138	138	135	130
21	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
22	148	148	148	148	148	148	148	148	148	147	136	*107*	*84.3*	*58.1*	*38.6*
23	168	168	168	168	168	168	168	165	160	153	143	*121*	*85.0*	*57.6*	*38.9*
24	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
25	101	101	101	101	101	101	101	101	101	101	101	...	...	...	...
26	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
27	207	207	207	207	207	207	207	207	207	205	...	...	...	...	...
28	207	207	207	207	207	207	207	207	207	205	...	...	...	...	...
29	236	236	236	236	236	236	236	236	236	235	...	...	...	...	...
30	236	233	229	227	225	223	222	220	217	209	...	...	...	...	...
31	236	236	236	236	236	236	236	236	236	235	...	...	...	...	...
32	265	260	254	254	253	252	249	248	245	234	...	...	...	...	...
33	108	107	106	105	104	104	104	104	104	104	104	104	104	104	102
34	108	107	106	105	104	104	104	104	104	104	104	...	...	...	...
35	118	117	116	115	114	112	109	106	104	103	102	...	...	...	...
36	118	118	115	114	114	114	114	113	112	110	109	107	106	103	101
37	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
38	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
39	100	100	98.2	97.0	96.5	96.5	96.5	95.8	94.7	93.4	92.2	91.0	89.7	87.9	85.7
40	118	118	115	114	114	114	114	113	112	110	109	107	106	103	101
41	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
42	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	*67.2*	*43.3*	*23.0*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	77.0	*49.5*	*31.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	77.0	*49.5*	*31.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	76.7	*49.6*	*31.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	77.0	*49.5*	*31.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	65.3	*42.0*	*26.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	77.0	*49.5*	*31.3*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	89.1	*46.0*	*32.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	88.9	*46.0*	*32.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	*25.2*	*14.9*	*5.87*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	*25.1*	*14.9*	*5.86*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	88.8	*61.7*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
37	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
38	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
39	72.9	*53.2*	*33.7*	*22.5*	*14.8*	*9.71*	*6.34*	...	...	...	...	...	...	...	...	...	...
40	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
41	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...
42	88.3	*61.9*	*40.3*	*26.4*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(**13**)	1	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	150 < *t* ≤ 250	4	1
(**13**)	2	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	100 < *t* ≤ 150	4	1
(**13**)	3	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	...	100 < *t* ≤ 150	4	1
(**13**)	4	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	60 < *t* ≤ 100	4	1
(**13**)	5	1Cr–½Mo	Smls. tube	SA/EN 10216–2	13CrMo4–5	...	...	40 < *t* ≤ 60	4	1
(**13**)	6	1Cr–½Mo	Smls. tube	SA/EN 10216–2	13CrMo4–5	...	...	*t* ≤ 40	4	1
	7	1Cr–½Mo	Plate	SA–387	12	K11757	2	...	4	1
	8	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...	...	4	1
(**13**)	9	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	...	60 < *t* ≤ 100	4	1
(**13**)	10	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	16 < *t* ≤ 60	4	1
(**13**)	11	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	...	6 ≤ *t* ≤ 60	4	1
(**13**)	12	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	*t* ≤ 16	4	1
	13	1Cr–½Mo	Forgings	SA–182	F12	K11564	2	...	4	1
	14	1Cr–½Mo	Forgings	SA–336	F12	K11564	...	...	4	1
	15	1Cr–V	Smls. tube	SA–213	T17	K12047	...	...	10B	1
	16	1¼Cr–½Mo	Castings	SA–217	WC6	J12072	...	...	4	1
	17	1¼Cr–½Mo	Cast pipe	SA–426	CP11	J12072	...	...	4	1
	18	1¼Cr–½Mo	Bar	SA–739	B11	K11797	...	...	4	1
	19	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11597	1	...	4	1
	20	1¼Cr–½Mo–Si	Smls. tube	SA–213	T11	K11597	...	...	4	1
	21	1¼Cr–½Mo–Si	Smls. & wld. fittings	SA–234	WP11	...	1	...	4	1
	22	1¼Cr–½Mo–Si	Wld. tube	SA–250	T11	K11597	...	...	4	1
	23	1¼Cr–½Mo–Si	Wld. tube	SA–250	T11S1	K11597	...	...	4	1
	24	1¼Cr–½Mo–Si	Smls. pipe	SA–335	P11	K11597	...	...	4	1
	25	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11597	1	...	4	1
	26	1¼Cr–½Mo–Si	Forged pipe	SA–369	FP11	K11597	...	...	4	1
	27	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	1	...	4	1
	28	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	4	1
	29	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	4	1
	30	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11572	2	...	4	1
	31	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	2	...	4	1
	32	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	3	...	4	1
	33	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	2	...	4	1
	34	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	4	1
	35	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	64 < *t* ≤ 100	11B	2
	36	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	≤64	11B	2
(**13**)	37	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	64 < *t* ≤ 150	11B	2
(**13**)	38	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	≤64	11B	2
	39	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	1	...	5A	1
	40	2¼Cr–1Mo	Smls. tube	SA–213	T22	K21590	...	...	5A	1
	41	2¼Cr–1Mo	Smls. & wld. fittings	SA–234	WP22	K21590	1	...	5A	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	420	245	649	NP	649	NP	CS–2	S4, T4
2	430	255	649	NP	649	NP	CS–2	S4, T4
3	440	225	649	NP	NP	NP	CS–2	H3, S4, T4
4	440	270	649	NP	649	NP	CS–2	S4, T4
5	440	280	649	NP	649	NP	CS–2	T4
6	440	290	649	NP	649	NP	CS–2	T4
7	450	275	649	371	649	NP	CS–2	S4, T5
8	450	275	NP	371	NP	NP	CS–2	G26, W10, W12
9	450	275	649	NP	NP	NP	CS–2	H3, S4, T4
10	450	290	649	NP	649	NP	CS–2	S4, T4
11	450	295	649	NP	NP	NP	CS–2	H3, S4, T4
12	450	300	649	NP	649	NP	CS–2	S4, T4
13	485	275	649	371	649	NP	CS–2	S4, T4
14	485	275	649	371	649	NP	CS–2	S4, T4
15	415	205	NP	NP	343	343	CS–2	...
16	485	275	593	371	593	NP	CS–2	G1, G17, T4
17	485	275	NP	371	NP	NP	CS–2	G17
18	485	310	NP	371	649	NP	CS–3	T4
19	415	205	649	NP	649	NP	CS–2	S4, T5
20	415	205	649	371	649	NP	CS–2	S4, T5
21	415	205	649	371	649	NP	CS–2	S4, T5, W14
22	415	205	649	NP	NP	NP	CS–2	G3, S4, T5
23	415	205	649	NP	NP	NP	CS–2	S4, T5, W13
24	415	205	649	371	649	NP	CS–2	S4, T5
25	415	205	649	NP	NP	NP	CS–2	S4, T5
26	415	205	649	371	649	NP	CS–2	S4, T5
27	415	240	649	371	649	NP	CS–2	S4, T4
28	415	240	NP	149 (Cl. 3 only)	NP	NP	CS–2	G27, W10, W12
29	415	240	NP	371	NP	NP	CS–2	G26, W10, W12
30	485	275	649	371	649	NP	CS–2	S4, T4
31	485	275	649	NP	649	NP	CS–2	S4, T4
32	515	310	NP	NP	649	NP	CS–3	T3
33	515	310	649	371	649	NP	CS–3	S4, T3
34	515	310	NP	371	NP	NP	CS–3	G26, W10, W12
35	725	620	NP	343 (SPT)	343	343	CS–5	S7
36	795	690	NP	NP	343	343	HT–1	...
37	725	620	NP	371 (Cl. MC & SPT)	343	343	CS–5	...
38	795	690	NP	371 (Cl. MC & SPT)	343	343	HT–1	...
39	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
40	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
41	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9, W14

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	120	120	117	116	116	116	115	115	115	115	115	115	115	115	112
2	123	123	120	119	118	118	118	118	118	118	118	118	118	118	116
3	126	126	123	122	121	121	118	115	114	112	111	109	107	105	103
4	126	126	123	122	121	121	121	121	121	121	121	121	121	120	119
5	126	126	126	126	126	126	126	126	126	126	126	126	126	123	118
6	126	126	126	126	126	126	126	126	126	126	126	126	126	123	118
7	128	128	125	124	123	123	123	123	123	123	123	123	123	123	123
8	128	127	125	124	123	123	123	123	123	123	123	...	...	...	...
9	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
10	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
11	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
12	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
13	138	137	135	133	132	132	132	132	132	132	132	132	132	129	125
14	138	138	134	133	132	132	132	132	132	132	132	132	132	129	125
15	118	118	118	118	118	116	112	109	108	106	...	...	...	...	...
16	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
17	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
18	138	138	138	138	138	138	138	138	138	138	138	138	138	135	107
19	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
20	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
21	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
22	100	100	100	100	100	98.8	95.8	92.5	91.3	89.8	88.0	86.8	84.3	82.3	80.7
23	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
24	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
25	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
26	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
27	118	118	118	118	118	118	118	118	118	118	118	118	116	114	101
28	118	118	118	118	118	...	...	...	...	...	...	...	...	...	...
29	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
30	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
31	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
32	148	148	148	148	148	148	148	148	148	148	148	148	148	143	*107*
33	148	148	148	148	148	148	148	148	148	148	148	148	148	143	*107*
34	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
35	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
36	227	227	227	227	227	227	227	227	227	227	...	...	...	...	...
37	207	207	207	207	207	207	207	207	207	207	206	...	...	...	...
38	227	227	227	227	227	227	227	227	227	227	221	...	...	...	...
39	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
40	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
41	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
2	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
3	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
4	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
5	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
6	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
7	94.4	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
10	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
11	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
12	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	(**13**)
13	*97.2*	*59.3*	*41.0*	*26.2*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	
14	*97.2*	*59.3*	*41.0*	*26.2*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	*73.3*	*52.1*	*36.4*	*25.2*	*17.6*	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	*72.9*	*52.3*	*36.3*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
19	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
20	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
21	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
22	65.3	*43.5*	*31.5*	*21.5*	*15.0*	*10.4*	*6.73*	...	...	...	...	...	...	...	...	...	...	
23	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
24	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
25	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
26	76.7	*51.0*	*36.7*	*25.1*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
27	*74.7*	*51.7*	*36.5*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	*73.3*	*52.1*	*36.4*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
31	*73.3*	*52.1*	*36.4*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
32	*72.9*	*52.3*	*36.3*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
33	*72.9*	*52.3*	*36.3*	*25.2*	*17.6*	*12.4*	*8.08*	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
39	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
40	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
41	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	2¼Cr–1Mo	Wld. tube	SA–250	T22	K21590	...	...	5A	1
	2	2¼Cr–1Mo	Wld. tube	SA–250	T22S1	K21590	...	...	5A	1
	3	2¼Cr–1Mo	Smls. pipe	SA–335	P22	K21590	...	...	5A	1
	4	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	1	...	5A	1
	5	2¼Cr–1Mo	Forged pipe	SA–369	FP22	K21590	...	...	5A	1
	6	2¼Cr–1Mo	Plate	SA–387	22	K21590	1	...	5A	1
	7	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	5A	1
(**13**)	8	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	150 < t ≤ 250	5A	1
(**13**)	9	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	100 < t ≤ 150	5A	1
(**13**)	10	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	60 < t ≤ 100	5A	1
(**13**)	11	2¼Cr–1Mo	Smls. tube	SA/EN 10216–2	10CrMo9–10	...	...	40 < t ≤ 60	5A	1
(**13**)	12	2¼Cr–1Mo	Smls. tube	SA/EN 10216–2	10CrMo9–10	...	...	t ≤ 40	5A	1
(**13**)	13	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	t ≤ 60	5A	1
	14	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...	...	5A	1
	15	2¼Cr–1Mo	Cast pipe	SA–426	CP22	J21890	...	...	5A	1
	16	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	3	...	5A	1
	17	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	3	...	5A	1
	18	2¼Cr–1Mo	Plate	SA–387	22	K21590	2	...	5A	1
	19	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	5A	1
	20	2¼Cr–1Mo	Bar	SA–739	B22	K21390	...	...	5A	1
	21	2¼Cr–1Mo	Castings	SA–487	8	J22091	A	...	5C	1
	22	2¼Cr–1Mo	Forgings	SA–508	22	K21590	3	...	5C	1
	23	2¼Cr–1Mo	Forgings	SA–541	22	K21390	3	...	5C	1
	24	2¼Cr–1Mo	Plate	SA–542	B	K21590	4	...	5C	1
	25	2¼Cr–1Mo–V	Forgings	SA–182	F22V	K31835	...	...	5C	1
	26	2¼Cr–1Mo–V	Forgings	SA–336	F22V	K31835	...	...	5C	1
	27	2¼Cr–1Mo–V	Forgings	SA–541	22V	K31835	...	...	5C	1
	28	2¼Cr–1Mo–V	Plate	SA–542	D	K31835	4a	...	5C	1
	29	2¼Cr–1Mo–V	Plate	SA–832	22V	K31835	...	...	5C	1
	30	3Cr–1Mo	Smls. tube	SA–213	T21	K31545	...	...	5A	1
	31	3Cr–1Mo	Smls. pipe	SA–335	P21	K31545	...	...	5A	1
	32	3Cr–1Mo	Forgings	SA–336	F21	K31545	1	...	5A	1
	33	3Cr–1Mo	Forged pipe	SA–369	FP21	K31545	...	...	5A	1
	34	3Cr–1Mo	Plate	SA–387	21	K31545	1	...	5A	1
	35	3Cr–1Mo	Cast pipe	SA–426	CP21	J31545	...	...	5A	1
	36	3Cr–1Mo	Forgings	SA–182	F21	K31545	...	...	5A	1
	37	3Cr–1Mo	Forgings	SA–336	F21	K31545	3	...	5A	1
	38	3Cr–1Mo	Plate	SA–387	21	K31545	2	...	5A	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	415	205	649	NP	NP	NP	CS–2	G3, S4, T4, W9
2	415	205	649	NP	NP	NP	CS–2	S4, T4, W9, W13
3	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
4	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
5	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
6	415	205	649	371	649	NP	CS–2	S4, T4, W7, W9
7	415	205	NP	371	NP	NP	CS–2	G26, W10, W12
8	450	250	593	NP	593	NP	CS–3	S4, T4, W7, W9
9	460	260	593	NP	593	NP	CS–3	S4, T4, W7, W9
10	470	280	593	NP	593	NP	CS–3	S4, T4, W7, W9
11	480	270	649	NP	649	NP	CS–2	T4, W7, W9
12	480	280	649	NP	649	NP	CS–2	T4, W7, W9
13	480	...	593	NP	593	NP	CS–3	G18, S4, T4, W7, W9
14	485	275	649	371	649	NP	CS–2	G1, G17, S4, T4, W7, W9
15	485	275	NP	371	NP	NP	CS–2	G17
16	515	310	649	371	649	NP	CS–3	S4, T4, W7, W9
17	515	310	649	371	649	NP	CS–3	S4, T4, W7, W9
18	515	310	649	371	649	NP	CS–3	S4, T4, W7, W9
19	515	310	NP	371	NP	NP	CS–3	G26, W10, W12
20	515	310	NP	371	649	NP	CS–3	T4, W7
21	585	380	NP	NP	538	NP	CS–3	G1, T4, W7
22	585	380	NP	NP	454	NP	CS–2	...
23	585	380	NP	NP	454	NP	CS–2	...
24	585	380	NP	NP	454	NP	CS–2	...
25	585	415	NP	NP	482	NP	CS–2	...
26	585	415	NP	NP	482	NP	CS–2	...
27	585	415	NP	NP	482	NP	CS–2	...
28	585	415	NP	NP	482	NP	CS–2	...
29	585	415	NP	NP	482	NP	CS–2	...
30	415	205	649	371	649	NP	CS–2	S4, T3
31	415	205	649	371	649	NP	CS–2	S4, T3
32	415	205	649	371	649	NP	CS–2	S4, T3
33	415	205	649	371	649	NP	CS–2	S4, T3
34	415	205	649	371	649	NP	CS–2	S4, T3
35	415	205	NP	371	NP	NP	CS–2	G17
36	515	310	649	371	649	NP	CS–3	S4, T3
37	515	310	649	371	649	NP	CS–3	S4, T3
38	515	310	649	371	649	NP	CS–3	S4, T3

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	100	100	99.8	98.3	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	85.5
2	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
3	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
4	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
5	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
6	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
7	118	118	118	116	114	114	114	114	114	114	114	...	...	...	...
8	129	129	128	126	125	124	123	123	122	121	120	118	116	113	109
9	131	131	131	129	128	127	126	125	125	124	123	121	119	116	112
10	134	134	134	132	131	129	129	128	127	127	125	123	121	118	114
11	137	137	137	137	135	133	132	132	132	131	129	126	123	119	113
12	137	137	137	137	135	133	132	132	132	131	129	126	123	119	113
13	137	137	137	135	133	132	132	131	130	129	128	126	124	121	117
14	138	138	138	137	136	134	133	133	132	131	129	127	124	119	113
15	138	138	138	137	136	134	133	133	132	131	129	...	...	...	...
16	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
17	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
18	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
19	148	148	147	146	144	142	141	141	140	139	138	...	...	...	...
20	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
21	168	168	167	165	163	162	162	161	160	160	157	154	150	145	120
22	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
23	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
24	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
25	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
26	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
27	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
28	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
29	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
30	118	118	118	116	114	114	114	114	114	114	114	114	114	113	*90.5*
31	118	118	118	116	114	114	114	114	114	114	114	114	114	113	*90.5*
32	118	118	118	116	114	114	114	114	114	114	114	114	114	113	*90.5*
33	118	118	118	116	114	114	114	114	114	114	114	114	114	113	*90.5*
34	118	118	118	116	114	114	114	114	114	114	114	114	114	113	*90.5*
35	118	118	118	116	114	114	114	114	114	114	114	...	...	...	...
36	148	148	147	146	144	142	141	141	140	139	138	136	133	127	*100*
37	148	148	147	146	144	142	141	141	140	139	138	136	133	127	*100*
38	148	148	147	146	144	142	141	141	140	139	138	136	133	127	*100*

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	*69.0*	*54.5*	*40.4*	*29.1*	*19.8*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
2	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
3	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
4	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
5	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
6	*80.9*	*64.0*	*47.7*	*34.5*	*23.5*	*15.5*	*9.39*	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
9	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
10	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
11	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	(**13**)
12	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	(**13**)
13	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
14	*90.4*	*64.0*	*45.0*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
17	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
18	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	*89.4*	*64.3*	*44.9*	*30.1*	*19.7*	*12.9*	*8.06*	...	...	...	...	...	...	...	...	...	...	
21	*88.1*	*65.1*	*42.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	*68.2*	*54.1*	*43.5*	*34.4*	*25.3*	*17.4*	*10.0*	...	...	...	...	...	...	...	...	...	...	
31	*68.2*	*54.1*	*43.5*	*34.4*	*25.3*	*17.4*	*10.0*	...	...	...	...	...	...	...	...	...	...	
32	*68.2*	*54.1*	*43.5*	*34.4*	*25.3*	*17.4*	*10.0*	...	...	...	...	...	...	...	...	...	...	
33	*68.2*	*54.1*	*43.5*	*34.4*	*25.3*	*17.4*	*10.0*	...	...	...	...	...	...	...	...	...	...	
34	*68.2*	*54.1*	*43.5*	*34.4*	*25.3*	*17.4*	*10.0*	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	*72.8*	*54.9*	*40.7*	*29.4*	*20.4*	*15.7*	*8.64*	...	...	...	...	...	...	...	...	...	...	
37	*72.8*	*54.9*	*40.7*	*29.4*	*20.4*	*15.7*	*8.64*	...	...	...	...	...	...	...	...	...	...	
38	*72.8*	*54.9*	*40.7*	*29.4*	*20.4*	*15.7*	*8.64*	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	3Cr–1Mo–¼V–Ti–B	Forgings	SA–182	F3V	K31830	...	...	5C	1
2	3Cr–1Mo–¼V–Ti–B	Forgings	SA–336	F3V	K31830	...	...	5C	1
3	3Cr–1Mo–¼V–Ti–B	Forgings	SA–508	3V	K31830	...	...	5C	1
4	3Cr–1Mo–¼V–Ti–B	Forgings	SA–541	3V	K31830	...	...	5C	1
5	3Cr–1Mo–¼V–Ti–B	Plate	SA–542	C	K31830	4a	...	5C	1
6	3Cr–1Mo–¼V–Ti–B	Plate	SA–832	21V	K31830	...	...	5C	1
7	3Cr–1Mo–¼V–Cb–Ca	Forgings	SA–182	F3VCb	...	...	...	5C	1
8	3Cr–1Mo–¼V–Cb–Ca	Forgings	SA–336	F3VCb	...	...	...	5C	1
9	3Cr–1Mo–¼V–Cb–Ca	Forgings	SA–508	3VCb	...	...	...	5C	1
10	3Cr–1Mo–¼V–Cb–Ca	Forgings	SA–541	3VCb	...	...	...	5C	1
11	3Cr–1Mo–¼V–Cb–Ca	Plate	SA–542	E	...	4a	...	5C	1
12	3Cr–1Mo–¼V–Cb–Ca	Plate	SA–832	23V	...	...	...	5C	1
13	5Cr–½Mo	Smls. tube	SA–213	T5	K41545	...	...	5B	1
14	5Cr–½Mo	Smls. & wld. fittings	SA–234	WP5	K41545	...	...	5B	1
15	5Cr–½Mo	Smls. pipe	SA–335	P5	K41545	...	...	5B	1
16	5Cr–½Mo	Forged pipe	SA–369	FP5	K41545	...	...	5B	1
17	5Cr–½Mo	Plate	SA–387	5	K41545	1	...	5B	1
18	5Cr–½Mo	Wld. pipe	SA–691	5CR	K41545	...	...	5B	1
19	5Cr–½Mo	Forgings	SA–336	F5	K41545	...	...	5B	1
20	5Cr–½Mo	Forgings	SA–182	F5	K41545	...	...	5B	1
21	5Cr–½Mo	Plate	SA–387	5	K41545	2	...	5B	1
22	5Cr–½Mo	Forgings	SA–336	F5A	K42544	...	...	5B	1
23	5Cr–½Mo	Castings	SA–217	C5	J42045	...	...	5B	1
24	5Cr–½Mo	Cast pipe	SA–426	CP5	J42045	...	...	5B	1
25	5Cr–½Mo	Forgings	SA–182	F5a	K42544	...	...	5B	1
26	5Cr–½Mo–Si	Smls. tube	SA–213	T5b	K51545	...	...	5B	1
27	5Cr–½Mo–Si	Smls. pipe	SA–335	P5b	K51545	...	...	5B	1
28	5Cr–½Mo–Ti	Smls. tube	SA–213	T5c	K41245	...	...	5B	1
29	5Cr–½Mo–Ti	Smls. pipe	SA–335	P5c	K41245	...	...	5B	1
30	9Cr–1Mo	Smls. tube	SA–213	T9	K90941	...	...	5B	1
31	9Cr–1Mo	Fittings	SA–234	WP9	K90941	...	...	5B	1
32	9Cr–1Mo	Smls. pipe	SA–335	P9	K90941	...	...	5B	1
33	9Cr–1Mo	Forged pipe	SA–369	FP9	K90941	...	...	5B	1
34	9Cr–1Mo	Forgings	SA–182	F9	K90941	...	...	5B	1
35	9Cr–1Mo	Forgings	SA–336	F9	K90941	...	...	5B	1
36	9Cr–1Mo	Castings	SA–217	C12	J82090	...	...	5B	1
37	9Cr–1Mo	Cast pipe	SA–426	CP9	J82090	...	...	5B	1
38	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...	$t \le 75$	15E	1
39	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...	$t > 75$	15E	1
40	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...	$t \le 75$	15E	1
41	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...	$t > 75$	15E	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	585	415	NP	NP	482	NP	CS–3	...
2	585	415	NP	NP	482	NP	CS–3	...
3	585	415	NP	NP	482	NP	CS–3	...
4	585	415	NP	NP	482	NP	CS–3	...
5	585	415	NP	NP	482	NP	CS–3	...
6	585	415	NP	NP	482	NP	CS–3	...
7	585	415	NP	NP	482	NP	CS–3	...
8	585	415	NP	NP	482	NP	CS–3	...
9	585	415	NP	NP	482	NP	CS–3	...
10	585	415	NP	NP	482	NP	CS–3	...
11	585	415	NP	NP	482	NP	CS–3	...
12	585	415	NP	NP	482	NP	CS–3	...
13	415	205	649	371	649	NP	CS–2	T4
14	415	205	649	371	649	NP	CS–2	T4, W14
15	415	205	649	371	649	NP	CS–2	T4
16	415	205	649	371	649	NP	CS–2	T4
17	415	205	649	371	649	NP	CS–2	T4
18	415	205	NP	371	NP	NP	CS–2	G26, W10, W12
19	415	250	649	NP	649	NP	CS–2	T4
20	485	275	649	371	649	NP	CS–2	T3
21	515	310	NP	371	649	NP	CS–3	T3
22	550	345	649	NP	649	NP	CS–3	T3
23	620	415	649	371	649	NP	CS–3	G1, G17, T3
24	620	415	NP	371	NP	NP	CS–3	G17
25	620	450	649	NP	649	NP	CS–5	T3
26	415	205	649	NP	649	NP	CS–2	T4
27	415	205	649	NP	649	NP	CS–2	T4
28	415	205	649	NP	649	NP	CS–2	T4
29	415	205	649	NP	649	NP	CS–2	T4
30	415	205	649	371	649	NP	CS–2	T5
31	415	205	649	NP	649	NP	CS–2	T5
32	415	205	649	371	649	NP	CS–2	T5
33	415	205	649	371	649	NP	CS–2	T5
34	585	380	649	NP	649	NP	CS–3	T4
35	585	380	NP	NP	649	NP	CS–3	T4
36	620	415	649	371 (SPT)	649	NP	CS–3	G1, T4
37	620	415	NP	371	NP	NP	CS–3	G17
38	585	415	649	371	649	NP	CS–3	T7
39	585	415	649	NP	649	NP	CS–3	T7
40	585	415	649	371	649	NP	CS–3	T7
41	585	415	649	371	649	NP	CS–3	T7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
2	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
3	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
4	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
5	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
6	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
7	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
8	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
9	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
10	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
11	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
12	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
13	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
14	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
15	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
16	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
17	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
18	118	118	118	116	114	114	113	112	111	109	107	...	...	...	...
19	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
20	138	138	138	136	134	132	132	131	130	128	125	121	118	102	*81.1*
21	148	148	147	146	143	142	142	140	139	137	134	130	126	104	*80.5*
22	158	158	157	154	152	152	151	150	148	146	143	139	133	104	*80.3*
23	177	177	177	174	172	170	170	169	167	164	161	156	134	103	*80.6*
24	177	177	177	174	172	170	170	169	167	164	161	...	...	...	...
25	177	177	177	174	172	170	170	169	167	164	161	156	134	103	*80.6*
26	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
27	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
28	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
29	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
30	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
31	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
32	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
33	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
34	168	167	166	164	162	161	161	159	157	155	152	147	142	137	121
35	168	167	166	164	162	161	161	159	157	155	152	147	142	137	121
36	177	177	177	174	172	170	170	169	167	164	161	156	151	145	123
37	177	177	177	174	172	170	170	169	167	164	161	...	...	...	...
38	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
39	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
40	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
41	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
14	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
15	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
16	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
17	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
20	*61.8*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
21	*62.0*	*46.3*	*34.8*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
22	*62.1*	*46.3*	*34.8*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
23	*62.0*	*46.3*	*34.8*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	*62.0*	*46.3*	*34.8*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
26	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
27	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
28	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
29	*61.7*	*46.4*	*34.7*	*25.8*	*18.0*	*11.5*	*6.68*	...	...	...	...	...	...	...	...	...	...
30	80.3	*61.0*	*42.9*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
31	80.3	*61.0*	*42.9*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
32	80.3	*61.0*	*42.9*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
33	80.3	*61.0*	*42.9*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
34	*89.0*	*60.7*	*43.1*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
35	*89.0*	*60.7*	*43.1*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
36	*88.2*	*61.0*	*43.0*	*30.0*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
39	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
40	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
41	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	9Cr–1Mo–V	Fittings	SA–234	WP91	K90901	...	$t \le 75$	15E	1
2	9Cr–1Mo–V	Fittings	SA–234	WP91	K90901	...	$t > 75$	15E	1
3	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...	$t \le 75$	15E	1
4	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...	$t > 75$	15E	1
5	9Cr–1Mo–V	Forgings	SA–336	F91	K90901	...	$t \le 75$	15E	1
6	9Cr–1Mo–V	Forgings	SA–336	F91	K90901	...	$t > 75$	15E	1
7	9Cr–1Mo–V	Forged pipe	SA–369	FP91	K90901	...	$t \le 75$	15E	1
8	9Cr–1Mo–V	Forged pipe	SA–369	FP91	K90901	...	$t > 75$	15E	1
9	9Cr–1Mo–V	Plate	SA–387	91	K90901	2	$t \le 75$	15E	1
10	9Cr–1Mo–V	Plate	SA–387	91	K90901	2	$t > 75$	15E	1
11	11Cr–Ti	Plate	SA–240	...	S40910	...	...	7	1
12	11Cr–Ti	Plate	SA–240	...	S40920	...	...	7	1
13	11Cr–Ti	Plate	SA–240	...	S40930	...	...	7	1
14	11Cr–Ti	Wld. tube	SA–268	TP409	S40900	...	...	7	1
15	11Cr–Ti	Smls. tube	SA–268	TP409	S40900	...	...	7	1
16	12Cr	Plate	SA–1010	40	S41003	...	$t \le 19$	7	1
17	12Cr	Bar	SA–479	403	S40300	A	...	6	1
18	12Cr	Bar	SA–479	403	S40300	1	...	6	1
19	12Cr	Plate	SA–1010	50	S41003	...	$t \le 19$	7	1
20	12Cr–Al	Bar	SA/JIS G4303	SUS405	...	...	...	7	1
21	12Cr–Al	Plate	SA–240	405	S40500	...	...	7	1
22	12Cr–Al	Plate	SA–240	405	S40500	...	...	7	1
23	12Cr–Al	Bar	SA–479	405	S40500	...	...	7	1
24	12Cr–Al	Smls. & wld. tube	SA–268	TP405	S40500	...	...	7	1
25	12Cr–Al	Wld. tube	SA–268	TP405	S40500	...	...	7	1
26	12Cr–Ti	Wld. tube	SA–268	...	S40800	...	...	7	1
27	12Cr–Ti	Smls. tube	SA–268	...	S40800	...	...	7	1
28	13Cr	Plate	SA–240	410S	S41008	...	...	7	1
29	13Cr	Smls. & wld. tube	SA–268	TP410	S41000	...	...	6	1
30	13Cr	Wld. tube	SA–268	TP410	S41000	...	...	6	1
31	13Cr	Plate	SA–240	410	S41000	...	...	6	1
32	13Cr	Forgings	SA–182	F6a	S41000	1	...	6	1
33	13Cr	Bar	SA–479	410	S41000	...	...	6	1
34	13Cr	Bar	SA–479	410	S41000	A	...	6	1
35	13Cr	Bar	SA–479	410	S41000	1	...	6	1
36	13Cr	Forgings	SA–182	F6a	S41000	2	...	6	3
37	13Cr	Castings	SA–217	CA15	J91150	...	...	6	3
38	13Cr	Cast pipe	SA–426	CPCA15	J91150	...	...	6	3
39	13Cr–4Ni	Castings	SA–487	CA6NM	J91540	A	...	6	4
40	13Cr–4Ni	Forgings	SA–182	F6NM	S41500	...	...	6	4

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	585	415	649	NP	NP	NP	CS–3	T7
2	585	415	649	NP	NP	NP	CS–3	T7
3	585	415	649	371	649	NP	CS–3	T7
4	585	415	649	NP	649	NP	CS–3	T7
5	585	415	649	NP	649	NP	CS–3	T7
6	585	415	649	NP	649	NP	CS–3	T7
7	585	415	649	NP	NP	NP	CS–3	T7
8	585	415	649	NP	NP	NP	CS–3	T7
9	585	415	649	371	649	NP	CS–3	T7
10	585	415	649	NP	649	NP	CS–3	T7
11	380	170	NP	NP	427	NP	CS–1	...
12	380	170	NP	NP	427	NP	CS–1	...
13	380	170	NP	NP	427	NP	CS–1	...
14	380	170	NP	NP	427	343	CS–1	G24
15	380	170	NP	NP	427	343	CS–1	...
16	455	275	NP	NP	316	316	CS–2	...
17	485	275	NP	371	NP	NP	...	...
18	485	275	NP	371	NP	NP	...	...
19	485	345	NP	NP	316	316	CS–3	...
20	410	174	NP	371	538	NP	CS–1	G19, T5
21	415	170	371	NP	538	343	CS–1	G19, T5
22	415	170	NP	371	NP	NP	CS–1	G19
23	415	170	NP	371	538	343	CS–1	G19, T5
24	415	205	371	NP	538	343	CS–2	G19, T5, W13, W14
25	415	205	371	NP	538	343	CS–2	G3, G19, G24, T5
26	380	205	NP	NP	427	343	CS–2	G19, W14
27	380	205	NP	NP	427	343	CS–2	G19
28	415	205	NP	371	649	343	CS–2	T4
29	415	205	371	NP	649	343	CS–2	T4, W13, W14
30	415	205	371	NP	649	343	CS–2	G3, G24, T4
31	450	205	NP	NP	649	343	CS–2	T4
32	485	275	NP	371	538	343	CS–2	T4
33	485	275	NP	NP	538	343	CS–2	G22, T4
34	485	275	NP	371	NP	NP	CS–2	...
35	485	275	371	371	NP	NP	CS–2	...
36	585	380	NP	371	649	343	CS–3	T3
37	620	450	NP	371	649	343	CS–5	G1, G17, T3
38	620	450	NP	371	NP	NP	CS–5	G17
39	760	550	NP	371	427	343	CS–5	G1, G17
40	795	620	NP	371	NP	NP	CS–3	G17

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
2	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
3	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
4	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
5	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
6	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
7	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
8	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
9	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
10	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
11	108	104	98.8	94.4	90.1	83.8	80.5	78.2	77.9	77.9	77.9	77.2	76.6	76.0	...
12	108	104	98.8	94.4	90.1	83.8	80.5	78.2	77.9	77.9	77.9	77.2	76.6	76.0	...
13	108	104	98.8	94.4	90.1	83.8	80.5	78.2	77.9	77.9	77.9	77.2	76.6	76.0	...
14	92.4	88.4	82.3	84.1	76.6	71.2	68.4	66.5	66.2	66.2	66.2	65.6	65.1	64.6	...
15	108	104	98.8	94.4	90.1	83.8	80.5	78.2	77.9	77.9	77.9	77.2	76.6	76.0	...
16	130	130	130	130	130	127	123	119	117	...	...	...	...	...	...
17	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
18	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
19	138	138	138	138	138	135	131	126	124	...	...	...	...	...	...
20	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
21	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
22	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...
23	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
24	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.2	88.4
25	101	101	101	99.7	98.5	96.7	95.4	93.9	92.4	90.5	88.6	86.1	83.0	79.3	75.2
26	92.4	92.4	92.3	91.4	90.3	89.0	87.8	86.3	84.8	82.9	81.0	78.5	76.0	73.5	...
27	108	108	108	107	106	104	103	101	99.6	98.0	95.5	92.9	89.2	85.5	...
28	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.0	88.3
29	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.0	88.3
30	101	101	101	99.7	98.5	96.7	95.4	93.9	92.4	90.5	88.6	86.1	82.9	79.4	74.1
31	128	128	126	125	123	120	119	117	115	114	111	108	104	100	89.9
32	138	138	138	137	135	133	131	129	127	124	122	118	113	109	92.1
33	138	138	138	137	135	133	131	129	127	124	122	118	113	109	92.1
34	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
35	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
36	168	168	167	166	164	162	159	157	154	151	148	143	138	123	*93.5*
37	177	177	177	176	174	171	169	166	163	160	156	151	146	117	*83.3*
38	177	177	177	176	174	171	169	166	163	160	156	...	...	...	...
39	216	216	216	215	212	208	204	200	198	195	192	189	184	180	...
40	227	227	227	227	227	225	217	209	205	202	197	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
2	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
3	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
4	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
5	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
6	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
7	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
8	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
9	126	117	107	*88.5*	*65.0*	*45.5*	*28.9*	...	...	...	...	...	...	...	...	...	...
10	126	118	103	*80.6*	*61.6*	*45.7*	*28.9*	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	67.3	*41.9*	*14.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	67.3	*41.9*	*14.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	67.3	*41.9*	*14.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	70.6	*40.9*	*14.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	59.8	*34.6*	*12.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*69.7*	*50.7*	*37.9*	*26.4*	*18.0*	*11.6*	*6.68*	...	...	...	...	...	...	...	...	...	...
29	*69.7*	*50.7*	*37.9*	*26.4*	*18.0*	*11.6*	*6.68*	...	...	...	...	...	...	...	...	...	...
30	*60.0*	*42.8*	*31.9*	*22.4*	*15.5*	*9.59*	*5.69*	...	...	...	...	...	...	...	...	...	...
31	*69.2*	*50.9*	*37.8*	*26.4*	*18.0*	*11.6*	*6.68*	...	...	...	...	...	...	...	...	...	...
32	*68.4*	*51.3*	*37.0*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	*68.4*	*51.3*	*37.0*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	*68.0*	*51.3*	*37.7*	*26.4*	*17.9*	*11.6*	*6.68*	...	...	...	...	...	...	...	...	...	...
37	*60.1*	*42.0*	*28.6*	*19.8*	*13.8*	*9.81*	*6.76*	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	15Cr	Wld. tube	SA–268	TP429	S42900	...	...	6	2
2	15Cr	Smls. & wld. tube	SA–268	TP429	S42900	...	...	6	2
3	15Cr	Plate	SA–240	429	S42900	...	...	6	2
4	17Cr	Wld. tube	SA–268	TP430	S43000	...	...	7	2
5	17Cr	Smls. & wld. tube	SA–268	TP430	S43000	...	...	7	2
6	17Cr	Plate	SA–240	430	S43000	...	...	7	2
7	17Cr	Bar	SA–479	430	S43000	...	...	7	2
8	17Cr–4Ni–3Cu	Castings	SA–747	CB7Cu–1	J92180	...	...	...	...
9	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1150	...	...	...
10	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1150	...	...	...
11	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150	...	...	...
12	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1100	...	...	...
13	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1100	...	...	...
14	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1100	...	...	...
15	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1075	...	...	...
16	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1075	...	...	...
17	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1075	...	...	...
18	18Cr–2Mo	Plate	SA–240	...	S44400	...	...	7	2
19	18Cr–2Mo	Wld. tube	SA–268	...	S44400	...	...	7	2
20	18Cr–2Mo	Smls. tube	SA–268	...	S44400	...	...	7	2
21	18Cr–Ti	Wld. tube	SA–268	TP439	S43035	...	...	7	2
22	18Cr–Ti	Smls. tube	SA–268	TP439	S43035	...	...	7	2
23	18Cr–Ti	Wld. pipe	SA–731	TP439	S43035	...	...	7	2
24	18Cr–Ti	Smls. pipe	SA–731	TP439	S43035	...	...	7	2
25	18Cr–Ti	Wld. tube	SA–803	TP439	S43035	...	...	7	2
26	18Cr–Ti	Smls. tube	SA–268	TP430 Ti	S43036	...	...	7	2
27	18Cr–Ti	Wld. tube	SA–268	TP430 Ti	S43036	...	...	7	2
28	18Cr–Ti	Bar	SA–479	439	S43035	...	...	7	2
29	26Cr–3Ni–3Mo	Plate	SA–240	26–3–3	S44660	...	≤5	10K	1
30	26Cr–3Ni–3Mo	Smls. tube	SA–268	26–3–3	S44660	...	≤5	10K	1
31	26Cr–3Ni–3Mo	Wld. tube	SA–268	26–3–3	S44660	...	≤5	10K	1
32	26Cr–3Ni–3Mo	Wld. tube	SA–268	26–3–3	S44660	...	≤5	10K	1
33	26Cr–3Ni–3Mo	Wld. tube	SA–803	26–3–3	S44660	...	≤5	10K	1
34	27Cr	Smls. tube	SA–268	TP446–1	S44600	...	...	10I	1
35	27Cr–1Mo	Forgings	SA–182	FXM–27Cb	S44627	...	...	10I	1
36	27Cr–1Mo	Plate	SA–240	XM–27	S44627	...	...	10I	1
37	27Cr–1Mo	Wld. tube	SA–268	TPXM–27	S44627	...	...	10I	1
38	27Cr–1Mo	Smls. tube	SA–268	TPXM–27	S44627	...	...	10I	1
39	27Cr–1Mo	Bar	SA–479	XM–27	S44627	...	...	10I	1
40	27Cr–1Mo	Smls. pipe	SA–731	TPXM–27	S44627	...	...	10I	1
41	27Cr–1Mo	Wld. pipe	SA–731	TPXM–27	S44627	...	...	10I	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	415	240	371	NP	371	343	CS–2	G3, G19, W14
2	415	240	371	NP	649	343	CS–2	G19, T4, W13, W14
3	450	205	NP	NP	649	343	CS–2	G19, T4
4	415	240	371	NP	649	343	CS–2	G3, G19, G24, T4
5	415	240	371	371	649	343	CS–2	G19, T4, W12, W13, W14
6	450	205	NP	NP	649	343	CS–2	G19, T4
7	485	275	371	371	538	343	CS–2	G19, G22, T4
8	1035	965	NP	NP	93	NP	HT–1	G1, G28, W1
9	930	725	NP	343	343	NP	HT–1	G8, G19, W1
10	930	725	NP	343	NP	NP	HT–1	G19, W1
11	930	725	NP	343	NP	NP	HT–1	G19, W1
12	965	795	NP	343	343	NP	HT–1	G8, G19, W1
13	965	795	NP	343	NP	NP	HT–1	G19, W1
14	965	795	NP	343	NP	NP	HT–1	G19, W1
15	1000	860	NP	343	NP	NP	HT–1	G19, W1
16	1000	860	NP	343	NP	NP	HT–1	G19, W1
17	1000	860	NP	343	NP	NP	HT–1	G19, W1
18	415	275	NP	NP	343	343	CS–2	G19
19	415	275	NP	NP	343	343	CS–2	G19, G24
20	415	275	NP	NP	343	343	CS–2	G19
21	415	205	427	NP	427	343	CS–2	G19, G24
22	415	205	427	NP	427	343	CS–2	G19
23	415	205	427	NP	NP	NP	CS–2	G19, G24
24	415	205	427	NP	NP	NP	CS–2	G19
25	415	205	NP	NP	316	316	CS–2	G19, G24
26	415	240	NP	NP	427	NP	CS–2	G19
27	415	240	NP	NP	427	NP	CS–2	G19, G24
28	485	275	NP	NP	538	343	CS–2	G19, G22, T4
29	585	450	NP	NP	371	343	HA–5	G19
30	585	450	NP	371	371	343	HA–5	G19, H5
31	585	450	NP	371	NP	NP	HA–5	G19, H5, W12
32	585	450	NP	NP	371	343	HA–5	G19, G24
33	585	450	NP	NP	316	316	HA–5	G19, G24
34	485	275	371	NP	343	343	CS–2	G19
35	415	240	NP	NP	343	343	HA–2	G19
36	450	275	NP	343	343	343	HA–2	G19
37	450	275	NP	NP	343	343	HA–2	G19, G24
38	450	275	NP	343	343	343	HA–2	G19
39	450	275	NP	371	343	343	HA–2	G19, G22
40	450	275	NP	NP	343	343	HA–2	G19
41	450	275	NP	NP	343	343	HA–2	G19, G24

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	101	101	101	99.7	98.5	96.7	95.4	93.9	92.4	90.5	88.6	...	...	...	...
2	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.3	86.2
3	128	128	126	125	123	120	119	117	115	114	111	108	104	101	87.8
4	101	101	101	99.7	98.5	96.7	95.4	93.9	92.4	90.5	88.6	86.1	83.0	79.4	73.3
5	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.3	86.2
6	128	128	126	125	123	120	119	117	115	114	111	108	104	101	87.8
7	138	138	138	137	135	133	131	129	127	124	122	118	113	109	90.1
8	221	221	221	...	...	...	...	...	...	...	...	...	...	...	...
9	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
10	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
11	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
12	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
13	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
14	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
15	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
16	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
17	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
18	118	118	118	116	114	112	110	107	105	104	...	...	...	...	...
19	101	101	101	99.0	97.1	95.3	93.5	91.3	89.7	87.7	...	...	...	...	...
20	118	118	118	116	114	112	110	107	105	104	...	...	...	...	...
21	101	101	100	96.5	91.5	85.9	81.9	80.3	79.7	79.3	79.2	78.6	77.3	76.1	...
22	118	118	118	113	108	101	96.6	94.0	93.8	93.7	93.0	92.3	91.1	89.8	...
23	101	101	100	96.5	91.5	85.9	81.9	80.3	79.7	79.3	79.2	78.6	77.3	76.1	...
24	118	118	118	113	108	101	96.6	94.0	93.8	93.7	93.0	92.3	91.1	89.8	...
25	101	101	100	96.5	91.5	85.9	81.9	80.3	79.7	...	...	...	...	...	...
26	118	118	118	116	114	111	109	107	105	104	102	99.7	97.0	93.8	...
27	100	100	100	98.5	97.0	94.6	92.8	90.8	89.7	88.3	86.7	84.8	82.5	79.7	...
28	138	138	138	136	133	130	127	124	123	121	119	116	113	110	91.7
29	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
30	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
31	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
32	142	142	142	142	142	140	139	139	138	138	137	...	...	...	...
33	142	142	142	142	142	140	139	139	138	...	...	...	...	...	...
34	138	138	138	136	133	130	127	124	123	121	119	...	...	...	...
35	118	118	118	116	114	111	111	111	111	111	...	...	...	...	...
36	128	128	128	127	126	125	125	125	125	125	...	...	...	...	...
37	109	109	109	108	107	106	106	106	106	106	...	...	...	...	...
38	128	128	128	127	126	125	125	125	125	125	...	...	...	...	...
39	128	128	128	127	126	125	125	125	125	125	125	...	...	...	...
40	128	128	128	127	126	125	125	125	125	125	...	...	...	...	...
41	109	109	109	108	107	106	106	106	106	106	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	*70.9*	*52.8*	*38.1*	*27.5*	*20.5*	*15.9*	*12.2*	...	...	...	...	...	...	...	...	...	...
3	*70.4*	*53.0*	*38.1*	*27.5*	*20.5*	*15.9*	*12.2*	...	...	...	...	...	...	...	...	...	...
4	*60.2*	*44.8*	*32.2*	*23.2*	*17.3*	*13.3*	*10.2*	...	...	...	...	...	...	...	...	...	...
5	*70.9*	*52.8*	*38.1*	*27.5*	*20.5*	*15.9*	*12.2*	...	...	...	...	...	...	...	...	...	...
6	*70.4*	*53.0*	*38.1*	*27.5*	*20.5*	*15.9*	*12.2*	...	...	...	...	...	...	...	...	...	...
7	*69.5*	*53.6*	*36.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*69.9*	*53.5*	*36.6*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	27Cr–1Mo–Ti	Smls. pipe	SA–731	TPXM–33	S44626	...	...	10I	1
	2	27Cr–1Mo–Ti	Wld. pipe	SA–731	TPXM–33	S44626	...	...	10I	1
	3	27Cr–1Mo–Ti	Plate	SA–240	XM–33	S44626	...	...	10I	1
	4	27Cr–1Mo–Ti	Smls. tube	SA–268	TPXM–33	S44626	...	...	10I	1
	5	27Cr–1Mo–Ti	Wld. tube	SA–268	TPXM–33	S44626	...	...	10I	1
	6	29Cr–4Mo	Bar	SA–479	...	S44700	...	...	10J	1
	7	29Cr–4Mo	Plate	SA–240	...	S44700	...	...	10J	1
	8	29Cr–4Mo	Smls. tube	SA–268	29–4	S44700	...	...	10J	1
	9	29Cr–4Mo	Wld. tube	SA–268	29–4	S44700	...	...	10J	1
	10	29Cr–4Mo–2Ni	Bar	SA–479	...	S44800	...	...	10K	1
	11	29Cr–4Mo–2Ni	Plate	SA–240	...	S44800	...	...	10K	1
	12	29Cr–4Mo–2Ni	Smls. tube	SA–268	29–4–2	S44800	...	...	10K	1
	13	29Cr–4Mo–2Ni	Wld. tube	SA–268	29–4–2	S44800	...	...	10K	1
	14	29Cr–4Mo–Ti	Smls. tube	SA–268	...	S44735	...	...	10J	1
	15	29Cr–4Mo–Ti	Wld. tube	SA–268	...	S44735	...	...	10J	1
	16	Mn–$^1/_4$Mo	Forgings	SA–372	D	K14508	...	...	...	...
	17	Mn–$^1/_4$Mo–V	Castings	SA–487	2	J13005	A	...	3	3
	18	Mn–$^1/_4$Mo–V	Castings	SA–487	2	J13005	B	...	3	3
	19	Mn–$^1/_2$Mo	Plate	SA–302	A	K12021	...	...	3	2
	20	Mn–$^1/_2$Mo	Wld. pipe	SA–672	H75	K12021	...	...	3	2
	21	Mn–$^1/_2$Mo	Plate	SA–302	B	K12022	...	...	3	3
	22	Mn–$^1/_2$Mo	Plate	SA–533	A	K12521	1	...	3	3
	23	Mn–$^1/_2$Mo	Plate	SA–533	A	K12521	2	...	3	3
	24	Mn–$^1/_2$Mo	Plate	SA–533	A	K12521	3	...	11A	4
	25	Mn–$^1/_2$Mo–$^1/_4$Ni	Plate	SA–533	D	K12529	1	...	3	3
	26	Mn–$^1/_2$Mo–$^1/_4$Ni	Plate	SA–533	D	K12529	2	...	3	3
	27	Mn–$^1/_2$Mo–$^1/_4$Ni	Plate	SA–533	D	K12529	3	...	11A	4
	28	Mn–$^1/_2$Mo–$^1/_2$Ni	Plate	SA–302	C	K12039	...	...	3	3
	29	Mn–$^1/_2$Mo–$^1/_2$Ni	Plate	SA–533	B	K12539	1	...	3	3
	30	Mn–$^1/_2$Mo–$^1/_2$Ni	Wld. pipe	SA–672	H80	K12039	...	...	3	3
	31	Mn–$^1/_2$Mo–$^1/_2$Ni	Wld. pipe	SA–672	J80	K12539	...	...	3	3
	32	Mn–$^1/_2$Mo–$^1/_2$Ni	Plate	SA–533	B	K12539	2	...	3	3
	33	Mn–$^1/_2$Mo–$^1/_2$Ni	Wld. pipe	SA–672	J90	K12539	...	...	3	3
	34	Mn–$^1/_2$Mo–$^1/_2$Ni	Plate	SA–533	B	K12539	3	...	11A	4
	35	Mn–$^1/_2$Mo–$^1/_2$Ni	Wld. pipe	SA–672	J100	K12539	...	...	11A	4
	36	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–302	D	K12054	...	...	3	3
	37	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–533	C	K12554	1	...	3	3
(**13**)	38	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–533	E	K12554	1	...	3	3
	39	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–533	C	K12554	2	...	3	3
(**13**)	40	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–533	E	K12554	2	...	3	3
	41	Mn–$^1/_2$Mo–$^3/_4$Ni	Plate	SA–533	C	K12554	3	...	11A	4

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	450	275	NP	NP	343	343	HA–2	G19
2	450	275	NP	NP	343	343	HA–2	G19, G24
3	470	310	NP	NP	343	343	HA–6	G19
4	470	310	NP	NP	343	343	HA–6	G19
5	470	310	NP	NP	343	343	HA–6	G19, G24
6	485	380	NP	NP	316	316	HA–6	G19, G22
7	550	415	NP	NP	316	316	HA–6	G19
8	550	415	NP	NP	316	316	HA–6	G19
9	550	415	NP	NP	316	316	HA–6	G19, G24
10	485	380	NP	NP	316	316	HA–6	G19, G22
11	550	415	NP	NP	316	316	HA–6	G19
12	550	415	NP	NP	316	316	HA–6	G19
13	550	415	NP	NP	316	316	HA–6	G19, G24
14	515	415	NP	NP	316	316	HA–6	G19
15	515	415	NP	NP	316	316	HA–6	G19, G24
16	725	450	NP	343	343	343	CS–5	G25, W2, W11
17	585	365	NP	371 (SPT)	343	343	CS–3	G1
18	620	450	NP	NP	343	343	CS–5	G1
19	515	310	538	371	538	343	CS–3	G11, S2, T3
20	515	310	NP	371	NP	NP	CS–3	S6, W10, W12
21	550	345	538	371	538	343	CS–3	G11, S2, T3
22	550	345	NP	371	538	NP	CS–5	G23, T4
23	620	485	NP	371	427	NP	CS–5	...
24	690	570	NP	371	NP	NP	CS–5	...
25	550	345	NP	371	NP	NP	CS–5	...
26	620	485	NP	371	427	NP	CS–5	...
27	690	570	NP	371	399	343	CS–5	...
28	550	345	538	371	538	343	CS–3	G11, S2, T3
29	550	345	NP	371	427	NP	CS–5	G23
30	550	345	NP	371	NP	NP	CS–3	G26, W10, W12
31	550	345	NP	371	NP	NP	CS–5	G26, W10, W12
32	620	485	NP	371	427	NP	CS–5	...
33	620	485	NP	371	NP	NP	CS–5	G26, W10, W12
34	690	570	NP	371	399	343	CS–5	...
35	690	570	NP	371	NP	NP	CS–5	G26, W10, W12
36	550	345	538	371	538	343	CS–3	G11, S2, T3
37	550	345	NP	371	427	NP	CS–5	G23
38	550	345	NP	NP	427	NP	CS–5	G23
39	620	485	NP	371	427	NP	CS–5	...
40	620	485	NP	NP	427	NP	CS–5	...
41	690	570	NP	371	NP	NP	CS–5	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	128	128	128	128	127	126	124	122	121	119	...	...	...	...	...
2	109	109	109	109	108	106	106	104	103	101	...	...	...	...	...
3	134	134	134	134	133	131	130	128	126	124	...	...	...	...	...
4	134	134	134	134	133	131	130	128	126	124	...	...	...	...	...
5	114	114	114	113	113	112	111	109	108	106	...	...	...	...	...
6	138	138	138	135	133	132	132	132	132	...	...	...	...	...	...
7	158	158	157	155	152	151	151	151	151	...	...	...	...	...	...
8	158	158	157	155	152	151	151	151	151	...	...	...	...	...	...
9	134	134	134	132	130	128	128	128	128	...	...	...	...	...	...
10	138	137	135	134	133	132	131	129	128	...	...	...	...	...	...
11	158	156	154	153	152	151	149	147	147	...	...	...	...	...	...
12	158	156	154	153	152	151	149	147	147	...	...	...	...	...	...
13	134	133	131	130	130	128	127	125	124	...	...	...	...	...	...
14	148	146	144	144	143	141	140	139	138	...	...	...	...	...	...
15	125	125	123	122	121	121	119	118	117	...	...	...	...	...	...
16	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
17	168	168	168	168	168	167	167	167	167	166	166	...	...	...	...
18	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
19	148	148	148	148	148	148	148	148	148	148	148	148	148	142	*107*
20	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
21	158	158	158	158	158	158	158	158	158	158	158	158	158	143	*106*
22	158	158	158	158	158	158	158	158	158	158	158	158	158	154	106
23	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
24	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...
25	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
26	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
27	197	197	197	197	197	197	197	197	197	197	197	197	...	...	...
28	158	158	158	158	158	158	158	158	158	158	158	158	158	143	*106*
29	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
30	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
31	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
32	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
33	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
34	197	197	197	197	197	197	197	197	197	197	197	197	...	...	...
35	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...
36	158	158	158	158	158	158	158	158	158	158	158	158	158	143	*106*
37	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
38	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
39	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
40	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
41	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	*68.1*	*43.1*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	*68.4*	*43.0*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	*77.2*	*55.6*	*32.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	*68.4*	*43.0*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	*68.4*	*43.0*	*23.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Mn–½Ni–V	Plate	SA–225	C	K12524	...	...	10A	1
2	Mn–V	Castings	SA–487	1	J13002	A	...	10A	1
3	Mn–V	Castings	SA–487	1	J13002	A	...	10A	1
4	Mn–V	Castings	SA–487	1	J13002	B	...	10A	1
5	1½Si–½Mo	Smls. pipe	SA–335	P15	K11578	...	...	3	1
6	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	A	...	3	3
7	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	B	...	11A	3
8	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	E	...	11A	3
9	½Ni–½Mo–V	Forgings	SA–541	3	K12045	1	...	3	3
10	½Ni–½Mo–V	Forgings	SA–541	3	K12045	2	...	3	3
11	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	64 < *t* ≤ 100	11B	3
12	¾Ni–½Cr–½Mo–V	Plate	SA–517	F	K11576	...	≤64	11B	3
13	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	≤64	11B	3
14	¾Ni–½Cu–Mo	Smls. & wld. tube	SA–423	2	K11540	...	...	4	2
15	¾Ni–½Cu–Mo	Wld. tube	SA–423	2	K11540	...	...	4	2
16	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	1	...	3	3
17	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	1	...	3	3
18	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	2	...	3	3
19	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	2	...	3	3
20	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	1	...	3	3
21	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	2	...	3	3
22	¾Ni–1Mo–¾Cr	Castings	SA–217	WC5	J22000	...	...	4	1
23	1Ni–½Cr–½Mo	Castings	SA–217	WC4	J12082	...	...	4	1
24	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	64 < *t* ≤ 100	11B	8
25	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	≤64	11B	8
26	1½Ni	Forgings	SA–350	LF5	K13050	1	...	9A	1
27	1½Ni	Forgings	SA–350	LF5	K13050	2	...	9A	1
28	1¾Ni–¾Cr–Mo	Forgings	SA–372	L	K24055	...	...	...	...
29	2Ni–1Cu	Forgings	SA–182	FR	K22035	...	...	9A	1
30	2Ni–1Cu	Fittings	SA–234	WPR	K22035	...	...	9A	1
31	2Ni–1Cu	Pipe	SA–333	9	K22035	...	...	9A	1
32	2Ni–1Cu	Smls. pipe	SA–333	9	K22035	...	...	9A	1
33	2Ni–1Cu	Wld. pipe	SA–333	9	K22035	...	...	9A	1
34	2Ni–1Cu	Tube	SA–334	9	K22035	...	...	9A	1
35	2Ni–1Cu	Forgings	SA–350	LF9	K22036	...	...	9A	1
36	2Ni–1Cu	Smls. & wld. fittings	SA–420	WPL9	K22035	...	...	9A	1
37	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	1	...	...	...
38	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2	...	...	...
39	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	3	...	...	...
40	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	4	...	...	...
41	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	5	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	725	485	NP	NP	371	343	CS–5	...
2	585	380	NP	371 (SPT)	NP	NP	CS–3	...
3	585	380	NP	NP	343	343	CS–3	G1
4	620	450	NP	NP	343	343	CS–5	G1
5	415	205	NP	NP	538	343	CS–2	T3
6	620	415	NP	343	343	343	CS–3	G1
7	725	585	NP	NP	371	343	CS–5	G1
8	795	655	NP	NP	371	343	CS–5	G1
9	550	345	NP	371	427	343	CS–5	G23
10	620	450	NP	371	371	NP	CS–5	...
11	725	620	NP	343 (SPT)	343	343	CS–5	S7
12	795	690	NP	343 (SPT)	343	343	HT–1	...
13	795	690	NP	NP	343	343	HT–1	...
14	415	255	343	NP	343	NP	CS–2	W13, W14
15	415	255	343	NP	343	NP	CS–2	G3, G24
16	550	345	NP	371	427	343	CS–5	G23
17	550	345	NP	371	427	343	CS–5	G23
18	620	450	NP	371	371	NP	CS–5	...
19	620	450	NP	371	371	NP	CS–5	...
20	550	345	NP	371	427	343	CS–5	G23
21	620	450	NP	371	371	NP	CS–5	...
22	485	275	593	371	593	NP	CS–2	G1, G17, T4
23	485	275	538	371	538	NP	CS–2	G1, G17, T4
24	725	620	NP	371 (SPT)	343	343	CS–5	...
25	795	690	NP	343 (SPT)	343	343	HT–1	...
26	415	205	NP	NP	260	260	CS–2	...
27	485	260	NP	NP	260	260	CS–2	...
28	1070	930	NP	NP	343	343	...	W11
29	435	315	NP	NP	38	38	CS–3	...
30	435	315	NP	NP	38	NP	CS–3	...
31	435	315	NP	NP	38	38	CS–3	...
32	435	315	NP	38	NP	NP	CS–3	...
33	435	315	NP	NP	38	38	CS–3	G24
34	435	315	NP	NP	38	38	CS–3	...
35	435	315	NP	NP	38	38	CS–3	...
36	435	315	NP	38	38	38	CS–3	W14
37	795	690	NP	371 (SPT)	NP	NP	HT–1	W1
38	930	825	NP	371 (SPT)	NP	NP	HT–1	W1
39	1070	965	NP	371 (SPT)	NP	NP	HT–1	W1
40	1205	1105	NP	371 (SPT)	NP	NP	HT–1	W1
41	1310	1240	NP	371 (SPT)	NP	NP	HT–1	W1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...
2	168	163	158	155	154	154	154	152	150	147	143	...	...	...	...
3	168	163	158	156	155	155	155	153	150	148	...	...	...	...	...
4	177	173	169	168	167	166	166	166	164	160	...	...	...	...	...
5	118	118	118	118	118	118	118	117	115	114	112	110	107	96.9	*88.8*
6	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
7	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...
8	227	227	227	227	227	227	227	227	227	227	227	...	...	...	...
9	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
10	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
11	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
12	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
13	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
14	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
15	101	101	101	101	101	101	101	101	101	101	...	...	...	...	...
16	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
17	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
18	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
19	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
20	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
21	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
22	138	138	138	138	138	138	138	138	138	138	138	138	138	135	120
23	138	138	138	138	138	138	138	138	138	138	138	138	138	135	113
24	207	207	207	207	207	207	207	207	207	206	202	...	...	...	...
25	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
26	118	116	113	111	108	106	105	...	...	...	...	...	...	...	...
27	138	135	132	129	126	123	123	...	...	...	...	...	...	...	...
28	305	305	305	305	305	305	305	305	302	294	...	...	...	...	...
29	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	123	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	105	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
38	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
39	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
40	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
41	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	*76.4*	*55.6*	*32.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	*89.3*	*58.8*	*39.6*	*27.4*	*16.3*	...	...	...	...	...	...	...	...	...	...	...	...
23	*76.6*	*49.7*	*31.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	2½Ni	Pipe	SA–333	7	K21903	...	...	9A	1
	2	2½Ni	Wld. pipe	SA–333	7	K21903	...	...	9A	1
	3	2½Ni	Tube	SA–334	7	K21903	...	...	9A	1
	4	2½Ni	Wld. tube	SA–334	7	K21903	...	...	9A	1
	5	2½Ni	Plate	SA–203	A	K21703	...	...	9A	1
(**13**)	6	2½Ni	Plate	SA–203	B	K22103	...	...	9A	1
	7	2½Ni	Castings	SA–352	LC2	J22500	...	...	9A	1
	8	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	3	...	3	3
	9	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	1	...	11A	5
	10	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	2	...	11B	10
	11	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	1	...	...	...
	12	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2	...	...	...
	13	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	3	...	...	...
	14	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	4	...	...	...
	15	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	5	...	...	...
	16	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	3	...	3	3
	17	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	85	...	...	...
	18	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	1	...	11A	5
	19	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	2	...	11B	10
	20	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	100	...	...	...
	21	3½Ni	Pipe	SA–333	3	K31918	...	...	9B	1
	22	3½Ni	Wld. pipe	SA–333	3	K31918	...	...	9B	1
	23	3½Ni	Tube	SA–334	3	K31918	...	...	9B	1
	24	3½Ni	Wld. tube	SA–334	3	K31918	...	...	9B	1
	25	3½Ni	Fittings	SA–420	WPL3	...	...	...	9B	1
	26	3½Ni	Plate	SA–203	D	K31718	...	...	9B	1
	27	3½Ni	Forgings	SA–350	LF3	K32025	1	...	9B	1
	28	3½Ni	Forgings	SA–350	LF3	K32025	2	...	9B	1
	29	3½Ni	Forgings	SA–765	III	K32026	...	...	9B	1
(**13**)	30	3½Ni	Plate	SA–203	E	K32018	...	...	9B	1
	31	3½Ni	Plate	SA–203	E	K32018	...	...	9B	1
	32	3½Ni	Castings	SA–352	LC3	J31550	...	...	9B	1
	33	3½Ni	Plate	SA–203	F	...	...	>50	9B	1
	34	3½Ni	Plate	SA–203	F	...	...	≤50	9B	1
	35	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	3	...	3	3
	36	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	1	...	11A	5
	37	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	2	...	11B	10
	38	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	1	...	...	...
	39	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2	...	...	...
	40	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	3	...	...	...
	41	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	4	...	...	...
	42	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	5	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	450	240	NP	NP	343	343	CS-2	...
2	450	240	NP	NP	343	343	CS-2	G24
3	450	240	NP	NP	343	343	CS-2	...
4	450	240	NP	NP	343	343	CS-2	G24
5	450	255	NP	371	538	343	CS-2	T2
6	485	275	NP	343	538	343	CS-2	T2
7	485	275	NP	38	343	343	CS-2	G1
8	620	485	NP	NP	343	NP	CS-5	...
9	725	585	NP	NP	343	NP	CS-5	...
10	795	690	NP	NP	343	NP	HT-1	...
11	795	690	NP	371 (SPT)	NP	NP	HT-1	W1
12	930	825	NP	371 (SPT)	NP	NP	HT-1	W1
13	1070	965	NP	371 (SPT)	NP	NP	HT-1	W1
14	1205	1105	NP	371 (SPT)	NP	NP	HT-1	W1
15	1310	1240	NP	371 (SPT)	NP	NP	HT-1	W1
16	620	485	NP	NP	343	NP	CS-5	...
17	725	585	NP	NP	343	343	...	W11
18	725	585	NP	NP	343	NP	CS-5	...
19	795	690	NP	NP	343	NP	HT-1	...
20	825	690	NP	NP	343	343	...	W11
21	450	240	NP	NP	343	343	CS-2	...
22	450	240	NP	NP	343	343	CS-2	G24
23	450	240	NP	NP	343	343	CS-2	...
24	450	240	NP	NP	343	343	CS-2	G24
25	450	240	NP	NP	343	343	CS-2	...
26	450	255	NP	371	538	343	CS-2	T2
27	485	260	NP	343	343	343	CS-2	...
28	485	260	NP	343	343	343	CS-2	...
29	485	260	NP	NP	343	343	CS-2	...
30	485	275	NP	149 (SPT)	NP	NP	CS-2	...
31	485	275	NP	343	538	343	CS-2	T2
32	485	275	NP	38	343	343	CS-2	G1
33	515	345	NP	NP	343	343	CS-3	...
34	550	380	NP	NP	343	343	CS-3	...
35	620	485	NP	NP	343	343	CS-5	...
36	725	585	NP	316 (SPT)	343	NP	CS-5	...
37	795	690	NP	NP	343	NP	HT-1	...
38	795	690	NP	371 (SPT)	NP	NP	HT-1	W1
39	930	825	NP	371 (SPT)	NP	NP	HT-1	W1
40	1070	965	NP	371 (SPT)	NP	NP	HT-1	W1
41	1205	1105	NP	371 (SPT)	NP	NP	HT-1	W1
42	1310	1240	NP	371 (SPT)	NP	NP	HT-1	W1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
2	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
3	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
4	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
5	128	128	128	128	128	128	128	128	126	120	112	*95.1*	*79.6*	*64.8*	*49.1*
6	138	138	138	138	138	138	138	138	136	129	122	*101*	*83.8*	*67.3*	*49.4*
7	138	138	138	138	138	138	138	138	136	129	...	...	...	...	...
8	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
9	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
10	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
11	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
12	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
13	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
14	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
15	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...
16	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
17	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
18	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
19	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
20	236	236	236	236	236	234	233	231	229	226	...	...	...	...	...
21	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
22	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
23	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
24	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
25	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
26	128	128	128	128	128	128	128	128	126	120	112	*95.1*	*79.6*	*64.8*	*49.1*
27	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
28	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
29	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
30	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...
31	138	138	138	138	138	138	138	138	136	129	122	*101*	*83.8*	*67.3*	*49.4*
32	138	138	138	138	138	138	138	138	136	129	...	...	...	...	...
33	148	148	148	148	148	148	148	148	146	140	...	...	...	...	...
34	158	158	158	158	158	158	158	158	152	137	...	...	...	...	...
35	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
36	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
37	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
38	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
39	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
40	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
41	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
42	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	*35.8*	*23.7*	*11.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	*35.6*	*23.7*	*11.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	*35.8*	*23.7*	*11.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
31	*35.6*	*23.7*	*11.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	5Ni–$^{1}/_{4}$Mo	Plate	SA–645	A	K41583	...	...	11A	2
	2	8Ni	Forgings	SA–522	II	K71340	...	...	11A	1
	3	8Ni	Plate	SA–553	II	K71340	...	...	11A	1
	4	8Ni	Plate	SA–553	II	K71340	...	...	11A	1
(**13**)	5	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	NNT640	≤50	11A	1
(**13**)	6	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT640	≤50	11A	1
(**13**)	7	9Ni	Plate	SA/EN 10028–4	X7Ni9	...	QT	≤50	11A	1
(**13**)	8	9Ni	Plate	SA/EN 10028–4	X7Ni9	...	QT	≤50	11A	1
(**13**)	9	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT680	≤50	11A	1
(**13**)	10	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT680	≤50	11A	1
	11	9Ni	Smls. & wld. pipe	SA–333	8	K81340	...	...	11A	1
	12	9Ni	Smls. & wld. pipe	SA–333	8	K81340	...	...	11A	1
	13	9Ni	Smls. pipe	SA–333	8	K81340	...	...	11A	1
	14	9Ni	Smls. pipe	SA–333	8	K81340	...	...	11A	1
	15	9Ni	Wld. pipe	SA–333	8	K81340	...	...	11A	1
	16	9Ni	Wld. tube	SA–334	8	K81340	...	...	11A	1
	17	9Ni	Smls. & wld. tube	SA–334	8	K81340	...	...	11A	1
	18	9Ni	Smls. tube	SA–334	8	K81340	...	...	11A	1
	19	9Ni	Smls. tube	SA–334	8	K81340	...	...	11A	1
	20	9Ni	Wld. tube	SA–334	8	K81340	...	...	11A	1
	21	9Ni	Plate	SA–353	...	K81340	...	...	11A	1
	22	9Ni	Plate	SA–353	...	K81340	...	...	11A	1
	23	9Ni	Plate	SA–353	...	K81340	...	...	11A	1
	24	9Ni	Smls. & wld. fittings	SA–420	WPL8	K81340	...	...	11A	1
	25	9Ni	Smls. & wld. fittings	SA–420	WPL8	K81340	...	...	11A	1
	26	9Ni	Forgings	SA–522	I	K81340	...	...	11A	1
	27	9Ni	Forgings	SA–522	I	K81340	...	...	11A	1
	28	9Ni	Plate	SA–553	I	K81340	...	...	11A	1
	29	9Ni	Plate	SA–553	I	K81340	...	...	11A	1
	30	25Ni–15Cr–2Ti	Bar	SA–638	660	S66286	...	...	...	...
	31	27Ni–22Cr–7Mo–Mn–Cu–N	Smls. tube	SA–213	...	S31277	...	...	45	...
	32	27Ni–22Cr–7Mo–Mn–Cu–N	Smls. tube	SA–213	...	S31277	...	...	45	...
	33	27Ni–22Cr–7Mo–Mn–Cu–N	Plate	SA–240	...	S31277	...	...	45	...
	34	27Ni–22Cr–7Mo–Mn–Cu–N	Plate	SA–240	...	S31277	...	...	45	...
	35	27Ni–22Cr–7Mo–Mn–Cu–N	Wld. tube	SA–249	...	S31277	...	...	45	...
	36	27Ni–22Cr–7Mo–Mn–Cu–N	Wld. tube	SA–249	...	S31277	...	...	45	...
	37	29Ni–20Cr–3Cu–2Mo	Castings	SA–351	CN7M	J95150	...	...	45	...
	38	29Ni–20Cr–3Cu–2Mo	Castings	SA–351	CN7M	J95150	...	...	45	...
	39	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...	...	8	3
	40	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...	...	8	3
	41	16Cr–9Mn–2Ni–N	Plate	SA–240	204	S20400	...	...	8	3
	42	16Cr–9Mn–2Ni–N	Plate	SA–240	204	S20400	...	...	8	3

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	655	450	NP	NP	121	121	CS–3	...
2	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W5
3	690	585	NP	93 (Cl. 3 only)	121	121	CS–3	G20, W5
4	690	585	NP	93 (Cl. 3 only)	121	121	CS–3	G20, W4
5	640	480	NP	NP	121	121	CS–3	G20
6	640	480	NP	NP	121	121	CS–3	G20
7	680	575	NP	NP	121	121	CS–3	G20, W4
8	680	575	NP	NP	121	121	CS–3	G20, W5
9	680	575	NP	NP	121	121	CS–3	G20, W4
10	680	575	NP	NP	121	121	CS–3	G20, W5
11	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W12
12	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W5, W12
13	690	515	NP	NP	121	121	CS–3	G20, W4
14	690	515	NP	NP	121	121	CS–3	G20, W5
15	690	515	NP	NP	121	121	CS–3	G20, G24, W3
16	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W12
17	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W5, W12
18	690	515	NP	NP	121	121	CS–3	G20, W4
19	690	515	NP	NP	121	121	CS–3	G20, W5
20	690	515	NP	NP	121	121	CS–3	G20, G24, W3
21	690	515	NP	93 (Cl. 3 only)	121	121	CS–3	G20, W4
22	690	515	NP	NP	121	121	CS–3	G20, W5
23	690	515	NP	93 (Cl. 3 only)	NP	NP	CS–3	G20, W5
24	690	515	NP	NP	121	121	CS–3	G20, W4
25	690	515	NP	NP	121	121	CS–3	G20, W3
26	690	515	NP	93 (Cl. 3 only)	121	121	CS–3	G20, S8, W4
27	690	515	NP	NP	121	121	CS–3	G20, S8, W5
28	690	585	NP	93 (Cl. 3 only)	121	121	CS–3	G20, W4
29	690	585	NP	93 (Cl. 3 only)	121	121	CS–3	G20, W5
30	895	585	NP	371	371	NP	HA–5	W1
31	772	359	NP	NP	427	NP	NFN–26	G5
32	772	359	NP	NP	427	NP	NFN–26	...
33	772	359	NP	NP	427	NP	NFN–26	G5
34	772	359	NP	NP	427	NP	NFN–26	...
35	772	359	NP	NP	427	NP	NFN–26	G3, G5
36	772	359	NP	NP	427	NP	NFN–26	...
37	425	170	316	316 (Cl. 3 only)	316	NP	NFN–9	G1, G5
38	425	170	316	NP	316	NP	NFN–9	G1
39	655	310	NP	NP	427	343	HA–6	G5
40	655	310	NP	NP	427	343	HA–6	...
41	655	330	NP	NP	482	343	HA–6	G5
42	655	330	NP	NP	482	343	HA–6	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	187	187	186	183	...	...	...	...	...	...	...	...	...	...	...
2	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
3	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
4	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
5	183	183	183	183	...	...	...	...	...	...	...	...	...	...	...
6	183	183	183	183	...	...	...	...	...	...	...	...	...	...	...
7	194	194	194	194	...	...	...	...	...	...	...	...	...	...	...
8	187	187	187	187	...	...	...	...	...	...	...	...	...	...	...
9	194	194	194	194	...	...	...	...	...	...	...	...	...	...	...
10	187	187	187	187	...	...	...	...	...	...	...	...	...	...	...
11	197	197	182	...	...	...	...	...	...	...	...	...	...	...	...
12	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
13	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
14	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
15	168	168	155	152	...	...	...	...	...	...	...	...	...	...	...
16	197	197	182	...	...	...	...	...	...	...	...	...	...	...	...
17	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
18	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
19	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
20	168	168	155	152	...	...	...	...	...	...	...	...	...	...	...
21	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
22	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
23	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
24	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
25	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
26	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
27	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
28	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
29	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
30	256	256	256	256	256	256	253	248	246	243	241	...	...	...	...
31	221	221	220	...	212	203	197	191	189	186	185	183	181	181	...
32	221	221	219	...	198	184	177	175	175	175	175	173	172	172	...
33	221	221	220	...	212	203	197	191	189	186	185	183	181	181	...
34	221	221	219	...	198	184	177	175	175	175	175	173	172	172	...
35	188	188	187	...	180	173	167	162	160	158	157	155	154	154	...
36	188	188	186	...	169	156	150	149	149	149	149	147	146	146	...
37	115	114	109	101	93.5	88.5	84.3	80.9	79.4	...	...	...	...	...	...
38	115	107	97.7	92.8	88.8	81.9	75.6	70.4	68.0	...	...	...	...	...	...
39	187	177	164	152	146	139	136	136	135	135	134	132	130	128	...
40	187	177	161	152	146	139	136	134	131	127	124	120	115	112	...
41	187	175	160	150	142	131	125	124	123	123	123	123	122	120	117
42	187	175	160	149	140	124	115	110	108	107	107	105	104	102	99.5

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding

Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	114	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	96.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	>125	8	1
2	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	>125	8	1
3	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...	...	8	1
4	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...	...	8	1
5	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316L	...	...	...	8	1
6	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	≤125	8	1
7	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	≤125	8	1
8	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...	...	8	1
9	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...	...	8	1
10	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...	...	8	1
11	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...	...	8	1
12	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	8	1
13	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	8	1
14	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	8	1
15	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316L	S31603	...	...	8	1
16	16Cr–12Ni–2Mo	Smls. pipe	SA–312	TP316L	S31603	...	...	8	1
17	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316L	S31603	...	...	8	1
18	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316L	S31603	...	...	8	1
19	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	1	...	8	1
20	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316L	S31603	...	...	8	1
21	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316L	S31603	...	...	8	1
22	16Cr–12Ni–2Mo	Bar	SA–479	316L	S31603	...	...	8	1
23	16Cr–12Ni–2Mo	Bar	SA–479	316L	S31603	...	...	8	1
24	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...	...	8	1
25	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...	...	8	1
26	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...	...	8	1
27	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316L	S31603	...	...	8	1
28	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316L	S31603	...	...	8	1
29	16Cr–12Ni–2Mo	Castings	SA–351	CF3M	J92800	...	...	8	1
30	16Cr–12Ni–2Mo	Castings	SA–351	CF3M	J92800	...	...	8	1
31	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF3M	J92800	...	...	8	1
32	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...	...	8	1
33	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...	...	8	1
34	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF8M	J92900	...	...	8	1
35	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	>125	8	1
36	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	>125	8	1
37	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...	...	8	1
38	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...	...	8	1
39	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	>125	8	1
40	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	>125	8	1
41	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...	...	8	1
42	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	450	170	454	427	454	343	HA–4	G5, G21
2	450	170	454	NP	454	343	HA–4	G21
3	450	170	454	427	454	343	HA–4	G5, G21
4	450	170	454	NP	454	343	HA–4	G21
5	480	175	454	427	454	NP	HA–4	G5, G21, G22
6	485	170	454	427	454	343	HA–4	G5, G21
7	485	170	454	NP	454	343	HA–4	G21
8	485	170	454	427	454	NP	HA–4	G5, G21
9	485	170	454	NP	454	NP	HA–4	G21
10	485	170	454	427	454	343	HA–4	G5, G21
11	485	170	454	NP	454	343	HA–4	G21
12	485	170	NP	427	NP	NP	HA–4	G5, W12
13	485	170	454	NP	454	343	HA–4	G5, G21, G24
14	485	170	454	NP	454	343	HA–4	G21, G24
15	485	170	454	427	454	343	HA–4	G5, G21, W12, W14
16	485	170	454	NP	454	343	HA–4	G21
17	485	170	454	NP	454	343	HA–4	G5, G21, G24
18	485	170	454	NP	454	343	HA–4	G21, G24
19	485	170	NP	427	NP	NP	HA–4	G5
20	485	170	NP	427	454	343	HA–4	G5, W12, W14
21	485	170	NP	427	NP	NP	HA–4	G5
22	485	170	454	427	454	343	HA–4	G5, G21, G22
23	485	170	454	NP	454	343	HA–4	G21, G22
24	485	170	NP	427	NP	NP	HA–4	G5, W12
25	485	170	NP	NP	454	343	HA–4	G5, G24
26	485	170	NP	NP	454	343	HA–4	G24
27	485	170	NP	427	NP	NP	HA–4	G5, W12
28	485	170	NP	427	NP	NP	HA–4	G5, W12
29	485	205	NP	427	454	343	HA–4	G1, G5, G16, G17, G19
30	485	205	NP	NP	454	343	HA–4	G1, G19
31	485	205	NP	427	427	NP	HA–4	G1, G5, G16, G17, G19
32	485	205	816	427	816	343	HA–2	G1, G5, G12, G16, G17, G19, H1, T6
33	485	205	816	NP	816	343	HA–2	G1, G12, G19, H1, T8
34	485	205	NP	427	427	NP	HA–2	G1, G5, G16, G17, G19
35	485	205	816	427	816	343	HA–2	G5, G12, T8
36	485	205	816	NP	816	343	HA–2	G12, T9
37	485	205	816	427	816	343	HA–2	G5, G12, T8
38	485	205	816	NP	816	343	HA–2	G12, T9
39	485	205	816	427	816	NP	HA–2	G5, G12, T8
40	485	205	816	NP	816	NP	HA–2	T9
41	485	205	NP	427	816	NP	HA–2	G5, T8
42	485	205	NP	NP	816	NP	HA–2	T9

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
2	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
3	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
4	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
5	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
6	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
7	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
8	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
9	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
10	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
11	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
12	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
13	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.2	75.9	74.7	73.4
14	97.9	90.3	82.1	77.8	74.3	68.7	64.8	61.4	60.4	59.7	58.4	57.2	55.9	55.2	54.7
15	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
16	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
17	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.2	75.9	74.7	73.4
18	97.9	90.3	82.1	77.8	74.3	68.7	64.8	61.4	60.4	59.7	58.4	57.2	55.9	55.2	54.7
19	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
20	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
21	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
22	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
23	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
24	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
25	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.2	75.9	74.7	73.4
26	97.9	90.3	82.1	77.8	74.3	68.7	64.8	61.4	60.4	59.7	58.4	57.2	55.9	55.2	54.7
27	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
28	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
29	138	138	138	136	134	133	125	119	116	114	112	111	110	108	107
30	138	128	117	111	107	98.5	92.7	88.2	86.1	84.4	83.2	82.0	81.1	80.2	79.5
31	138	138	138	136	134	133	125	119	116	114	112	111	110	108	...
32	138	138	138	136	134	133	125	119	116	114	112	111	110	108	107
33	138	128	117	111	107	98.5	92.7	88.2	86.1	84.4	83.2	82.0	81.1	80.2	79.5
34	138	138	138	136	134	133	125	119	116	114	112	111	110	108	...
35	138	138	138	136	134	133	126	119	116	114	112	111	110	108	108
36	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
37	138	138	138	136	134	133	126	119	116	114	112	111	110	108	108
38	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
39	138	138	138	136	134	133	126	119	116	114	112	111	110	108	108
40	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
41	138	138	138	136	134	133	126	119	116	114	112	111	110	108	108
42	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	107	104	*94.7*	*73.7*	*57.9*	*46.0*	*36.9*	*30.1*	*24.3*	*20.3*	*17.0*	*14.3*	*12.1*	*10.3*	...	...	...
33	78.9	78.2	77.6	73.7	*57.9*	*46.0*	*36.9*	*30.1*	*24.3*	*20.3*	*17.0*	*14.3*	*12.1*	*10.3*	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
36	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
37	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
38	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
39	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
40	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
41	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
42	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	≤125	8	1
2	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	≤125	8	1
3	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...	...	8	1
4	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...	...	8	1
5	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...	...	8	1
6	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...	...	8	1
7	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
8	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
9	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
10	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
11	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316	S31600	...	...	8	1
12	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316	S31600	...	...	8	1
13	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316	S31600	...	...	8	1
14	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316	S31600	...	...	8	1
15	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	1	...	8	1
16	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...	...	8	1
17	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...	...	8	1
18	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316	S31600	...	...	8	1
19	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316	S31600	...	...	8	1
20	16Cr–12Ni–2Mo	Bar	SA–479	316	S31600	...	...	8	1
21	16Cr–12Ni–2Mo	Bar	SA–479	316	S31600	...	...	8	1
22	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	8	1
23	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	8	1
24	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	8	1
25	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316	S31600	...	...	8	1
26	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316	S31600	...	...	8	1
27	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	≤125	8	1
28	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	≤125	8	1
29	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...	...	8	1
30	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...	...	8	1
31	16Cr–12Ni–2Mo	Plate	SA–240	316H	S31609	...	...	8	1
32	16Cr–12Ni–2Mo	Plate	SA–240	316H	S31609	...	...	8	1
33	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
34	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
35	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
36	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
37	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316H	S31609	...	...	8	1
38	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316H	S31609	...	...	8	1
39	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316H	S31609	...	...	8	1
40	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316H	S31609	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	816	427	816	NP	HA–2	G5, G12, T8
2	515	205	816	NP	816	NP	HA–2	G12, T9
3	515	205	816	427	816	NP	HA–2	G5, G12, T8
4	515	205	816	NP	816	NP	HA–2	G12, T9
5	515	205	816	427	816	343	HA–2	G5, G12, T8
6	515	205	816	NP	816	343	HA–2	G12, T9
7	515	205	816	NP	NP	NP	HA–2	G12, T9, W13
8	515	205	816	427	NP	NP	HA–2	G5, G12, T8, W12, W13
9	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T7
10	515	205	816	NP	816	343	HA–2	G3, G12, G24, T9
11	515	205	816	427	816	343	HA–2	G5, G12, T8, W12, W13, W14
12	515	205	816	NP	816	343	HA–2	G12, T9, W13, W14
13	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T7
14	515	205	816	NP	816	343	HA–2	G3, G12, G24, T9
15	515	205	NP	427	NP	NP	HA–2	G5, W12
16	515	205	816	427	816	343	HA–2	G5, G12, H1, T8, W12
17	515	205	816	NP	816	343	HA–2	G12, H1, T9
18	515	205	NP	427	816	343	HA–2	G5, G12, T8, W12, W14
19	515	205	NP	427	NP	NP	HA–2	G5, W12
20	515	205	816	427	816	343	HA–2	G5, G12, G22, H1, T8
21	515	205	816	NP	816	343	HA–2	G12, G22, H1, T9
22	515	205	NP	427	NP	NP	HA–2	G5, W12
23	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T7
24	515	205	NP	NP	816	343	HA–2	G12, G24, T9
25	515	205	NP	427	NP	NP	HA–2	G5, W12
26	515	205	NP	427	NP	NP	HA–2	G5, W12
27	515	205	816	427	816	NP	HA–2	G5, T8
28	515	205	816	NP	816	NP	HA–2	T9
29	515	205	816	427	816	NP	HA–2	G5, T8
30	515	205	816	NP	816	NP	HA–2	T9
31	515	205	816	427	816	NP	HA–2	G5, T8
32	515	205	816	NP	816	NP	HA–2	T9
33	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T7
34	515	205	816	NP	816	NP	HA–2	G3, G24, T9
35	515	205	816	NP	NP	NP	HA–2	T9, W13
36	515	205	816	427	NP	NP	HA–2	G5, T8, W12, W13
37	515	205	816	427	816	NP	HA–2	G5, T8, W12, W13
38	515	205	816	NP	816	NP	HA–2	T9, W13
39	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T7
40	515	205	816	NP	816	NP	HA–2	G3, G24, T9

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
2	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
3	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
4	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
5	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
6	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
7	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
8	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
9	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
10	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
11	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
12	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
13	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
14	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
15	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
16	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
17	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
18	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
19	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
20	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
21	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
22	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
23	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
24	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
25	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
26	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
27	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
28	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
29	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
30	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
31	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
32	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
33	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
34	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
35	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
36	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
37	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
38	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
39	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
40	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
2	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
3	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
4	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
5	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
6	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
7	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
8	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
9	90.5	89.9	89.3	*85.3*	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
10	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
11	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
12	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
13	90.5	89.9	89.3	*85.3*	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
14	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
17	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
18	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
21	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	90.5	89.9	89.3	*85.3*	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
24	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
28	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
29	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
30	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
31	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
32	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
33	90.5	89.9	89.3	*85.3*	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
34	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
35	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
36	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
37	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
38	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
39	90.5	89.9	89.3	*85.3*	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
40	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	1	...	8	1
2	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...	...	8	1
3	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...	...	8	1
4	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316H	S31609	...	...	8	1
5	16Cr–12Ni–2Mo	Bar	SA–479	316H	S31609	...	...	8	1
6	16Cr–12Ni–2Mo	Bar	SA–479	316H	S31609	...	...	8	1
7	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316H	S31609	...	...	8	1
8	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316H	S31609	...	...	8	1
9	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316	...	...	...	8	1
10	16Cr–12Ni–2Mo	Plate	SA/EN 10028–7	X5CrNiMo17–12–2	...	...	≤75	8	1
11	16Cr–12Ni–2Mo	Plate	SA/EN 10028–7	X5CrNiMo17–12–2	...	...	≤75	8	1
12	16Cr–12Ni–2Mo–Cb	Plate	SA–240	316Cb	S31640	...	...	8	1
13	16Cr–12Ni–2Mo–Cb	Plate	SA–240	316Cb	S31640	...	...	8	1
14	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	>125	8	1
15	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316LN	S31653	...	...	8	1
16	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	≤125	8	1
17	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316LN	S31653	...	...	8	1
18	16Cr–12Ni–2Mo–N	Plate	SA–240	316LN	S31653	...	...	8	1
19	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316LN	S31653	...	...	8	1
20	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316LN	S31653	...	...	8	1
21	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	1	...	8	1
22	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316LN	S31653	...	...	8	1
23	16Cr–12Ni–2Mo–N	Fittings	SA–403	316LN	S31653	...	...	8	1
24	16Cr–12Ni–2Mo–N	Bar	SA–479	316LN	S31653	...	...	8	1
25	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316LN	S31653	...	...	8	1
26	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316N	S31651	...	...	8	1
27	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...	...	8	1
28	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...	...	8	1
29	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...	...	8	1
30	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...	...	8	1
31	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	8	1
32	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	8	1
33	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	8	1
34	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	8	1
35	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316N	S31651	...	...	8	1
36	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316N	S31651	...	...	8	1
37	16Cr–12Ni–2Mo–N	Wld. pipe	SA–312	TP316N	S31651	...	...	8	1
38	16Cr–12Ni–2Mo–N	Wld. pipe	SA–312	TP316N	S31651	...	...	8	1
39	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	1	...	8	1
40	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...	...	8	1
41	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	NP	427	NP	NP	HA–2	G5, W12
2	515	205	816	427	816	NP	HA–2	G5, H1, T8
3	515	205	816	NP	816	NP	HA–2	H1, T9
4	515	205	NP	427	816	NP	HA–2	G5, G12, T8, W12, W14
5	515	205	816	427	NP	NP	HA–2	G5, H1, T8
6	515	205	816	NP	NP	NP	HA–2	H1, T9
7	515	205	NP	427	NP	NP	HA–2	G5, W12
8	515	205	NP	427	NP	NP	HA–2	G5, W12
9	520	205	816	427	816	NP	HA–2	G5, G12, G22, H1, T8
10	520	220	NP	NP	550	NP	HA–2	G5
11	520	220	NP	NP	550	NP	HA–2	...
12	515	205	NP	NP	816	343	HA–2	G5, G12, T8
13	515	205	NP	NP	816	343	HA–2	G12, T9
14	485	205	NP	427	NP	NP	HA–2	G5
15	485	205	NP	427	NP	NP	HA–2	G5
16	515	205	NP	427	NP	NP	HA–2	G5
17	515	205	NP	427	NP	NP	HA–2	G5
18	515	205	NP	427	NP	NP	HA–2	G5
19	515	205	NP	427	NP	NP	HA–2	G5, W12
20	515	205	NP	427	NP	NP	HA–2	G5, W12
21	515	205	NP	427	NP	NP	HA–2	G5, W12
22	515	205	NP	427	NP	NP	HA–2	G5
23	515	205	NP	427	NP	NP	HA–2	G5, W12
24	515	205	NP	427	NP	NP	HA–2	G5
25	515	205	NP	427	NP	NP	HA–2	G5, W12
26	550	240	NP	427	NP	NP	HA–2	G5
27	550	240	649	427	649	NP	HA–2	G5, G12, T7
28	550	240	649	NP	649	NP	HA–2	G12, T8
29	550	240	NP	427	649	343	HA–2	G5, G12, T7
30	550	240	NP	NP	649	343	HA–2	G12, T8
31	550	240	649	NP	NP	NP	HA–2	G5, G12, T7, W13
32	550	240	649	NP	NP	NP	HA–2	G12, T8, W13
33	550	240	649	NP	649	343	HA–2	G3, G12, G24, T8
34	550	240	649	NP	649	343	HA–2	G3, G5, G12, G24, T7
35	550	240	649	427	649	343	HA–2	G5, G12, T7, W12, W13, W14
36	550	240	649	NP	649	343	HA–2	G12, T8, W13, W14
37	550	240	649	NP	649	343	HA–2	G3, G12, G24, T8
38	550	240	649	NP	649	343	HA–2	G3, G5, G12, G24, T7
39	550	240	NP	427	NP	NP	HA–2	G5, W12
40	550	240	649	427	649	343	HA–2	G5, G12, H1, T7
41	550	240	649	NP	649	343	HA–2	G12, H1, T8

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
2	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
3	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
4	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
5	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
6	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
7	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
8	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
9	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
10	147	147	147	146	144	142	133	126	124	121	120	119	117	115	114
11	147	134	125	119	114	106	98.7	93.7	91.7	90.0	88.6	87.4	86.4	85.5	84.8
12	138	138	138	138	138	134	125	117	116	114	112	111	110	109	108
13	138	130	120	114	109	99.3	92.2	86.7	85.0	84.1	82.9	82.0	81.4	80.6	79.8
14	138	138	138	134	130	124	119	115	113	110	107	105	102	99.7	...
15	138	138	138	134	130	124	119	115	113	110	107	105	102	99.7	...
16	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
17	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
18	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
19	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
20	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
21	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
22	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
23	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
24	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
25	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...
26	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
27	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
28	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
29	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
30	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
31	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
32	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
33	134	128	120	115	111	104	97.6	93.1	90.7	88.4	86.6	84.7	83.5	82.3	80.5
34	134	134	133	131	129	126	125	124	122	119	117	115	113	111	109
35	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
36	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
37	134	128	120	115	111	104	97.6	93.1	90.7	88.4	86.6	84.7	83.5	82.3	80.5
38	134	134	133	131	129	126	125	124	122	119	117	115	113	111	109
39	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
40	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
41	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
3	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
4	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
5	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
6	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
10	114	113	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	84.1	83.4	82.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
13	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
28	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
29	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
30	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
31	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
32	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
33	79.1	77.8	76.8	74.7	*70.0*	*55.3*	*42.9*	...	...	...	...	...	...	...	...	...	...
34	107	105	101	*85.7*	*70.0*	*55.3*	*42.9*	...	...	...	...	...	...	...	...	...	...
35	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
36	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
37	79.1	77.8	76.8	74.7	*70.0*	*55.3*	*42.9*	...	...	...	...	...	...	...	...	...	...
38	107	105	101	*85.7*	*70.0*	*55.3*	*42.9*	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
41	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo–N	Smls. & wld. fittings	SA–403	316N	S31651	...	...	8	1
2	16Cr–12Ni–2Mo–N	Bar	SA–479	316N	S31651	...	...	8	1
3	16Cr–12Ni–2Mo–N	Bar	SA–479	316N	S31651	...	...	8	1
4	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316N	S31651	...	...	8	1
5	16Cr–12Ni–2Mo–N	Wld. pipe	SA–813	TP316N	S31651	...	...	8	1
6	16Cr–12Ni–2Mo–N	Wld. pipe	SA–814	TP316N	S31651	...	...	8	1
7	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...	...	8	1
8	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...	...	8	1
9	16Cr–12Ni–2Mo–Ti	Plate	SA–240	316Ti	S31635	...	...	8	1
10	16Cr–12Ni–2Mo–Ti	Plate	SA–240	316Ti	S31635	...	...	8	1
11	17Cr–4Ni–6Mn	Plate	SA–240	201–1	S20100	...	...	8	3
12	17Cr–4Ni–6Mn	Plate	SA–240	201–1	S20100	...	...	8	3
13	17Cr–4Ni–6Mn	Plate	SA–666	201–1	S20100	...	...	8	3
14	17Cr–4Ni–6Mn	Plate	SA–666	201–1	S20100	...	...	8	3
15	17Cr–4Ni–6Mn	Plate	SA–240	201–2	S20100	...	...	8	3
16	17Cr–4Ni–6Mn	Plate	SA–666	201–2	S20100	...	...	8	3
17	17Cr–7Ni	Plate, sheet, strip	SA–240	301	S30100	...	...	8	1
18	17Cr–7Ni	Plate, sheet, strip	SA–240	301	S30100	...	...	8	1
19	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...	...	8	3
20	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...	...	8	3
21	18Cr–3Ni–12Mn	Wld. tube	SA–249	XM–29	S24000	...	...	8	3
22	18Cr–3Ni–12Mn	Wld. tube	SA–249	XM–29	S24000	...	...	8	3
23	18Cr–3Ni–12Mn	Wld. pipe	SA–312	XM–29	S24000	...	...	8	3
24	18Cr–3Ni–12Mn	Wld. pipe	SA–312	XM–29	S24000	...	...	8	3
25	18Cr–3Ni–12Mn	Bar	SA–479	XM–29	S24000	...	...	8	3
26	18Cr–3Ni–12Mn	Bar	SA–479	XM–29	S24000	...	...	8	3
27	18Cr–3Ni–12Mn	Wld. tube	SA–688	TPXM–29	S24000	...	...	8	3
28	18Cr–3Ni–12Mn	Wld. tube	SA–688	TPXM–29	S24000	...	...	8	3
29	18Cr–5Ni–3Mo	Smls. tube	SA–789	...	S31500	...	...	10H	1
30	18Cr–5Ni–3Mo	Wld. tube	SA–789	...	S31500	...	...	10H	1
31	18Cr–5Ni–3Mo	Smls. pipe	SA–790	...	S31500	...	...	10H	1
32	18Cr–5Ni–3Mo	Wld. pipe	SA–790	...	S31500	...	...	10H	1
33	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	>125	8	1
34	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	>125	8	1
35	18Cr–8Ni	Forgings	SA–965	F304L	S30403	...	...	8	1
36	18Cr–8Ni	Forgings	SA–965	F304L	S30403	...	...	8	1
37	18Cr–8Ni	Bar	SA/JIS G4303	SUS304L	...	...	...	8	1
38	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	≤125	8	1
39	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	≤125	8	1
40	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...	...	8	1
41	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...	...	8	1
42	18Cr–8Ni	Plate	SA–240	304L	S30403	...	...	8	1
43	18Cr–8Ni	Plate	SA–240	304L	S30403	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	550	240	NP	427	649	343	HA–2	G5, G12, T7, W12, W14
2	550	240	649	427	NP	NP	HA–2	G5, G12, H1, T7
3	550	240	649	NP	NP	NP	HA–2	G12, H1, T8
4	550	240	NP	427	NP	NP	HA–2	G5, W12
5	550	240	NP	427	NP	NP	HA–2	G5, W12
6	550	240	NP	427	NP	NP	HA–2	G5, W12
7	550	240	NP	427	649	343	HA–2	G5, G12, T7
8	550	240	NP	NP	649	343	HA–2	G12, T8
9	515	205	NP	NP	816	343	HA–2	G5, G12, T8
10	515	205	NP	NP	816	343	HA–2	G12, T9
11	515	260	NP	NP	149	149	HA–2	...
12	515	260	NP	NP	149	149	HA–2	G5
13	515	260	NP	NP	149	149	HA–2	...
14	515	260	NP	NP	149	149	HA–2	G5
15	655	310	NP	NP	149	149	HA–6	...
16	655	310	NP	NP	149	149	HA–6	...
17	515	205	NP	NP	427	NP	HA–1	G5
18	515	205	NP	NP	427	NP	HA–1	...
19	690	380	NP	NP	427	343	HA–6	G5
20	690	380	NP	NP	427	343	HA–6	...
21	690	380	NP	NP	427	343	HA–6	G5, G24
22	690	380	NP	NP	427	343	HA–6	G24
23	690	380	NP	NP	427	343	HA–6	G5, G24
24	690	380	NP	NP	427	343	HA–6	G24
25	690	380	NP	NP	427	343	HA–6	G5, G22
26	690	380	NP	NP	427	343	HA–6	G22
27	690	380	NP	NP	427	343	HA–6	G5, G24
28	690	380	NP	NP	427	343	HA–6	G24
29	635	440	NP	NP	399	343	HA–5	G19
30	635	440	NP	NP	399	343	HA–5	G19, G24
31	635	440	NP	NP	399	343	HA–5	G19
32	635	440	NP	NP	399	343	HA–5	G19, G24
33	450	170	427	427	649	343	HA–3	G5, G21, T4
34	450	170	427	NP	649	343	HA–3	G21, T5
35	450	170	427	427	649	343	HA–3	G5, G21, T4
36	450	170	427	NP	649	343	HA–3	G21, T5
37	480	175	427	427	649	NP	HA–3	G5, G21, G22, T4
38	485	170	427	427	649	343	HA–3	G5, G21, T4
39	485	170	427	NP	649	343	HA–3	G21, T5
40	485	170	427	427	649	NP	HA–3	G5, G21, T4
41	485	170	427	NP	649	NP	HA–3	G21, T5
42	485	170	427	427	649	343	HA–3	G5, G21, T4
43	485	170	427	NP	649	343	HA–3	G21, T5

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
2	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
3	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
4	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
5	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
6	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
7	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
8	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
9	138	138	138	138	138	134	125	117	116	114	112	111	110	109	108
10	138	130	120	114	109	99.3	92.2	86.7	85.0	84.1	82.9	82.0	81.4	80.6	79.8
11	147	147	130	121	114	...	...	...	...	...	...	...	...	...	...
12	147	147	140	134	130	...	...	...	...	...	...	...	...	...	...
13	147	147	130	121	114	...	...	...	...	...	...	...	...	...	...
14	147	147	140	134	130	...	...	...	...	...	...	...	...	...	...
15	187	171	154	145	135	...	...	...	...	...	...	...	...	...	...
16	187	171	154	145	135	...	...	...	...	...	...	...	...	...	...
17	138	133	118	112	108	106	106	106	106	106	105	103	101	98.7	...
18	138	120	109	104	99.3	93.4	90.0	87.2	85.6	83.8	81.7	79.3	76.9	74.7	...
19	197	196	191	185	179	172	168	165	163	161	158	154	151	147	...
20	197	196	191	182	172	152	140	134	131	129	127	125	123	120	...
21	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
22	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
23	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
24	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
25	197	196	191	185	179	172	168	165	163	161	158	154	151	147	...
26	197	196	191	182	172	152	140	134	131	129	127	125	123	120	...
27	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
28	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
29	181	178	174	171	168	167	167	167	167	167	167	167	...	...	...
30	154	152	148	145	143	142	142	142	142	142	142	142	...	...	...
31	181	178	174	171	168	167	167	167	167	167	167	167	...	...	...
32	154	152	148	145	143	142	142	142	142	142	142	142	...	...	...
33	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
34	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
35	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
36	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
37	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
38	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
39	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
40	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
41	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
42	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
43	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
2	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
3	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	126	124	119	*101*	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
8	93.1	91.7	90.1	88.5	*81.6*	*65.3*	*50.4*	...	...	...	...	...	...	...	...	...	...
9	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
10	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
34	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
35	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
36	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
37	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
38	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
39	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
40	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
41	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
42	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
43	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	8	1
2	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	8	1
3	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	8	1
4	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304L	S30403	...	...	8	1
5	18Cr–8Ni	Smls. pipe	SA–312	TP304L	S30403	...	...	8	1
6	18Cr–8Ni	Wld. pipe	SA–312	TP304L	S30403	...	...	8	1
7	18Cr–8Ni	Wld. pipe	SA–312	TP304L	S30403	...	...	8	1
8	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	1	...	8	1
9	18Cr–8Ni	Smls. & wld. fittings	SA–403	304L	S30403	...	...	8	1
10	18Cr–8Ni	Wld. pipe	SA–409	TP304L	S30403	...	...	8	1
11	18Cr–8Ni	Bar	SA–479	304L	S30403	...	...	8	1
12	18Cr–8Ni	Bar	SA–479	304L	S30403	...	...	8	1
13	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	8	1
14	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	8	1
15	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	8	1
16	18Cr–8Ni	Wld. pipe	SA–813	TP304L	S30403	...	...	8	1
17	18Cr–8Ni	Wld. pipe	SA–814	TP304L	S30403	...	...	8	1
18	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	>125	8	1
19	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	>125	8	1
20	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	>125	8	1
21	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	>125	8	1
22	18Cr–8Ni	Castings	SA–351	CF3	J92500	...	...	8	1
23	18Cr–8Ni	Castings	SA–351	CF3	J92500	...	...	8	1
24	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	8	1
25	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	8	1
26	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	8	1
27	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
28	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
29	18Cr–8Ni	Cast pipe	SA–451	CPF3	J92500	...	...	8	1
30	18Cr–8Ni	Cast pipe	SA–451	CPF8	J92600	...	...	8	1
31	18Cr–8Ni	Forgings	SA–965	F304	S30400	...	...	8	1
32	18Cr–8Ni	Forgings	SA–965	F304	S30400	...	...	8	1
33	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...	...	8	1
34	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...	...	8	1
35	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	≤125	8	1
36	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	≤125	8	1
37	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	≤125	8	1
38	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	≤125	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	485	170	NP	427	NP	NP	HA–3	G5, W12
2	485	170	427	NP	649	343	HA–3	G5, G21, G24, T4
3	485	170	427	NP	649	343	HA–3	G21, G24, T5
4	485	170	427	427	649	343	HA–3	G5, G21, T4, W12, W14
5	485	170	427	NP	649	343	HA–3	G21, T5
6	485	170	427	NP	649	343	HA–3	G5, G21, G24, T4
7	485	170	427	NP	649	343	HA–3	G21, G24, T5
8	485	170	NP	427	NP	NP	HA–3	G5, W12
9	485	170	NP	427	649	343	HA–3	G5, T4, W12, W14
10	485	170	NP	427	NP	NP	HA–3	G5, W12
11	485	170	427	427	649	343	HA–3	G5, G21, G22, T4
12	485	170	427	NP	649	343	HA–3	G21, G22, T5
13	485	170	NP	427	NP	NP	HA–3	G5, W12
14	485	170	NP	NP	649	343	HA–3	G5, G24, T4
15	485	170	NP	NP	649	343	HA–3	G24, T5
16	485	170	NP	427	NP	NP	HA–3	G5, W12
17	485	170	NP	427	NP	NP	HA–3	G5, W12
18	485	205	816	427	816	343	HA–1	G5, G12, T7
19	485	205	816	NP	816	343	HA–1	G12, T8
20	485	205	816	427	816	NP	HA–1	G5, T7
21	485	205	816	NP	816	NP	HA–1	T8
22	485	205	NP	427	427	343	HA–3	G1, G5, G16, G17, G19
23	485	205	NP	NP	427	343	HA–3	G1, G19
24	485	205	816	427	NP	NP	HA–1	G1, G5, G12, G16, G17, G19, H1, T6
25	485	205	816	NP	816	343	HA–1	G1, G12, G19, H1, T7
26	485	205	NP	NP	816	343	HA–1	G1, G5, G12, G19, T6
27	485	205	NP	427	816	343	HA–1	G5, G12, S9, T7
28	485	205	NP	NP	816	343	HA–1	G12, S9, T8
29	485	205	NP	427	NP	NP	HA–3	G5, G16, G17, G19
30	485	205	NP	427	NP	NP	HA–1	G5, G16, G17, G19
31	485	205	816	427	816	343	HA–1	G5, G12, T7
32	485	205	816	NP	816	343	HA–1	G12, T8
33	485	205	NP	427	816	NP	HA–1	G5, T7
34	485	205	NP	NP	816	NP	HA–1	T8
35	515	205	816	NP	816	NP	HA–1	G12, T8
36	515	205	816	427	816	NP	HA–1	G5, G12, T7
37	515	205	816	NP	816	NP	HA–1	T8
38	515	205	816	427	816	NP	HA–1	G5, T7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
2	97.8	97.8	97.8	97.8	97.8	93.2	87.2	83.0	81.4	80.0	78.7	77.6	76.5	75.4	73.6
3	97.8	88.9	82.5	78.4	74.9	69.0	64.6	61.5	60.3	59.2	58.3	57.5	56.7	55.8	54.9
4	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
5	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
6	97.8	97.8	97.8	97.8	97.8	93.2	87.2	83.0	81.4	80.0	78.7	77.6	76.5	75.4	73.6
7	97.8	88.9	82.5	78.4	74.9	69.0	64.6	61.5	60.3	59.2	58.3	57.5	56.7	55.8	54.9
8	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
9	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
10	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
11	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
12	115	105	97.0	92.3	88.1	81.2	76.0	72.3	70.9	69.7	68.6	67.6	66.7	65.7	64.6
13	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
14	97.8	97.8	97.8	97.8	97.8	93.2	87.2	83.0	81.4	80.0	78.7	77.6	76.5	75.4	73.6
15	97.8	88.9	82.5	78.4	74.9	69.0	64.6	61.5	60.3	59.2	58.3	57.5	56.7	55.8	54.9
16	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
17	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
18	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
19	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
20	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
21	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
22	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
23	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	77.7	76.4	...
24	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
25	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	77.7	76.4	74.9
26	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
27	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
28	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
29	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
30	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
31	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
32	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
33	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
34	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
35	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
36	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
37	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
38	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	*61.6*	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
3	53.9	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
4	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
5	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
6	*61.6*	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
7	53.9	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	*72.5*	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
12	63.4	*60.2*	*49.5*	*40.4*	*32.9*	*26.7*	*22.0*	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	*61.6*	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
15	53.9	*51.2*	*42.1*	*34.3*	*28.0*	*22.7*	*18.7*	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
19	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
20	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
21	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	99.5	92.8	*75.6*	*61.2*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.7*	*14.7*	*12.9*	*11.0*	...	...	...
25	73.6	72.6	70.0	*61.2*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.7*	*14.7*	*12.9*	*11.0*	...	...	...
26	99.5	92.8	*75.6*	*61.2*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.7*	*14.7*	*12.9*	*11.0*	...	...	...
27	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
28	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
32	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
33	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
34	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
35	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
36	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
37	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...
38	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...	...	8	1
2	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...	...	8	1
3	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...	...	8	1
4	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...	...	8	1
5	18Cr–8Ni	Plate	SA–240	302	S30200	...	...	8	1
6	18Cr–8Ni	Plate	SA–240	302	S30200	...	...	8	1
7	18Cr–8Ni	Plate	SA–240	304	S30400	...	...	8	1
8	18Cr–8Ni	Plate	SA–240	304	S30400	...	...	8	1
9	18Cr–8Ni	Plate	SA–240	304H	S30409	...	...	8	1
10	18Cr–8Ni	Plate	SA–240	304H	S30409	...	...	8	1
11	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1
12	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1
13	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1
14	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1
15	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
16	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
17	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
18	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
19	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304	S30400	...	...	8	1
20	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304	S30400	...	...	8	1
21	18Cr–8Ni	Wld. pipe	SA–312	TP304	S30400	...	...	8	1
22	18Cr–8Ni	Wld. pipe	SA–312	TP304	S30400	...	...	8	1
23	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304H	S30409	...	...	8	1
24	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304H	S30409	...	...	8	1
25	18Cr–8Ni	Wld. pipe	SA–312	TP304H	S30409	...	...	8	1
26	18Cr–8Ni	Wld. pipe	SA–312	TP304H	S30409	...	...	8	1
27	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	1	...	8	1
28	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	1	...	8	1
29	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	1	...	8	1
(**13**) 30	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
(**13**) 31	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
32	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...	...	8	1
33	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...	...	8	1
34	18Cr–8Ni	Smls. & wld. fittings	SA–403	304	S30400	...	...	8	1
35	18Cr–8Ni	Smls. & wld. fittings	SA–403	304H	S30409	...	...	8	1
36	18Cr–8Ni	Wld. pipe	SA–409	TP304	S30400	...	...	8	1
37	18Cr–8Ni	Bar	SA–479	302	S30200	...	...	8	1
38	18Cr–8Ni	Bar	SA–479	302	S30200	...	...	8	1
39	18Cr–8Ni	Bar	SA–479	304	S30400	...	...	8	1
40	18Cr–8Ni	Bar	SA–479	304	S30400	...	...	8	1
41	18Cr–8Ni	Bar	SA–479	304H	S30409	...	...	8	1
42	18Cr–8Ni	Bar	SA–479	304H	S30409	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	816	NP	816	NP	HA–1	G12, T8
2	515	205	816	427	816	NP	HA–1	G5, G12, T7
3	515	205	816	NP	816	NP	HA–1	T8
4	515	205	816	427	816	NP	HA–1	G5, T7
5	515	205	NP	NP	399	343	HA–1	G5
6	515	205	NP	NP	399	343	HA–1	...
7	515	205	816	NP	816	343	HA–1	G12, T8
8	515	205	816	427	816	343	HA–1	G5, G12, H1, T7
9	515	205	816	427	816	NP	HA–1	G5, T7
10	515	205	816	NP	816	NP	HA–1	T8
11	515	205	816	NP	NP	NP	HA–1	G12, T8, W13
12	515	205	816	427	NP	NP	HA–1	G5, G12, T7, W12, W13
13	515	205	816	NP	816	343	HA–1	G3, G5, G12, G24, T7
14	515	205	816	NP	816	343	HA–1	G3, G12, G24, T8
15	515	205	816	NP	NP	NP	HA–1	T8, W13
16	515	205	816	427	NP	NP	HA–1	G5, T7, W12, W13
17	515	205	816	NP	816	NP	HA–1	G3, G5, G24, T7
18	515	205	816	NP	816	NP	HA–1	G3, G24, T8
19	515	205	816	427	816	343	HA–1	G5, G12, T7, W12, W13, W14
20	515	205	816	NP	816	343	HA–1	G12, T8, W13, W14
21	515	205	816	NP	816	343	HA–1	G3, G5, G12, G24, T7
22	515	205	816	NP	816	343	HA–1	G3, G12, G24, T8
23	515	205	816	427	816	NP	HA–1	G5, T7, W12, W13, W14
24	515	205	816	NP	816	NP	HA–1	T8, W13, W14
25	515	205	816	NP	816	NP	HA–1	G3, G5, G24, T7
26	515	205	816	NP	816	NP	HA–1	G3, G24, T8
27	515	205	NP	427	NP	NP	HA–1	G5, W12
28	515	205	NP	427	NP	NP	HA–1	G5, W12
29	515	205	NP	427	NP	NP	HA–1	G5, W12
30	515	205	816	427	816	343	HA–1	G5, G12, H1, S11, T7
31	515	205	816	NP	816	343	HA–1	G12, H1, S11, T8
32	515	205	816	427	816	NP	HA–1	G5, H1, T7
33	515	205	816	NP	816	NP	HA–1	H1, T8
34	515	205	NP	427	816	343	HA–1	G5, G12, T7, W12, W14
35	515	205	NP	427	816	NP	HA–1	G5, T7, W12, W14
36	515	205	NP	427	NP	NP	HA–1	G5, W12
37	515	205	NP	427	399	343	HA–1	G5, G24
38	515	205	NP	NP	399	343	HA–1	G22
39	515	205	816	427	816	343	HA–1	G5, G12, G22, T7
40	515	205	816	NP	816	343	HA–1	G12, G22, T8
41	515	205	816	427	816	NP	HA–1	G5, G22, T7
42	515	205	816	NP	816	NP	HA–1	G22, T8

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
2	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
3	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
4	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
5	138	138	137	134	130	126	122	116	114	111	109	107	...	...	...
6	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	...	...	...
7	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
8	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
9	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
10	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
11	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
12	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
13	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
14	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
15	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
16	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
17	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
18	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
19	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
20	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
21	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
22	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
23	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
24	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
25	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
26	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
27	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
28	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
29	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
30	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
31	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
32	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
33	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
34	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
35	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
36	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
37	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
38	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	...	...	...
39	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
40	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
41	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
42	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	**525**	**550**	**575**	**600**	**625**	**650**	**675**	**700**	**725**	**750**	**775**	**800**	**825**	**850**	**875**	**900**	
1	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
2	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
3	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
4	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
8	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
9	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
10	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
11	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
12	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
13	84.0	83.2	79.0	*67.3*	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
14	62.6	61.3	60.1	58.6	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
15	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
16	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
17	84.0	83.2	79.0	*67.3*	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
18	62.6	61.3	60.1	58.6	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
19	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
20	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
21	84.0	83.2	79.0	*67.3*	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
22	62.6	61.3	60.1	58.6	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
23	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
24	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
25	84.0	83.2	79.0	*67.3*	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
26	62.6	61.3	60.1	58.6	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	(**13**)
31	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	(**13**)
32	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
33	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
34	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
35	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
40	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
41	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
42	73.6	72.4	70.8	68.9	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	8	1
	2	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	8	1
	3	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	8	1
	4	18Cr–8Ni	Wld. pipe	SA–813	TP304	S30400	...	...	8	1
	5	18Cr–8Ni	Wld. pipe	SA–813	TP304H	S30409	...	...	8	1
	6	18Cr–8Ni	Wld. pipe	SA–814	TP304	S30400	...	...	8	1
	7	18Cr–8Ni	Wld. pipe	SA–814	TP304H	S30409	...	...	8	1
	8	18Cr–8Ni	Bar	SA/JIS G4303	SUS302	...	...	...	8	1
	9	18Cr–8Ni	Bar	SA/JIS G4303	SUS304	...	...	...	8	1
	10	18Cr–8Ni	Plate	SA/EN 10028–7	X5CrNi18–10	...	...	≤75	8	1
	11	18Cr–8Ni	Plate	SA/EN 10028–7	X5CrNi18–10	...	...	≤75	8	1
	12	18Cr–8Ni	Castings	SA–351	CF3A	J92500	...	...	8	1
	13	18Cr–8Ni	Castings	SA–351	CF3A	J92500	...	...	8	1
	14	18Cr–8Ni	Castings	SA–351	CF8A	J92600	...	...	8	1
	15	18Cr–8Ni	Castings	SA–351	CF8A	J92600	...	...	8	1
	16	18Cr–8Ni	Cast pipe	SA–451	CPF3A	J92500	...	...	8	1
	17	18Cr–8Ni	Cast pipe	SA–451	CPF8A	J92600	...	...	8	1
(**13**)	18	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	>125	8	1
(**13**)	19	18Cr–8Ni–N	Forgings	SA–965	F304LN	S30453	...	...	8	1
(**13**)	20	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	≤125	8	1
(**13**)	21	18Cr–8Ni–N	Smls. tube	SA–213	TP304LN	S30453	...	...	8	1
(**13**)	22	18Cr–8Ni–N	Plate	SA–240	304LN	S30453	...	...	8	1
(**13**)	23	18Cr–8Ni–N	Wld. tube	SA–249	TP304LN	S30453	...	...	8	1
(**13**)	24	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304LN	S30453	...	...	8	1
(**13**)	25	18Cr–8Ni–N	Smls. pipe	SA–376	TP304LN	S30453	...	...	8	1
(**13**)	26	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304LN	S30453	WP	...	8	1
(**13**)	27	18Cr–8Ni–N	Bar	SA–479	304LN	S30453	...	...	8	1
(**13**)	28	18Cr–8Ni–N	Wld. tube	SA–688	TP304LN	S30453	...	...	8	1
(**13**)	29	18Cr–8Ni–N	Wld. pipe	SA–813	TP304LN	S30453	...	...	8	1
(**13**)	30	18Cr–8Ni–N	Wld. pipe	SA–814	TP304LN	S30453	...	...	8	1
	31	18Cr–8Ni–N	Forgings	SA–182	F304N	S30451	...	...	8	1
	32	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...	...	8	1
	33	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...	...	8	1
	34	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...	...	8	1
	35	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...	...	8	1
	36	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1
	37	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1
	38	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1
	39	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1
	40	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	NP	427	NP	NP	HA–1	G5, W12
2	515	205	NP	NP	816	343	HA–1	G5, G12, G24, T7
3	515	205	NP	NP	816	343	HA–1	G12, G24, T8
4	515	205	NP	427	NP	NP	HA–1	G5, W12
5	515	205	NP	427	NP	NP	HA–1	G5, W12
6	515	205	NP	427	NP	NP	HA–1	G5, W12
7	515	205	NP	427	NP	NP	HA–1	G5, W12
8	520	205	NP	427	399	NP	HA–1	G5, G24
9	520	205	816	427	816	NP	HA–1	G5, G12, G22, T7
10	520	210	NP	NP	550	NP	HA–1	G5
11	520	210	NP	NP	550	NP	HA–1	...
12	530	240	NP	343	371	343	HA–3	G1, G5, G16, G17, G19
13	530	240	NP	NP	371	343	HA–3	G1, G19
14	530	240	NP	343	343	343	HA–1	G1, G5, G16, G17, G19
15	530	240	NP	NP	343	343	HA–1	G1, G19
16	530	240	NP	343	NP	NP	HA–3	G5, G16, G17, G19
17	530	240	NP	343	NP	NP	HA–1	G5, G16, G17, G19
18	485	205	NP	427	427	NP	HA–1	G5
19	485	205	NP	427	427	NP	HA–1	G5
20	515	205	NP	427	427	NP	HA–1	G5
21	515	205	NP	427	427	NP	HA–1	G5
22	515	205	NP	427	427	NP	HA–1	G5
23	515	205	NP	427	427	NP	HA–1	G5, W12, W14
24	515	205	NP	427	427	NP	HA–1	G5, W12, W14
25	515	205	NP	427	427	NP	HA–1	G5
26	515	205	NP	427	427	NP	HA–1	G5, W12, W14
27	515	205	NP	427	427	NP	HA–1	G5
28	515	205	NP	427	427	NP	HA–1	G5, W12, W14
29	515	205	NP	427	427	NP	HA–1	G5, W12, W14
30	515	205	NP	427	427	NP	HA–1	G5, W12, W14
31	550	240	NP	427	NP	NP	HA–1	G5
32	550	240	649	427	649	NP	HA–1	G5, G12, T7
33	550	240	649	NP	649	NP	HA–1	G12, T8
34	550	240	NP	427	649	343	HA–1	G5, G12, T7
35	550	240	NP	NP	649	343	HA–1	G12, T8
36	550	240	649	NP	NP	NP	HA–1	G5, G12, T7, W13
37	550	240	649	NP	NP	NP	HA–1	G12, T8, W13
38	550	240	649	NP	NP	NP	HA–1	G3, G5, G12, T5
39	550	240	649	NP	649	343	HA–1	G3, G12, G24, T8
40	550	240	NP	NP	649	343	HA–1	G5, G12, G24, T5

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
2	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
3	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
4	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
5	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
6	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
7	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
8	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
9	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
10	140	140	139	134	131	127	124	118	115	113	111	108	106	104	103
11	140	125	115	109	105	97.1	91.5	87.2	85.3	83.5	81.9	80.3	78.8	77.3	75.9
12	152	148	142	138	134	130	128	128	128	128	127	...	...	...	...
13	152	143	133	126	120	112	105	100	97.9	96.0	94.2	...	...	...	...
14	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
15	152	143	133	126	120	112	105	100	97.9	96.0	...	...	...	...	...
16	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
17	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
18	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
19	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
20	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
21	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
22	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
23	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
24	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
25	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
26	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
27	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
28	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
29	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
30	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
31	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
32	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
33	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
34	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
35	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
36	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
37	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
38	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
39	134	122	110	103	97.7	88.9	82.9	79.1	77.2	75.5	74.3	73.0	72.4	71.3	69.4
40	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	84.0	83.2	79.0	*67.3*	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
3	62.6	61.3	60.1	58.6	*55.4*	*44.1*	*35.5*	*28.0*	*22.2*	*18.2*	*15.0*	*12.3*	*9.83*	*7.33*	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	99.3	98.0	93.3	*79.6*	*65.4*	*51.4*	*41.7*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	
10	101	97.5	95.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	74.6	73.2	71.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
33	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
34	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
35	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
36	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
37	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...	
38	92.5	*90.5*	*83.9*	*66.4*	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...	
39	68.0	66.7	65.9	63.0	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...	
40	92.5	*90.5*	*83.9*	*66.4*	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304N	S30451	...	...	8	1
2	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304N	S30451	...	...	8	1
3	18Cr–8Ni–N	Wld. pipe	SA–312	TP304N	S30451	...	...	8	1
4	18Cr–8Ni–N	Wld. pipe	SA–312	TP304N	S30451	...	...	8	1
5	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	1	...	8	1
6	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...	...	8	1
7	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...	...	8	1
8	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304N	S30451	...	...	8	1
9	18Cr–8Ni–N	Bar	SA–479	304N	S30451	...	...	8	1
10	18Cr–8Ni–N	Bar	SA–479	304N	S30451	...	...	8	1
11	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...	...	8	1
12	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...	...	8	1
13	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...	...	8	1
14	18Cr–8Ni–N	Wld. pipe	SA–813	TP304N	S30451	...	...	8	1
15	18Cr–8Ni–N	Wld. pipe	SA–814	TP304N	S30451	...	...	8	1
16	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...	...	8	1
17	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...	...	8	1
18	18Cr–8Ni–4Si–N	Bar	SA–479	...	S21800	...	...	8	3
19	18Cr–10Ni–Cb	Forgings	SA–965	F348H	S34809	...	...	8	1
20	18Cr–10Ni–Cb	Forgings	SA–965	F348H	S34809	...	...	8	1
21	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	8	1
22	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	8	1
23	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	8	1
24	18Cr–10Ni–Cb	Cast pipe	SA–451	CPF8C	J92710	...	...	8	1
25	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	>125	8	1
26	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...	...	8	1
27	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...	...	8	1
28	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	>125	8	1
29	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	>125	8	1
30	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...	...	8	1
31	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...	...	8	1
32	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	>125	8	1
33	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	>125	8	1
34	18Cr–10Ni–Cb	Forgings	SA–965	F348	S34800	...	...	8	1
35	18Cr–10Ni–Cb	Forgings	SA–965	F348	S34800	...	...	8	1
36	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	>125	8	1
37	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	>125	8	1
38	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	≤125	8	1
39	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	≤125	8	1
40	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...	...	8	1
41	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...	...	8	1
42	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...	...	8	1
43	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	550	240	649	427	649	343	HA–1	G5, G12, T7, W12, W13, W14
2	550	240	649	NP	649	343	HA–1	G12, T8, W13, W14
3	550	240	649	NP	649	343	HA–1	G3, G5, G12, G24, T5
4	550	240	649	NP	649	343	HA–1	G3, G12, G24, T8
5	550	240	NP	427	NP	NP	HA–1	G5, W12
6	550	240	649	427	649	343	HA–1	G5, G12, H1, T7
7	550	240	649	NP	649	343	HA–1	G12, H1, T8
8	550	240	NP	427	649	343	HA–1	G5, T7, W12, W14
9	550	240	649	NP	NP	NP	HA–1	G12, T8
10	550	240	649	427	NP	NP	HA–1	G5, G12, T7
11	550	240	NP	427	NP	NP	HA–1	G5, W12
12	550	240	NP	NP	649	343	HA–1	G5, G12, G24, T7
13	550	240	NP	NP	649	343	HA–1	G12, G24, T8
14	550	240	NP	427	NP	NP	HA–1	G5, W12
15	550	240	NP	427	NP	NP	HA–1	G5, W12
16	550	240	NP	427	649	343	HA–1	G5, G12, T7
17	550	240	NP	NP	649	343	HA–1	G12, T8
18	655	345	NP	427	NP	NP	HA–6	...
19	450	170	NP	NP	816	NP	HA–2	G5, H2, T9
20	450	170	NP	NP	816	NP	HA–2	H2, T9
21	485	205	NP	427	NP	NP	HA–2	G5, G16, G17, G19
22	485	205	NP	NP	816	343	HA–2	G1, G5, G12, G19, T7
23	485	205	NP	NP	816	343	HA–2	G1, G12, G19, T7
24	485	205	NP	427	NP	NP	HA–2	G5, G16, G17, G19
25	485	205	816	427	816	343	HA–2	G5, G12, T7
26	485	205	816	427	816	343	HA–2	G5, G12, H1, T7
27	485	205	816	NP	816	343	HA–2	G12, H1, T7
28	485	205	816	NP	NP	NP	HA–2	H2, T9
29	485	205	816	427	816	NP	HA–2	G5, H2, T8
30	485	205	NP	NP	816	NP	HA–2	H2, T9
31	485	205	NP	427	816	NP	HA–2	G5, H2, T8
32	485	205	816	NP	NP	NP	HA–2	T7
33	485	205	816	427	816	343	HA–2	G5, G12, T7
34	485	205	NP	NP	816	343	HA–2	G5, G12, H1, T7
35	485	205	NP	NP	816	343	HA–2	G12, H1, T7
36	485	205	816	NP	NP	NP	HA–2	T9
37	485	205	816	427	816	NP	HA–2	G5, T8
38	515	205	816	427	816	NP	HA–2	G5, G12, H1, T6
39	515	205	816	NP	816	NP	HA–2	G12, H1, T7
40	515	205	816	427	816	NP	HA–2	G5, G12, H1, T6
41	515	205	816	NP	816	NP	HA–2	G12, H1, T7
42	515	205	816	427	816	343	HA–2	G5, G12, T6
43	515	205	816	NP	816	343	HA–2	G12, T7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
2	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
3	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
4	134	122	110	103	97.7	88.9	82.9	79.1	77.2	75.5	74.3	73.0	72.4	71.3	69.4
5	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
6	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
7	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
8	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
9	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
10	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
11	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
12	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
13	134	122	110	103	97.7	88.9	82.9	79.1	77.2	75.5	74.3	73.0	72.4	71.3	69.4
14	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
15	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
16	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
17	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
18	187	185	176	164	152	137	128	123	121	119	118	116	116	115	...
19	115	115	115	114	112	107	103	101	101	101	101	101	101	100	100
20	115	110	105	101	98.5	92.2	87.1	83.0	81.6	80.3	79.2	78.6	78.0	77.3	77.2
21	138	135	131	126	121	115	111	108	108	108	108	108	108	108	...
22	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
23	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
24	138	135	131	126	121	115	111	108	108	108	108	108	108	108	...
25	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
26	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
27	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
28	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
29	138	135	131	126	121	115	111	108	108	108	108	108	108	108	108
30	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
31	138	135	131	126	121	115	111	108	108	108	108	108	108	108	108
32	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
33	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
34	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
35	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
36	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
37	138	135	131	126	121	115	111	108	108	108	108	108	108	108	108
38	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
39	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
40	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
41	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
42	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
43	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
2	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
3	92.5	*90.5*	*83.9*	*66.4*	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...
4	68.0	66.7	65.9	63.0	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
7	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
8	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
9	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
10	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	92.5	90.5	83.9	*66.4*	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...
13	68.0	66.7	65.9	63.0	*54.5*	*44.1*	*35.5*	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	109	106	98.3	*78.6*	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
17	80.5	78.8	77.3	74.0	*64.3*	*51.4*	*41.6*	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	99.7	98.6	97.3	95.8	91.3	*70.9*	*53.9*	*41.4*	*31.9*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
20	77.2	77.2	76.9	76.5	75.6	*70.9*	*53.9*	*41.4*	*31.9*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	107	106	98.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
23	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	107	106	98.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
26	107	106	98.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
27	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
28	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
29	107	106	105	103	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
30	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
31	107	106	105	103	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
32	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
33	107	106	98.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
34	107	106	98.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
35	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
36	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
37	107	106	105	103	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
38	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
39	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
40	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
41	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
42	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
43	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
2	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
3	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
4	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
5	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347	S34700	...	...	8	1
6	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347	S34700	...	...	8	1
7	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347	S34700	...	...	8	1
8	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347	S34700	...	...	8	1
9	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	1	...	8	1
10	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...	...	8	1
11	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...	...	8	1
12	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347	S34700	...	...	8	1
13	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP347	S34700	...	...	8	1
14	18Cr–10Ni–Cb	Bar	SA–479	347	S34700	...	...	8	1
15	18Cr–10Ni–Cb	Bar	SA–479	347	S34700	...	...	8	1
16	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347	S34700	...	...	8	1
17	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	≤125	8	1
18	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	≤125	8	1
19	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...	...	8	1
20	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...	...	8	1
21	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...	...	8	1
22	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...	...	8	1
23	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
24	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
25	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
26	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
27	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347H	S34709	...	...	8	1
28	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347H	S34709	...	...	8	1
29	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347H	S34709	...	...	8	1
30	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347H	S34709	...	...	8	1
31	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...	...	8	1
32	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...	...	8	1
33	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347H	S34709	...	...	8	1
34	18Cr–10Ni–Cb	Bar	SA–479	347H	S34709	...	...	8	1
35	18Cr–10Ni–Cb	Bar	SA–479	347H	S34709	...	...	8	1
36	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347H	S34709	...	...	8	1
37	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP347H	S34709	...	...	8	1
38	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347LN	S34751	...	...	8	1
39	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347LN	S34751	...	...	8	1
40	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347LN	S34751	...	...	8	1
41	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347LN	S34751	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	816	NP	NP	NP	HA–2	G12, T7, W13
2	515	205	816	427	NP	NP	HA–2	G5, G12, T6, W12, W13
3	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T6
4	515	205	816	NP	816	343	HA–2	G3, G12, G24, T7
5	515	205	816	427	816	343	HA–2	G5, G12, T6, W12, W13, W14
6	515	205	816	NP	816	343	HA–2	G12, T7, W13, W14
7	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T6
8	515	205	816	NP	816	343	HA–2	G3, G12, G24, T7
9	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
10	515	205	816	427	816	343	HA–2	G5, G12, H1, T6
11	515	205	816	NP	816	343	HA–2	G12, H1, T7
12	515	205	NP	427	816	343	HA–2	G5, G12, T6, W12, W14
13	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
14	515	205	816	427	816	343	HA–2	G5, G12, G22, T6
15	515	205	816	NP	816	343	HA–2	G12, G22, T7
16	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
17	515	205	816	427	816	NP	HA–2	G5, H2, T8
18	515	205	816	NP	816	NP	HA–2	H2, T9
19	515	205	816	427	816	NP	HA–2	G5, H2, T8
20	515	205	816	NP	816	NP	HA–2	H2, T9
21	515	205	816	427	816	NP	HA–2	G5, H2, T8
22	515	205	816	NP	816	NP	HA–2	H2, T9
23	515	205	816	427	NP	NP	HA–2	G5, T8, W12, W13
24	515	205	816	NP	NP	NP	HA–2	T9, W13
25	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T8
26	515	205	816	NP	816	NP	HA–2	G3, G24, T9
27	515	205	816	427	816	NP	HA–2	G5, H2, T8, W12, W13, W14
28	515	205	816	NP	816	NP	HA–2	H2, T9, W13, W14
29	515	205	816	NP	816	NP	HA–2	G3, G5, G24, H2, T8
30	515	205	816	NP	816	NP	HA–2	G3, G24, H2, T9
31	515	205	816	427	816	NP	HA–2	G5, H2, T8
32	515	205	816	NP	816	NP	HA–2	H2, T9
33	515	205	NP	427	816	NP	HA–2	G5, H2, T8, W12, W14
34	515	205	816	427	NP	NP	HA–2	G5, H2, T8
35	515	205	816	NP	NP	NP	HA–2	H2, T9
36	515	205	NP	427	NP	NP	HA–2	G5, H2, W12
37	515	205	NP	427	NP	NP	HA–2	G5, W12
38	515	205	NP	NP	593	NP	HA–2	G5, T8
39	515	205	NP	NP	593	NP	HA–2	...
40	515	205	NP	NP	593	NP	HA–2	G5, T8
41	515	205	NP	NP	593	NP	HA–2	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
2	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
3	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
4	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
5	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
6	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
7	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
8	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
9	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
10	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
11	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
12	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
13	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
14	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
15	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
16	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
17	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
18	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
19	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
20	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
21	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
22	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
23	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
24	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
25	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
26	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
27	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
28	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
29	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
30	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
31	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
32	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
33	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
34	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
35	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
36	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
37	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
38	138	137	137	136	131	123	117	114	113	112	112	112	112	112	111
39	138	128	120	115	110	101	94.7	90.2	88.6	87.5	86.7	86.2	85.9	85.7	85.7
40	138	137	137	136	131	123	117	114	113	112	112	112	112	112	111
41	138	128	120	115	110	101	94.7	90.2	88.6	87.5	86.7	86.2	85.9	85.7	85.7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	92.4	92.4	90.3	*77.2*	*57.3*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
2	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
3	97.6	95.4	*85.5*	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
4	78.6	78.6	76.8	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
5	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
6	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
7	97.6	95.4	*85.5*	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
8	78.6	78.6	76.8	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
11	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
12	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
15	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
18	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
19	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
20	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
21	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
22	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
23	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
24	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
25	97.5	96.8	96.2	91.9	*77.9*	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
26	78.6	78.6	78.6	78.4	75.7	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
27	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
28	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
29	97.5	96.8	96.2	91.9	*77.9*	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
30	78.6	78.6	78.6	78.4	75.7	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
31	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
32	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
33	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
34	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
35	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	111	110	108	106	*84.5*	...	...	...	...	...	...	...	...	...	...	...	...
39	85.6	85.4	85.1	84.7	83.2	...	...	...	...	...	...	...	...	...	...	...	...
40	111	110	108	106	*84.5*	...	...	...	...	...	...	...	...	...	...	...	...
41	85.6	85.4	85.1	84.7	83.2	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	≤125	8	1
2	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	≤125	8	1
3	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...	...	8	1
4	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...	...	8	1
5	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...	...	8	1
6	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...	...	8	1
7	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
8	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
9	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
10	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
11	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348	S34800	...	...	8	1
12	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP348	S34800	...	...	8	1
13	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348	S34800	...	...	8	1
14	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348	S34800	...	...	8	1
15	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	1	...	8	1
16	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...	...	8	1
17	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...	...	8	1
18	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348	S34800	...	...	8	1
19	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP348	S34800	...	...	8	1
20	18Cr–10Ni–Cb	Bar	SA–479	348	S34800	...	...	8	1
21	18Cr–10Ni–Cb	Bar	SA–479	348	S34800	...	...	8	1
22	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348	S34800	...	...	8	1
23	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348	S34800	...	...	8	1
24	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	≤125	8	1
25	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	≤125	8	1
26	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...	...	8	1
27	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...	...	8	1
28	18Cr–10Ni–Cb	Plate	SA–240	348H	S34809	...	...	8	1
29	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
30	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
31	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
32	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
33	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348H	S34809	...	...	8	1
34	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP348H	S34809	...	...	8	1
35	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348H	S34809	...	...	8	1
36	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348H	S34809	...	...	8	1
37	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348H	S34809	...	...	8	1
38	18Cr–10Ni–Cb	Bar	SA–479	348H	S34809	...	...	8	1
39	18Cr–10Ni–Cb	Bar	SA–479	348H	S34809	...	...	8	1
40	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348H	S34809	...	...	8	1
41	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348H	S34809	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	816	427	816	NP	HA–2	G5, G12, T6
2	515	205	816	NP	816	NP	HA–2	G12, T7
3	515	205	816	427	816	NP	HA–2	G5, G12, T6
4	515	205	816	NP	816	NP	HA–2	G12, T7
5	515	205	NP	427	816	343	HA–2	G5, G12, T6
6	515	205	NP	NP	816	343	HA–2	G12, T7
7	515	205	816	NP	NP	NP	HA–2	G12, T7, W13
8	515	205	816	427	NP	NP	HA–2	G5, G12, T6, W12, W13
9	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T6
10	515	205	816	NP	816	343	HA–2	G3, G12, G24, T7
11	515	205	816	427	816	343	HA–2	G5, G12, T6, W12, W14
12	515	205	816	NP	816	343	HA–2	G12, T7
13	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T6
14	515	205	NP	NP	816	343	HA–2	G12, G24, T7
15	515	205	NP	427	NP	NP	HA–2	G5, W12
16	515	205	816	427	816	343	HA–2	G5, G12, H1, T6
17	515	205	816	NP	816	343	HA–2	G12, H1, T7
18	515	205	NP	427	816	343	HA–2	G5, G12, H2, T6, W12, W14
19	515	205	NP	427	NP	NP	HA–2	G5, W12
20	515	205	816	427	816	343	HA–2	G5, G12, G22, H1, T6
21	515	205	816	NP	816	343	HA–2	G12, G22, H1, T7
22	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
23	515	205	NP	427	NP	NP	HA–2	G5, W12
24	515	205	816	427	816	NP	HA–2	G5, T8
25	515	205	816	NP	816	NP	HA–2	T9
26	515	205	816	427	816	NP	HA–2	G5, H2, T8
27	515	205	816	NP	816	NP	HA–2	H2, T9
28	515	205	NP	427	NP	NP	HA–2	G5, H2
29	515	205	816	427	NP	NP	HA–2	G5, T8, W12, W13
30	515	205	816	NP	NP	NP	HA–2	T9, W13
31	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T8
32	515	205	816	NP	816	NP	HA–2	G3, G24, T9
33	515	205	816	427	816	NP	HA–2	G5, H2, T8, W12, W14
34	515	205	816	NP	816	NP	HA–2	H2, T9
35	515	205	NP	NP	816	NP	HA–2	G5, G24, H2, T8
36	515	205	NP	NP	816	NP	HA–2	G24, H2, T9
37	515	205	NP	427	816	NP	HA–2	G5, H2, T8, W12, W14
38	515	205	816	427	NP	NP	HA–2	G5, H2, T8
39	515	205	816	NP	NP	NP	HA–2	H2, T9
40	515	205	NP	427	NP	NP	HA–2	G5, H2, W12
41	515	205	NP	427	NP	NP	HA–2	G5, W12

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
2	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
3	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
4	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
5	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
6	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
7	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
8	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
9	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
10	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
11	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
12	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
13	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
14	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
15	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
16	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
17	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
18	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
19	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
20	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
21	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
22	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
23	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
24	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
25	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
26	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
27	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
28	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
29	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
30	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
31	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
32	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
33	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
34	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
35	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
36	117	112	107	103	101	94.3	89.1	85.3	83.3	81.8	81.2	79.9	79.3	79.3	78.7
37	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
38	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
39	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
40	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
41	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
2	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
3	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
4	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
5	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
6	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
7	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
8	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
9	97.6	95.4	*85.5*	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
10	78.6	78.6	76.8	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
11	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
12	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
13	97.6	95.4	*85.5*	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
14	78.6	78.6	76.8	*65.9*	*49.5*	*34.0*	*25.9*	*19.7*	*14.0*	*9.80*	*7.53*	*5.95*	*4.96*	*4.50*	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
17	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
18	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
21	92.4	92.4	90.3	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
25	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
26	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
27	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
30	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
31	97.5	96.8	96.2	91.9	*77.9*	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
32	78.6	78.6	78.6	78.4	75.7	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
33	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
34	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
35	97.5	96.8	96.2	91.9	*77.9*	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
36	78.6	78.6	78.6	78.4	75.7	*58.8*	*45.7*	*35.1*	*26.8*	*20.1*	*15.8*	*12.6*	*9.52*	*6.41*	...	...	...
37	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
38	115	114	113	109	*92.3*	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
39	92.4	92.4	92.4	92.2	89.1	*69.3*	*53.9*	*41.4*	*31.8*	*23.9*	*18.8*	*14.6*	*10.8*	*7.83*	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Cb	Bar	SA/JIS G4303	SUS347	...	...	...	8	1
2	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347HFG	S34710	...	...	8	1
3	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347HFG	S34710	...	...	8	1
4	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	>10	8	1
5	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	>10	8	1
6	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321	S32100	...	>10	8	1
7	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321	S32100	...	>10	8	1
8	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	>10	8	1
9	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	>10	8	1
10	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	>5	8	1
11	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	>5	8	1
12	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321H	S32109	...	>5	8	1
13	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321H	S32109	...	>5	8	1
14	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	>10	8	1
15	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	>125	8	1
16	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	>125	8	1
17	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...	...	8	1
18	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...	...	8	1
19	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	>125	8	1
20	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	>125	8	1
21	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...	...	8	1
22	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...	...	8	1
23	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	≤125	8	1
24	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	≤125	8	1
25	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	≤125	8	1
26	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	8	1
27	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	8	1
28	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	8	1
29	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	8	1
30	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	8	1
31	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	8	1
32	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
33	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
34	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
35	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
36	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	≤10	8	1
37	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	≤10	8	1
38	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321	S32100	...	≤10	8	1
39	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321	S32100	...	≤10	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	520	205	816	427	816	NP	HA–2	G5, G12, G22, T6
2	550	205	732	NP	NP	NP	HA–2	G5, T8
3	550	205	732	NP	NP	NP	HA–2	T9
4	485	170	816	427	816	NP	HA–2	G5, G12, T7
5	485	170	816	NP	816	NP	HA–2	G12, T7
6	485	170	816	427	816	NP	HA–2	G5, G12, T7, W12, W13, W14
7	485	170	816	NP	816	NP	HA–2	G12, T7, W13, W14
8	485	170	NP	427	816	343	HA–2	G5, G12, H1, T7
9	485	170	NP	NP	816	343	HA–2	G12, H1, T7
10	485	170	816	427	816	NP	HA–2	G5, T8
11	485	170	816	NP	816	NP	HA–2	T8
12	485	170	816	427	816	NP	HA–2	G5, T8, W12, W13, W14
13	485	170	816	NP	816	NP	HA–2	T8, W13, W14
14	485	170	NP	427	816	NP	HA–2	G5, H2, T8
15	485	205	816	427	816	NP	HA–2	G5, G12, T6
16	485	205	816	NP	816	NP	HA–2	G12, T7
17	485	205	816	427	816	343	HA–2	G5, G12, H1, T6
18	485	205	816	NP	816	343	HA–2	G12, H1, T7
19	485	205	816	427	816	NP	HA–2	G5, H2, T8
20	485	205	816	NP	816	NP	HA–2	H2, T8
21	485	205	NP	427	816	NP	HA–2	G5, H2, T8
22	485	205	NP	NP	816	NP	HA–2	H2, T8
23	515	205	816	NP	NP	NP	HA–2	G5, G12, T7
24	515	205	816	NP	816	343	HA–2	G12, T7
25	515	205	NP	427	816	343	HA–2	G5, G12, T6
26	515	205	816	NP	NP	NP	HA–2	G5, G12, T7
27	515	205	816	NP	816	NP	HA–2	G12, T7
28	515	205	NP	427	816	NP	HA–2	G5, G12, T6
29	515	205	816	NP	NP	NP	HA–2	G5, G12, T7
30	515	205	816	NP	816	343	HA–2	G12, T7
31	515	205	NP	427	816	343	HA–2	G5, G12, T6
32	515	205	816	NP	NP	NP	HA–2	G12, T7, W13
33	515	205	816	427	NP	NP	HA–2	G5, G12, T7, W12, W13
34	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T7
35	515	205	816	NP	816	343	HA–2	G3, G12, G24, T7
36	515	205	816	427	816	343	HA–2	G5, G12, T7
37	515	205	816	NP	816	343	HA–2	G12, T7
38	515	205	816	427	816	343	HA–2	G5, G12, T7, W12, W13, W14
39	515	205	816	NP	816	343	HA–2	T7, W13, W14

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
2	138	138	138	138	138	138	134	132	131	131	130	130	128	127	125
3	138	129	123	120	116	110	105	102	100	98.5	97.2	96.0	94.9	93.9	92.9
4	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
5	115	109	102	98.7	95.0	88.8	83.0	79.0	77.2	75.5	74.3	73.0	72.5	71.2	70.5
6	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
7	115	109	102	98.7	95.0	88.8	83.0	79.0	77.2	75.5	74.3	73.0	72.5	71.2	70.5
8	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
9	115	109	102	98.7	95.0	88.8	83.0	79.0	77.2	75.5	74.3	73.0	72.5	71.2	70.5
10	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
11	115	108	102	98.7	95.0	88.8	83.0	79.0	77.2	75.5	74.3	73.0	72.5	71.2	70.5
12	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
13	115	108	102	98.7	95.0	88.8	83.0	79.0	77.2	75.5	74.3	73.0	72.5	71.2	70.5
14	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
15	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
16	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
17	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
18	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
19	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
20	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
21	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
22	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
23	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
24	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
25	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
26	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
27	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
28	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
29	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
30	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
31	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
32	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
33	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
34	117	117	117	114	112	110	110	108	106	104	102	101	99.4	98.1	97.5
35	117	111	104	101	97.1	90.2	85.0	80.6	78.5	76.9	75.6	74.4	73.8	72.6	71.9
36	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
37	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
38	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
39	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	115	113	*99.8*	*77.2*	*57.7*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...
2	124	123	122	120	*107*	*85.4*	*67.0*	*51.7*	*39.3*	*29.4*	*21.7*	...	...	...	...	...	...
3	92.0	91.0	90.1	89.0	88.0	*85.4*	*67.0*	*51.7*	*39.3*	*29.4*	*21.7*	...	...	...	...	...	...
4	94.2	93.3	84.1	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
5	69.8	69.5	67.7	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
6	94.2	93.3	84.1	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
7	69.8	69.5	67.7	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
8	94.2	93.3	84.1	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
9	69.8	69.5	67.7	*61.6*	*44.3*	*33.1*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
10	94.2	93.6	91.2	78.0	*59.5*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
11	69.9	69.2	68.8	67.4	*59.5*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
12	94.2	93.6	91.2	78.0	*59.5*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
13	69.9	69.2	68.8	67.4	*59.5*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
14	94.2	93.6	91.2	78.0	*59.5*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
15	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
16	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
17	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
18	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
19	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
20	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
21	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
22	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
23	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
24	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
25	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
26	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
27	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
28	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
29	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
30	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
31	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
32	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
33	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
34	96.3	95.2	78.7	*51.2*	*38.0*	*28.4*	*21.1*	*15.5*	*10.4*	*6.86*	*5.18*	*3.76*	*2.39*	*1.41*	...	...	...
35	71.2	70.5	64.2	*51.2*	*38.0*	*28.4*	*21.1*	*15.5*	*10.4*	*6.86*	*5.18*	*3.76*	*2.39*	*1.41*	...	...	...
36	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
37	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
38	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
39	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	1	...	8	1
2	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	≤10	8	1
3	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	≤10	8	1
4	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	≤10	8	1
5	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321	S32100	...	...	8	1
6	18Cr–10Ni–Ti	Wld. pipe	SA–409	TP321	S32100	...	...	8	1
7	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...	...	8	1
8	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...	...	8	1
9	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...	...	8	1
10	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321	S32100	...	...	8	1
11	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321	S32100	...	...	8	1
12	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	≤125	8	1
13	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	≤125	8	1
14	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...	...	8	1
15	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...	...	8	1
16	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...	...	8	1
17	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...	...	8	1
18	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1
19	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1
20	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1
21	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1
22	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	≤5	8	1
23	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	≤5	8	1
24	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321H	S32109	...	≤5	8	1
25	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321H	S32109	...	≤5	8	1
26	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	≤10	8	1
27	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	≤10	8	1
28	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321H	S32109	...	...	8	1
29	18Cr–10Ni–Ti	Bar	SA–479	321H	S32109	...	...	8	1
30	18Cr–10Ni–Ti	Bar	SA–479	321H	S32109	...	...	8	1
31	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321H	S32109	...	...	8	1
32	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321H	S32109	...	...	8	1
33	18Cr–10Ni–Ti	Bar	SA/JIS G4303	SUS321	...	...	...	8	1
34	18Cr–11Ni	Plate	SA–240	305	S30500	...	...	8	1
35	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	>125	8	1
36	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	>125	8	1
37	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	≤125	8	1
38	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	≤125	8	1
39	18Cr–13Ni–3Mo	Forgings	SA–182	F317	S31700	...	≤125	8	1
40	18Cr–13Ni–3Mo	Forgings	SA–182	F317	S31700	...	≤125	8	1
41	18Cr–13Ni–3Mo	Plate	SA–240	317	S31700	...	...	8	1
42	18Cr–13Ni–3Mo	Plate	SA–240	317	S31700	...	...	8	1
43	18Cr–13Ni–3Mo	Plate	SA–240	317L	S31703	...	...	8	1
44	18Cr–13Ni–3Mo	Plate	SA–240	317L	S31703	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
2	515	205	816	NP	NP	NP	HA–2	G5, G12, H1, T7
3	515	205	816	NP	816	NP	HA–2	G12, H1, T7
4	515	205	NP	427	816	NP	HA–2	G5, G12, T6
5	515	205	NP	427	816	343	HA–2	G5, G12, T6, W12, W14
6	515	205	NP	427	NP	NP	HA–2	G5, W12
7	515	205	816	NP	NP	NP	HA–2	G5, G12, H1, T7
8	515	205	816	NP	816	343	HA–2	G12, G22, H1, T7
9	515	205	NP	427	816	343	HA–2	G5, G12, G22, H1, T6
10	515	205	NP	427	NP	NP	HA–2	G5, H1, W12
11	515	205	NP	427	NP	NP	HA–2	G5, W12
12	515	205	816	427	816	NP	HA–2	G5, H2, T8
13	515	205	816	NP	816	NP	HA–2	H2, T8
14	515	205	816	427	816	NP	HA–2	G5, H2, T8
15	515	205	816	NP	816	NP	HA–2	H2, T8
16	515	205	816	427	816	NP	HA–2	G5, H2, T8
17	515	205	816	NP	816	NP	HA–2	H2, T8
18	515	205	816	NP	NP	NP	HA–2	T8, W13
19	515	205	816	427	NP	NP	HA–2	G5, T8, W12, W13
20	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T8
21	515	205	816	NP	816	NP	HA–2	G3, G24, T8
22	515	205	816	427	816	NP	HA–2	G5, T8
23	515	205	816	NP	816	NP	HA–2	T8
24	515	205	816	427	816	NP	HA–2	G5, T8, W12, W13, W14
25	515	205	816	NP	816	NP	HA–2	T8, W13, W14
26	515	205	816	427	816	NP	HA–2	G5, H2, T8
27	515	205	816	NP	816	NP	HA–2	H2, T8
28	515	205	NP	427	816	NP	HA–2	G5, H2, T8, W12, W14
29	515	205	816	NP	816	NP	HA–2	H2, T8
30	515	205	816	427	816	NP	HA–2	G5, H2, T8
31	515	205	NP	427	NP	NP	HA–2	G5, H2, W12
32	515	205	NP	427	NP	NP	HA–2	G5, W12
33	520	205	NP	427	816	NP	HA–2	G5, G12, G22, H1, T6
34	515	205	NP	427	NP	NP	HA–1	G5
35	450	170	NP	NP	454	343	HA–4	G5
36	450	170	NP	NP	454	343	HA–4	...
37	485	170	NP	NP	454	343	HA–4	G5
38	485	170	NP	NP	454	343	HA–4	...
39	515	205	NP	NP	816	343	HA–2	G5, G12, T8
40	515	205	NP	NP	816	343	HA–2	G12, T9
41	515	205	NP	NP	816	343	HA–2	G5, G12, T8
42	515	205	NP	NP	816	343	HA–2	G12, T9
43	515	205	NP	NP	454	343	HA–4	G5
44	515	205	NP	NP	454	343	HA–4	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
2	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
3	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
4	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
5	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
6	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
7	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
8	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
9	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
10	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
11	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
12	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
13	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
14	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
15	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
16	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
17	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
18	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
19	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
20	117	117	117	114	112	110	110	108	106	104	102	101	99.4	98.1	97.4
21	117	111	104	101	97.1	90.2	85.0	80.6	78.5	76.9	75.6	74.4	73.8	72.6	71.8
22	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
23	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
24	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
25	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
26	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
27	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
28	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
29	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
30	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
31	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
32	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
33	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
34	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
35	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
36	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
37	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
38	115	106	96.3	91.3	87.4	81.2	76.0	72.5	71.2	70.0	68.8	67.5	66.3	65.0	63.8
39	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
40	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
41	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
42	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
43	138	138	138	137	135	131	123	118	116	113	111	109	107	105	103
44	138	127	115	109	105	97.1	91.2	87.3	85.4	83.8	82.5	80.6	79.4	78.1	76.9

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
3	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
4	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
5	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	113	112	94.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
8	83.9	83.0	77.6	*59.2*	*44.8*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
9	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
13	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
14	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
15	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
16	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
17	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
18	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
19	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
20	96.3	95.4	87.8	64.4	*49.7*	*39.3*	*31.4*	*24.5*	*19.4*	*15.5*	*12.1*	*9.85*	*7.93*	*5.62*	...	...	...
21	71.3	70.6	69.9	64.0	*49.7*	*39.3*	*31.4*	*24.5*	*19.4*	*15.5*	*12.1*	*9.85*	*7.93*	*5.62*	...	...	...
22	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
23	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
24	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
25	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
26	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
27	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
28	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
29	83.9	83.0	82.4	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
30	113	112	103	77.7	*58.7*	*46.0*	*36.9*	*28.7*	*22.9*	*18.4*	*14.4*	*11.5*	*9.16*	*6.64*	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	113	111	*87.4*	*57.5*	*44.4*	*32.9*	*24.5*	*18.3*	*12.6*	*8.41*	*6.18*	*4.37*	*2.77*	*1.62*	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
40	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
41	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
42	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	8	1
2	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	8	1
3	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	8	1
4	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317L	S31703	...	...	8	1
5	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317L	S31703	...	...	8	1
6	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317	S31700	...	...	8	1
7	18Cr–13Ni–3Mo	Smls. pipe	SA–312	TP317	S31700	...	...	8	1
8	18Cr–13Ni–3Mo	Wld. pipe	SA–312	TP317	S31700	...	...	8	1
9	18Cr–13Ni–3Mo	Wld. pipe	SA–312	TP317	S31700	...	...	8	1
10	18Cr–13Ni–3Mo	Smls. pipe	SA–312	TP317L	S31703	...	...	8	1
11	18Cr–13Ni–3Mo	Smls. pipe	SA–312	TP317L	S31703	...	...	8	1
12	18Cr–13Ni–3Mo	Wld. pipe	SA–312	TP317L	S31703	...	...	8	1
13	18Cr–13Ni–3Mo	Wld. pipe	SA–312	TP317L	S31703	...	...	8	1
14	18Cr–13Ni–3Mo	Smls. & wld. fittings	SA–403	317	S31700	...	...	8	1
15	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	CR	...	8	1
16	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	CR	...	8	1
17	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–S	...	8	1
18	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–S	...	8	1
19	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–W	...	8	1
20	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–W	...	8	1
21	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–WU	...	8	1
22	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–WU	...	8	1
23	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–WX	...	8	1
24	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–WX	...	8	1
25	18Cr–18Ni–2Si	Smls. tube	SA–213	XM–15	S38100	...	...	8	1
26	18Cr–18Ni–2Si	Smls. tube	SA–213	XM–15	S38100	...	...	8	1
27	18Cr–18Ni–2Si	Plate	SA–240	XM–15	S38100	...	...	8	1
28	18Cr–18Ni–2Si	Plate	SA–240	XM–15	S38100	...	...	8	1
29	18Cr–18Ni–2Si	Wld. tube	SA–249	TPXM–15	S38100	...	...	8	1
30	18Cr–18Ni–2Si	Wld. tube	SA–249	TPXM–15	S38100	...	...	8	1
31	18Cr–18Ni–2Si	Wld. pipe	SA–312	TPXM–15	S38100	...	...	8	1
32	18Cr–18Ni–2Si	Wld. pipe	SA–312	TPXM–15	S38100	...	...	8	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	NP	427	NP	NP	HA–2	G5, W12
2	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T8
3	515	205	NP	NP	816	343	HA–2	G12, G24, T9
4	515	205	NP	NP	454	343	HA–4	G5, G24
5	515	205	NP	NP	454	343	HA–4	G24
6	515	205	NP	427	816	343	HA–2	G5, G12, T8, W12, W14
7	515	205	NP	NP	816	343	HA–2	G12, T9
8	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T8
9	515	205	NP	NP	816	343	HA–2	G12, G24, T9
10	515	205	NP	NP	454	343	HA–4	G5
11	515	205	NP	NP	454	343	HA–4	...
12	515	205	NP	NP	454	343	HA–4	G5, G24
13	515	205	NP	NP	454	343	HA–4	G24
14	515	205	NP	NP	816	343	HA–2	G5, G12, T8, W14
15	515	205	NP	NP	454	343	HA–4	G5, G24
16	515	205	NP	NP	454	343	HA–4	G24
17	515	205	NP	NP	454	343	HA–4	G5
18	515	205	NP	NP	454	343	HA–4	...
19	515	205	NP	NP	454	343	HA–4	G5, G24
20	515	205	NP	NP	454	343	HA–4	G24
21	515	205	NP	NP	454	343	HA–4	G5, G24
22	515	205	NP	NP	454	343	HA–4	G24
23	515	205	NP	NP	454	343	HA–4	G5, G24
24	515	205	NP	NP	454	343	HA–4	G24
25	515	205	NP	NP	538	343	HA–2	G5
26	515	205	NP	NP	538	343	HA–2	...
27	515	205	NP	NP	538	343	HA–2	G5
28	515	205	NP	NP	538	343	HA–2	...
29	515	205	NP	NP	538	343	HA–2	G5, G24
30	515	205	NP	NP	538	343	HA–2	G24
31	515	205	NP	NP	510	343	HA–2	G5, G24
32	515	205	NP	NP	538	343	HA–2	G24

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
2	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
3	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
4	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
5	117	108	98.3	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
6	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
7	138	128	118	112	107	99.2	92.8	88.1	86.1	84.1	82.9	82.0	81.4	80.6	79.8
8	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
9	117	109	99.8	94.9	90.8	84.0	78.8	74.7	73.3	72.1	70.8	69.6	69.0	68.4	67.7
10	138	138	138	138	135	131	123	118	116	113	111	109	107	105	103
11	138	126	115	109	105	97.1	91.3	87.3	85.4	83.8	82.5	80.6	79.4	78.1	76.9
12	117	117	117	117	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
13	117	107	98.5	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
14	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
15	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
16	117	108	98.3	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
17	138	138	138	137	135	131	123	118	116	113	111	109	107	105	103
18	138	127	115	109	105	97.1	91.2	87.3	85.4	83.8	82.5	80.6	79.4	78.1	76.9
19	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
20	117	108	98.3	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
21	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
22	117	108	98.3	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
23	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
24	117	108	98.3	93.0	88.8	82.5	78.0	74.1	72.6	71.4	70.1	68.9	67.7	66.4	65.2
25	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
26	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
27	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
28	138	126	113	107	103	95.7	89.9	85.9	84.1	82.2	80.5	79.2	77.3	76.0	74.8
29	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
30	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8
31	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
32	117	107	96.2	91.2	87.4	81.1	76.6	72.7	71.2	70.0	68.8	67.5	66.3	65.0	63.8

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	90.5	89.9	89.3	85.3	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
3	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
7	79.2	78.7	77.8	77.1	75.0	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
8	90.5	89.9	89.3	85.3	*68.1*	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
9	67.1	66.5	65.9	65.3	64.0	*55.6*	*42.9*	*33.0*	*25.3*	*19.4*	*14.7*	*11.3*	*8.90*	*6.77*	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	107	106	105	99.8	*80.3*	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	99.3	98.0	93.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	73.6	72.4	70.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	99.3	98.0	93.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	73.6	72.4	70.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	84.0	83.2	79.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	62.6	61.3	60.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	84.0	83.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	62.6	61.3	60.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	19Cr–9Ni–½Mo	Castings	SA–351	CF10	J92590	...	...	8	1
2	19Cr–9Ni–½Mo	Castings	SA–351	CF10	J92590	...	...	8	1
3	19Cr–9Ni–2Mo	Castings	SA–351	CF10M	...	...	...	8	1
4	19Cr–9Ni–2Mo	Castings	SA–351	CF10M	...	...	...	8	1
5	19Cr–10Ni–3Mo	Castings	SA–351	CG8M	J93000	...	...	8	1
6	19Cr–10Ni–3Mo	Castings	SA–351	CG8M	J93000	...	...	8	1
7	19Cr–15Ni–4Mo	Smls. tube	SA–213	...	S31725	...	...	8	4
8	19Cr–15Ni–4Mo	Smls. tube	SA–213	...	S31725	...	...	8	4
9	19Cr–15Ni–4Mo	Plate	SA–240	...	S31725	...	...	8	4
10	19Cr–15Ni–4Mo	Plate	SA–240	...	S31725	...	...	8	4
11	19Cr–15Ni–4Mo	Wld. tube	SA–249	...	S31725	...	...	8	4
12	19Cr–15Ni–4Mo	Wld. tube	SA–249	...	S31725	...	...	8	4
13	19Cr–15Ni–4Mo	Smls. pipe	SA–312	...	S31725	...	...	8	4
14	19Cr–15Ni–4Mo	Smls. pipe	SA–312	...	S31725	...	...	8	4
15	19Cr–15Ni–4Mo	Wld. pipe	SA–312	...	S31725	...	...	8	4
16	19Cr–15Ni–4Mo	Wld. pipe	SA–312	...	S31725	...	...	8	4
17	19Cr–15Ni–4Mo	Wld. pipe	SA–358	...	S31725	...	...	8	4
18	19Cr–15Ni–4Mo	Wld. pipe	SA–358	...	S31725	...	...	8	4
19	19Cr–15Ni–4Mo	Smls. pipe	SA–376	...	S31725	...	...	8	4
20	19Cr–15Ni–4Mo	Smls. pipe	SA–376	...	S31725	...	...	8	4
21	19Cr–15Ni–4Mo	Wld. pipe	SA–409	...	S31725	...	...	8	4
22	19Cr–15Ni–4Mo	Wld. pipe	SA–409	...	S31725	...	...	8	4
23	19Cr–15Ni–4Mo	Bar	SA–479	...	S31725	...	...	8	4
24	19Cr–15Ni–4Mo	Bar	SA–479	...	S31725	...	...	8	4
25	20Cr–10Ni	Bar	SA–479	ER308	S30880	...	...	...	...
26	20Cr–18Ni–6Mo	Castings	SA–351	CK3MCuN	J93254	...	...	8	4
27	20Cr–18Ni–6Mo	Castings	SA–351	CK3MCuN	J93254	...	...	8	4
28	20Cr–18Ni–6Mo	Forgings	SA–182	F44	S31254	...	...	8	4
29	20Cr–18Ni–6Mo	Forgings	SA–182	F44	S31254	...	...	8	4

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	485	205	NP	NP	816	343	HA–1	G1, G5, G19, T6
2	485	205	NP	NP	816	343	HA–1	G1, G19, T7
3	485	205	NP	NP	816	NP	HA–2	G1, G5, G19, T6
4	485	205	NP	NP	816	NP	HA–2	G1, G19, T8
5	515	240	NP	NP	538	343	HA–2	G1, G5, G19
6	515	240	NP	NP	538	343	HA–2	G1, G19
7	515	205	NP	NP	204	204	HA–4	G5
8	515	205	NP	NP	204	204	HA–4	...
9	515	205	NP	NP	204	204	HA–4	G5
10	515	205	NP	NP	204	204	HA–4	...
11	515	205	NP	NP	204	204	HA–4	G5, G24
12	515	205	NP	NP	204	204	HA–4	G24
13	515	205	NP	NP	204	NP	HA–4	G5
14	515	205	NP	NP	204	NP	HA–4	...
15	515	205	NP	NP	204	NP	HA–4	G5, G24
16	515	205	NP	NP	204	NP	HA–4	G24
17	515	205	NP	NP	204	204	HA–4	G5, G24
18	515	205	NP	NP	204	204	HA–4	G24
19	515	205	NP	NP	204	204	HA–4	G5
20	515	205	NP	NP	204	204	HA–4	...
21	515	205	NP	NP	204	204	HA–4	G5, G24
22	515	205	NP	NP	204	204	HA–4	G24
23	515	205	NP	NP	204	204	HA–4	G5
24	515	205	NP	NP	204	204	HA–4	...
25	515	205	NP	427	NP	NP	HA–2	G5
26	550	260	NP	399	399	343	HA–2	G1, G5
27	550	260	NP	NP	399	343	HA–2	G1
28	650	305	NP	399	399	343	HA–2	G5
29	650	305	NP	NP	399	343	HA–2	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
2	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	77.7	76.4	74.9
3	138	138	138	136	134	133	125	119	116	114	112	111	110	108	107
4	138	129	119	113	108	99.3	92.7	88.1	86.1	84.4	83.2	82.0	81.1	80.2	79.5
5	148	146	143	139	135	132	128	122	120	117	116	114	113	112	111
6	148	139	127	120	113	102	94.9	90.0	88.4	87.2	86.0	84.7	83.5	82.9	81.7
7	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
8	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
9	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
10	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
11	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
12	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
13	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
14	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
15	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
16	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
17	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
18	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
19	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
20	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
21	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
22	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
23	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
24	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
25	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
26	158	158	158	154	149	143	139	136	135	134	133	132	...	...	...
27	158	151	141	134	127	119	112	107	106	105	104	103	...	...	...
28	185	185	185	181	176	168	163	159	158	157	156	156	...	...	...
29	185	175	162	154	147	137	129	125	123	121	120	119	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	99.5	92.8	*75.6*	*61.2*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.7*	*14.7*	*12.9*	*11.0*	...	...	...
2	73.6	72.6	70.0	*61.2*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.7*	*14.7*	*12.9*	*11.0*	...	...	...
3	107	104	*94.7*	*73.7*	*57.9*	*46.0*	*36.9*	*30.1*	*24.3*	*20.3*	*17.0*	*14.3*	*12.1*	*10.3*	...	...	...
4	78.9	78.2	77.6	73.7	*57.9*	*46.0*	*36.9*	*30.1*	*24.3*	*20.3*	*17.0*	*14.3*	*12.1*	*10.3*	...	...	...
5	109	97.7	72.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	80.5	78.9	77.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	20Cr–18Ni–6Mo	Wld. tube	SA–249	...	S31254	...	...	8	4
	2	20Cr–18Ni–6Mo	Wld. tube	SA–249	...	S31254	...	...	8	4
	3	20Cr–18Ni–6Mo	Smls. pipe	SA–312	...	S31254	...	...	8	4
	4	20Cr–18Ni–6Mo	Smls. pipe	SA–312	...	S31254	...	...	8	4
	5	20Cr–18Ni–6Mo	Wld. pipe	SA–312	...	S31254	...	...	8	4
	6	20Cr–18Ni–6Mo	Wld. pipe	SA–312	...	S31254	...	...	8	4
	7	20Cr–18Ni–6Mo	Wld. pipe	SA–358	...	S31254	...	...	8	4
	8	20Cr–18Ni–6Mo	Wld. pipe	SA–358	...	S31254	...	...	8	4
	9	20Cr–18Ni–6Mo	Fittings	SA–403	...	S31254	...	...	8	4
	10	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...	>5	8	4
	11	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...	>5	8	4
	12	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...	≤5	8	4
	13	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...	≤5	8	4
	14	21Cr–6Ni–9Mn	Forgings	SA–182	FXM–11	S21904	...	...	8	3
	15	21Cr–6Ni–9Mn	Smls. pipe	SA–312	TPXM–11	S21904	...	...	8	3
	16	21Cr–6Ni–9Mn	Smls. pipe	SA–312	TPXM–11	S21904	...	...	8	3
	17	21Cr–6Ni–9Mn	Wld. pipe	SA–312	TPXM–11	S21904	...	...	8	3
	18	21Cr–6Ni–9Mn	Wld. pipe	SA–312	TPXM–11	S21904	...	...	8	3
	19	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...	...	8	3
	20	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...	...	8	3
	21	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...	...	8	3
	22	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...	...	8	3
	23	21Cr–11Ni–N	Forgings	SA–182	F45	S30815	...	...	8	2
	24	21Cr–11Ni–N	Forgings	SA–182	F45	S30815	...	...	8	2
	25	21Cr–11Ni–N	Smls. tube	SA–213	...	S30815	...	...	8	2
	26	21Cr–11Ni–N	Smls. tube	SA–213	...	S30815	...	...	8	2
	27	21Cr–11Ni–N	Plate	SA–240	...	S30815	...	...	8	2
	28	21Cr–11Ni–N	Plate	SA–240	...	S30815	...	...	8	2
	29	21Cr–11Ni–N	Wld. tube	SA–249	...	S30815	...	...	8	2
	30	21Cr–11Ni–N	Wld. tube	SA–249	...	S30815	...	...	8	2
	31	21Cr–11Ni–N	Smls. pipe	SA–312	...	S30815	...	...	8	2
	32	21Cr–11Ni–N	Smls. pipe	SA–312	...	S30815	...	...	8	2
	33	21Cr–11Ni–N	Wld. pipe	SA–312	...	S30815	...	...	8	2
	34	21Cr–11Ni–N	Wld. pipe	SA–312	...	S30815	...	...	8	2
	35	21Cr–11Ni–N	Bar	SA–479	...	S30815	...	...	8	2
	36	21Cr–11Ni–N	Bar	SA–479	...	S30815	...	...	8	2
(13)	37	22Cr–2Ni–Mo–N	Forgings	SA–182	F66	S32202	...	...	10H	1
(13)	38	22Cr–2Ni–Mo–N	Plate	SA–240	...	S32202	...	...	10H	1
(13)	39	22Cr–2Ni–Mo–N	Bar	SA–479	...	S32202	...	...	10H	1
(13)	40	22Cr–2Ni–Mo–N	Smls. tube	SA–789	...	S32202	...	...	10H	1
(13)	41	22Cr–2Ni–Mo–N	Wld. tube	SA–789	...	S32202	...	...	10H	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	650	305	NP	399	399	343	HA–2	G5, G24
2	650	305	NP	NP	399	343	HA–2	G24
3	650	305	NP	399	399	NP	HA–2	G5
4	650	305	NP	NP	399	NP	HA–2	...
5	650	305	NP	399	399	NP	HA–2	G5, G24
6	650	305	NP	NP	399	NP	HA–2	G24
7	650	305	NP	399	399	343	HA–2	G5, G24
8	650	305	NP	NP	399	343	HA–2	G24
9	650	305	NP	399	NP	NP	HA–2	G5, W12
10	655	310	NP	399	399	343	HA–2	G5
11	655	310	NP	NP	399	343	HA–2	...
12	690	310	NP	399	399	343	HA–2	G5
13	690	310	NP	NP	399	343	HA–2	...
14	620	345	NP	NP	316	316	HA–6	...
15	620	345	NP	NP	316	316	HA–6	G5
16	620	345	NP	NP	316	316	HA–6	...
17	620	345	NP	NP	316	316	HA–6	G5, G24
18	620	345	NP	NP	316	316	HA–6	G24
19	620	345	NP	NP	316	316	HA–6	G5
20	620	345	NP	NP	316	316	HA–6	...
21	620	345	NP	NP	316	316	HA–6	G5
22	620	345	NP	NP	316	316	HA–6	...
23	600	310	899	NP	899	343	HA–6	G5, G6, T5
24	600	310	899	NP	899	343	HA–6	G6, T6
25	600	310	899	NP	899	343	HA–6	G5, G6, T5
26	600	310	899	NP	899	343	HA–6	G6, T6
27	600	310	899	NP	899	343	HA–6	G5, G6, T5
28	600	310	899	NP	899	343	HA–6	G6, T6
29	600	310	899	NP	899	343	HA–6	G5, G6, G24, T5
30	600	310	899	NP	899	343	HA–6	G6, G24, T6
31	600	310	899	NP	899	343	HA–6	G5, G6, T5
32	600	310	899	NP	899	343	HA–6	G6, T6
33	600	310	899	NP	899	343	HA–6	G5, G6, G24, T5
34	600	310	899	NP	899	343	HA–6	G6, G24, T6
35	600	310	899	NP	899	343	HA–6	G5, G6, T5
36	600	310	899	NP	899	343	HA–6	G6, T6
37	648	448	NP	NP	316	NP	HA–5	G19
38	648	448	NP	NP	316	NP	HA–5	G19
39	648	448	NP	NP	316	NP	HA–5	G19
40	648	448	NP	NP	316	NP	HA–5	G19
41	648	448	NP	NP	316	NP	HA–5	G19, G24

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	157	157	157	154	149	143	139	135	134	134	133	132	...	...	...
2	157	149	138	131	125	116	110	106	104	103	102	101	...	...	...
3	185	185	185	181	176	168	163	159	158	157	156	156	...	...	...
4	185	175	162	154	147	137	129	125	123	121	120	119	...	...	...
5	157	157	157	154	149	143	139	135	134	134	133	132	...	...	...
6	157	149	138	131	125	116	110	106	104	103	102	101	...	...	...
7	157	157	157	154	149	143	139	135	134	134	133	132	...	...	...
8	157	149	138	131	125	116	110	106	104	103	102	101	...	...	...
9	185	185	185	181	176	168	163	159	158	157	156	156	...	...	...
10	187	187	186	183	178	170	164	161	160	159	158	158	...	...	...
11	187	178	167	158	151	140	133	128	125	124	123	122	...	...	...
12	197	197	197	193	187	179	173	169	168	167	166	165	...	...	...
13	197	182	166	158	151	140	133	128	125	124	123	122	...	...	...
14	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
15	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
16	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
17	151	151	151	146	140	134	130	127	126	...	...	...	...	...	...
18	151	151	150	140	128	115	107	102	99.9	...	...	...	...	...	...
19	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
20	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
21	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
22	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
23	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
24	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
25	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
26	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
27	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
28	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
29	145	145	144	141	136	132	128	126	125	124	123	122	121	119	118
30	145	145	144	137	129	117	110	105	103	102	101	99.9	98.7	98.0	96.9
31	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
32	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
33	145	145	144	141	136	132	128	126	125	124	123	122	121	119	118
34	145	145	144	137	129	117	110	105	103	102	101	99.9	98.7	98.0	96.9
35	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
36	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
37	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
38	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
39	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
40	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
41	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	136	*117*	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
24	112	109	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
25	136	*117*	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
26	112	109	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
27	136	*117*	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
28	112	109	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
29	114	*101*	*79.6*	*62.9*	*50.0*	*39.1*	*30.0*	*23.8*	*18.7*	*14.7*	*11.8*	*10.3*	*8.82*	*6.89*	*5.61*	*4.92*	*4.10*	
30	95.6	92.7	*79.6*	*62.9*	*50.0*	*39.1*	*30.0*	*23.8*	*18.7*	*14.7*	*11.8*	*10.3*	*8.82*	*6.89*	*5.61*	*4.92*	*4.10*	
31	136	*117*	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
32	112	109	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
33	114	*101*	*79.6*	*62.9*	*50.0*	*39.1*	*30.0*	*23.8*	*18.7*	*14.7*	*11.8*	*10.3*	*8.82*	*6.89*	*5.61*	*4.92*	*4.10*	
34	95.6	92.7	*79.6*	*62.9*	*50.0*	*39.1*	*30.0*	*23.8*	*18.7*	*14.7*	*11.8*	*10.3*	*8.82*	*6.89*	*5.61*	*4.92*	*4.10*	
35	136	*117*	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
36	112	109	*93.4*	*73.6*	*58.4*	*45.8*	*35.5*	*28.0*	*22.3*	*17.7*	*14.2*	*11.9*	*10.2*	*8.19*	*6.58*	*5.80*	*4.85*	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(13)	1	22Cr–2Ni–Mo–N	Smls. pipe	SA–790	...	S32202	...	...	10H	1
(13)	2	22Cr–2Ni–Mo–N	Wld. pipe	SA–790	...	S32202	...	...	10H	1
(13)	3	22Cr–2Ni–Mo–N	Smls. fittings	SA–815	...	S32202	...	...	10H	1
(13)	4	22Cr–2Ni–Mo–N	Wld. fittings	SA–815	...	S32202	...	...	10H	1
	5	22Cr–5Ni–3Mo–N	Forgings	SA–182	F51	S31803	...	...	10H	1
	6	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S31803	...	...	10H	1
	7	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S31803	...	...	10H	1
	8	22Cr–5Ni–3Mo–N	Smls. tube	SA–789	...	S31803	...	...	10H	1
	9	22Cr–5Ni–3Mo–N	Wld. tube	SA–789	...	S31803	...	...	10H	1
	10	22Cr–5Ni–3Mo–N	Smls. pipe	SA–790	...	S31803	...	...	10H	1
	11	22Cr–5Ni–3Mo–N	Wld. pipe	SA–790	...	S31803	...	...	10H	1
	12	22Cr–5Ni–3Mo–N	Smls. fittings	SA–815	...	S31803	...	...	10H	1
	13	22Cr–5Ni–3Mo–N	Wld. fittings	SA–815	...	S31803	...	...	10H	1
	14	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S31803	...	...	10H	1
(13)	15	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S32205	...	...	10H	1
(13)	16	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S32205	...	...	10H	1
(13)	17	22Cr–5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S32205	...	...	10H	1
(13)	18	22Cr–5Ni–3Mo–N	Smls. pipe	SA–790	...	S32205	...	...	10H	1
(13)	19	22Cr–5Ni–3Mo–N	Wld. pipe	SA–790	...	S32205	...	...	10H	1
(13)	20	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S32205	...	...	10H	1
(13)	21	22Cr–5Ni–3Mo–N	Smls. fittings	SA–815	...	S32205	...	...	10H	1
(13)	22	22Cr–5Ni–3Mo–N	Wld. fittings	SA–815	...	S32205	...	...	10H	1
(13)	23	22Cr–5Ni–3Mo–N	Forgings	SA–182	F60	S32205	...	...	10H	1
(13)	24	22Cr–5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S32205	...	...	10H	1
(13)	25	22Cr–5Ni–3Mo–N	Smls. tube	SA–789	...	S32205	...	...	10H	1
(13)	26	22Cr–5Ni–3Mo–N	Wld. tube	SA–789	...	S32205	...	...	10H	1
	27	22Cr–13Ni–5Mn	Castings	SA–351	CG6MMN	J93790	...	...	8	3
	28	22Cr–13Ni–5Mn	Forgings	SA–182	FXM–19	S20910	...	...	8	3
	29	22Cr–13Ni–5Mn	Smls. tube	SA–213	XM–19	S20910	...	...	8	3
	30	22Cr–13Ni–5Mn	Plate	SA–240	XM–19	S20910	...	...	8	3
	31	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...	...	8	3
	32	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...	...	8	3
	33	22Cr–13Ni–5Mn	Smls. & wld. pipe	SA–312	TPXM–19	S20910	...	...	8	3
	34	22Cr–13Ni–5Mn	Smls. pipe	SA–312	TPXM–19	S20910	...	...	8	3
	35	22Cr–13Ni–5Mn	Wld. pipe	SA–312	TPXM–19	S20910	...	...	8	3
	36	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	1	...	8	3
	37	22Cr–13Ni–5Mn	Smls. & wld. fittings	SA–403	XM–19	S20910	...	...	8	3
	38	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	...	...	8	3
	39	22Cr–13Ni–5Mn	Wld. pipe	SA–813	TPXM–19	S20910	...	...	8	3
	40	22Cr–13Ni–5Mn	Wld. pipe	SA–814	TPXM–19	S20910	...	...	8	3

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	648	448	NP	NP	316	NP	HA–5	G19
2	648	448	NP	NP	316	NP	HA–5	G19, G24
3	648	448	NP	NP	316	NP	HA–5	G19
4	648	448	NP	NP	316	NP	HA–5	G3, G19
5	620	450	316	NP	316	316	HA–5	G19
6	620	450	316	NP	316	316	HA–5	G19
7	620	450	316	NP	316	NP	HA–5	G19
8	620	450	316	NP	316	316	HA–5	G19
9	620	450	316	NP	316	316	HA–5	G19, G24
10	620	450	316	NP	316	316	HA–5	G19
11	620	450	316	NP	316	316	HA–5	G19, G24
12	620	450	316	NP	NP	NP	HA–5	G19
13	620	450	316	NP	NP	NP	HA–5	G19, G24
14	620	450	NP	NP	316	316	HA–5	G19, W14
15	655	450	NP	316	316	316	HA–5	G19
16	655	450	NP	316	316	NP	HA–5	G19
17	655	450	NP	316	NP	NP	HA–5	G19, W12
18	655	450	NP	NP	316	316	HA–5	G19
19	655	450	NP	NP	316	316	HA–5	G19, G24
20	655	450	NP	316	NP	NP	HA–5	G19, W12
21	655	450	NP	NP	316	316	HA–5	G19
22	655	450	NP	NP	316	316	HA–5	G19, G24
23	655	480	NP	316	316	316	HA–5	G19
24	655	480	NP	316	NP	NP	HA–5	G19, W12
25	655	480	NP	NP	316	316	HA–5	G19
26	655	480	NP	NP	316	316	HA–5	G19, G24
27	585	295	NP	NP	566	343	HA–2	G1
28	690	380	NP	427	649	343	HA–6	G5, T8
29	690	380	NP	NP	649	NP	HA–6	T8
30	690	380	NP	427	649	343	HA–6	G5, T8
31	690	380	NP	427	NP	NP	HA–6	G5, W12
32	690	380	NP	NP	649	343	HA–6	G24, T8
33	690	380	NP	427	NP	NP	HA–6	G5, W12
34	690	380	NP	NP	649	343	HA–6	T8
35	690	380	NP	NP	649	343	HA–6	G24, T8
36	690	380	NP	427	NP	NP	HA–6	G5, W12
37	690	380	NP	427	649	343	HA–6	G5, T8, W12, W14
38	690	380	NP	427	649	343	HA–6	G5, G22, T8
39	690	380	NP	427	NP	NP	HA–6	G5, W12
40	690	380	NP	427	NP	NP	HA–6	G5, W12

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
2	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...
3	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
4	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...
5	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
6	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
7	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
8	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
9	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
10	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
11	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
12	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
13	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
14	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
15	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
16	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
17	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
18	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
19	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
20	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
21	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
22	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
23	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
24	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
25	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
26	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
27	134	133	132	128	123	116	111	107	106	104	102	101	101	99.5	98.2
28	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
29	197	196	195	191	185	180	176	174	172	169	167	165	162	161	159
30	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
31	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
32	168	167	165	162	158	153	149	147	146	144	142	140	138	137	135
33	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
34	197	196	195	191	185	180	176	174	172	169	167	165	162	161	159
35	168	167	165	162	158	153	149	147	146	144	142	140	138	137	135
36	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
37	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
38	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
39	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
40	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	97.5	96.6	95.0	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	161	158	157	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
29	157	156	154	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
30	161	158	157	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	134	132	131	129	*111*	*71.4*	*48.0*	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	157	156	154	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
35	134	132	131	129	*111*	*71.4*	*48.0*	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	161	158	157	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
38	161	158	157	152	*132*	*83.6*	*56.1*	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	23Cr–4Ni–Mo–Cu–N	Plate	SA–240	...	S32304	...	...	10H	1
2	23Cr–4Ni–Mo–Cu–N	Smls. tube	SA–789	...	S32304	...	>25	10H	1
3	23Cr–4Ni–Mo–Cu–N	Wld. tube	SA–789	...	S32304	...	>25	10H	1
4	23Cr–4Ni–Mo–Cu–N	Smls. pipe	SA–790	...	S32304	...	...	10H	1
5	23Cr–4Ni–Mo–Cu–N	Wld. pipe	SA–790	...	S32304	...	...	10H	1
6	23Cr–4Ni–Mo–Cu–N	Smls. tube	SA–789	...	S32304	...	≤25	10H	1
7	23Cr–4Ni–Mo–Cu–N	Wld. tube	SA–789	...	S32304	...	≤25	10H	1
8	23Cr–12Ni	Smls. & wld. fittings	SA–403	309	S30900	...	...	8	2
9	23Cr–12Ni	Smls. tube	SA–213	TP309S	S30908	...	...	8	2
10	23Cr–12Ni	Smls. tube	SA–213	TP309S	S30908	...	...	8	2
11	23Cr–12Ni	Plate	SA–240	309S	S30908	...	...	8	2
12	23Cr–12Ni	Plate	SA–240	309S	S30908	...	...	8	2
13	23Cr–12Ni	Wld. tube	SA–249	TP309S	S30908	...	...	8	2
14	23Cr–12Ni	Wld. tube	SA–249	TP309S	S30908	...	...	8	2
15	23Cr–12Ni	Smls. & wld. pipe	SA–312	TP309S	S30908	...	...	8	2
16	23Cr–12Ni	Smls. pipe	SA–312	TP309S	S30908	...	...	8	2
17	23Cr–12Ni	Wld. pipe	SA–312	TP309S	S30908	...	...	8	2
18	23Cr–12Ni	Wld. pipe	SA–312	TP309S	S30908	...	...	8	2
19	23Cr–12Ni	Wld. pipe	SA–312	TP309S	S30908	...	...	8	2
20	23Cr–12Ni	Wld. pipe	SA–312	TP309S	S30908	...	...	8	2
21	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	1	...	8	2
22	23Cr–12Ni	Bar	SA–479	309S	S30908	...	...	8	2
23	23Cr–12Ni	Bar	SA–479	309S	S30908	...	...	8	2
24	23Cr–12Ni	Wld. pipe	SA–813	TP309S	S30908	...	...	8	2
25	23Cr–12Ni	Wld. pipe	SA–813	TP309S	S30908	...	...	8	2
26	23Cr–12Ni	Wld. pipe	SA–814	TP309S	S30908	...	...	8	2
27	23Cr–12Ni	Wld. pipe	SA–814	TP309S	S30908	...	...	8	2
28	23Cr–12Ni	Smls. tube	SA–213	TP309H	S30909	...	...	8	2
29	23Cr–12Ni	Smls. tube	SA–213	TP309H	S30909	...	...	8	2
30	23Cr–12Ni	Plate	SA–240	309H	S30909	...	...	8	2
31	23Cr–12Ni	Plate	SA–240	309H	S30909	...	...	8	2
32	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...	...	8	2
33	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...	...	8	2
34	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...	...	8	2
35	23Cr–12Ni	Smls. pipe	SA–312	TP309H	S30909	...	...	8	2
36	23Cr–12Ni	Smls. pipe	SA–312	TP309H	S30909	...	...	8	2
37	23Cr–12Ni	Wld. pipe	SA–312	TP309H	S30909	...	...	8	2
38	23Cr–12Ni	Wld. pipe	SA–312	TP309H	S30909	...	...	8	2
39	23Cr–12Ni	Bar	SA–479	309H	S30909	...	...	8	2
40	23Cr–12Ni	Bar	SA–479	309H	S30909	...	...	8	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	600	400	NP	NP	316	316	HA–6	G19
2	600	400	NP	NP	316	316	HA–6	G19
3	600	400	NP	NP	316	316	HA–6	G19, G24
4	600	400	NP	NP	316	316	HA–6	G19
5	600	400	NP	NP	316	316	HA–6	G19, G24
6	690	450	NP	NP	316	316	HA–5	G19
7	690	450	NP	NP	316	316	HA–5	G19, G24
8	515	205	NP	427	816	343	HA–2	G5, G12, T5, W12, W14
9	515	205	816	NP	816	343	HA–2	G5, G12, T5
10	515	205	816	NP	816	343	HA–2	G12, T6
11	515	205	816	427	816	343	HA–2	G5, G12, T5
12	515	205	816	NP	816	343	HA–2	G12, T6
13	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
14	515	205	NP	NP	816	343	HA–2	G12, G24, T6
15	515	205	816	427	816	343	HA–2	G5, G12, T5, W12, W14
16	515	205	816	NP	816	343	HA–2	G12, T6
17	515	205	816	NP	NP	NP	HA–2	G5, G12, T5, W13
18	515	205	816	NP	NP	NP	HA–2	G12, T6, W13
19	515	205	816	NP	816	343	HA–2	G3, G5, G12, G24, T5
20	515	205	816	NP	816	343	HA–2	G3, G12, G24, T6
21	515	205	NP	427	NP	NP	HA–2	G5, W12
22	515	205	538	NP	538	343	HA–2	G5, G12, G22, T5
23	515	205	538	NP	538	343	HA–2	G12, G22, T6
24	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
25	515	205	NP	NP	816	343	HA–2	G12, G24, T6
26	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
27	515	205	NP	NP	816	343	HA–2	G12, G24, T6
28	515	205	816	NP	816	NP	HA–2	G5, T6
29	515	205	816	NP	816	NP	HA–2	T7
30	515	205	816	NP	816	NP	HA–2	G5, H1, T6
31	515	205	816	NP	816	NP	HA–2	H1, T7
32	515	205	NP	427	NP	NP	HA–2	G5, W12
33	515	205	NP	NP	816	NP	HA–2	G5, G24, T6
34	515	205	NP	NP	816	NP	HA–2	G24, T7
35	515	205	816	NP	816	NP	HA–2	G5, T6
36	515	205	816	NP	816	NP	HA–2	T7
37	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T6
38	515	205	816	NP	816	NP	HA–2	G3, G24, T7
39	515	205	816	NP	816	NP	HA–2	G5, T6
40	515	205	816	NP	816	NP	HA–2	T7

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
2	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
3	145	144	140	135	132	128	125	124	123	...	...	...	...	...	...
4	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
5	145	144	140	135	132	128	125	124	123	...	...	...	...	...	...
6	197	194	189	184	178	173	170	168	167	...	...	...	...	...	...
7	168	165	160	156	152	147	145	143	142	...	...	...	...	...	...
8	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
9	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
10	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
11	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
12	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
13	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
14	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
15	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
16	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
17	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
18	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
19	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
20	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
21	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...
22	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
23	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
24	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
25	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
26	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
27	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
28	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
29	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
30	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
31	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
32	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...
33	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
34	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
35	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
36	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
37	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
38	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
39	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
40	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
9	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
10	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
11	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
12	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
13	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
14	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
15	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
16	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
17	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
18	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
19	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
20	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	115	*89.4*	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	86.7	78.5	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
25	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
26	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
27	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
28	117	107	*83.8*	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
29	86.7	85.4	78.9	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
30	117	107	*83.8*	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
31	86.7	85.4	78.9	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	99.8	91.3	*71.2*	*55.8*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...
34	73.6	72.3	66.8	*55.7*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...
35	117	107	*83.8*	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
36	86.7	85.4	78.9	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
37	99.8	91.3	*71.2*	*55.8*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...
38	73.6	72.3	66.8	*55.7*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...
39	117	107	*83.8*	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...
40	86.7	85.4	78.9	*65.2*	*48.6*	*36.3*	*27.3*	*21.1*	*15.9*	*12.5*	*9.89*	*7.77*	*6.12*	*4.59*	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	23Cr–12Ni–Cb	Smls. tube	SA–213	TP309Cb	S30940	...	...	8	2
2	23Cr–12Ni–Cb	Smls. tube	SA–213	TP309Cb	S30940	...	...	8	2
3	23Cr–12Ni–Cb	Plate	SA–240	309Cb	S30940	...	...	8	2
4	23Cr–12Ni–Cb	Plate	SA–240	309Cb	S30940	...	...	8	2
5	23Cr–12Ni–Cb	Wld. tube	SA–249	TP309Cb	S30940	...	...	8	2
6	23Cr–12Ni–Cb	Wld. tube	SA–249	TP309Cb	S30940	...	...	8	2
7	23Cr–12Ni–Cb	Smls. & wld. pipe	SA–312	TP309Cb	S30940	...	...	8	2
8	23Cr–12Ni–Cb	Smls. pipe	SA–312	TP309Cb	S30940	...	...	8	2
9	23Cr–12Ni–Cb	Wld. pipe	SA–312	TP309Cb	S30940	...	...	8	2
10	23Cr–12Ni–Cb	Wld. pipe	SA–312	TP309Cb	S30940	...	...	8	2
11	23Cr–12Ni–Cb	Bar	SA–479	309Cb	S30940	...	...	8	2
12	23Cr–12Ni–Cb	Bar	SA–479	309Cb	S30940	...	...	8	2
13	23Cr–12Ni–Cb	Wld. pipe	SA–813	TP309Cb	S30940	...	...	8	2
14	23Cr–12Ni–Cb	Wld. pipe	SA–813	TP309Cb	S30940	...	...	8	2
15	23Cr–12Ni–Cb	Wld. pipe	SA–814	TP309Cb	S30940	...	...	8	2
16	23Cr–12Ni–Cb	Wld. pipe	SA–814	TP309Cb	S30940	...	...	8	2
17	24Cr–10Ni–4Mo–N	Castings	SA–995	2A	J93345	...	...	10H	1
18	25Cr–4Ni–4Mo–Ti	Plate	SA–240	...	S44635	...	...	10I	1
19	25Cr–4Ni–4Mo–Ti	Wld. tube	SA–268	...	S44635	...	...	10I	1
20	25Cr–5Ni–3Mo–2Cu	Castings	SA–995	1B	J93372	...	...	10H	1
21	25Cr–5Ni–3Mo–2Cu	Plate	SA–240	...	S32550	...	...	10H	1
22	25Cr–5Ni–3Mo–2Cu	Bar	SA–479	...	S32550	...	...	10H	1
23	25Cr–5Ni–3Mo–2Cu	Smls. tube	SA–789	...	S32550	...	...	10H	1
24	25Cr–5Ni–3Mo–2Cu	Wld. tube	SA–789	...	S32550	...	...	10H	1
25	25Cr–5Ni–3Mo–2Cu	Smls. pipe	SA–790	...	S32550	...	...	10H	1
26	25Cr–5Ni–3Mo–2Cu	Wld. pipe	SA–790	...	S32550	...	...	10H	1
27	25Cr–6Ni–Mo–N	Plate	SA–240	...	S31200	...	...	10H	1
28	25Cr–6.5Ni–3Mo–N	Smls. tube	SA–789	...	S31260	...	...	10H	1
29	25Cr–6.5Ni–3Mo–N	Wld. tube	SA–789	...	S31260	...	...	10H	1
30	25Cr–6.5Ni–3Mo–N	Smls. pipe	SA–790	...	S31260	...	...	10H	1
31	25Cr–6.5Ni–3Mo–N	Wld. pipe	SA–790	...	S31260	...	...	10H	1
32	25Cr–6.5Ni–3Mo–N	Plate	SA–240	...	S31260	...	...	10H	1
33	25Cr–7Ni–3Mo–W–Cu–N	Forgings	SA–182	F54	S39274	...	...	10H	1
34	25Cr–7Ni–3Mo–W–Cu–N	Smls. tube	SA–789	...	S39274	...	...	10H	1
35	25Cr–7Ni–3Mo–W–Cu–N	Wld. tube	SA–789	...	S39274	...	...	10H	1
36	25Cr–7Ni–3Mo–W–Cu–N	Smls. pipe	SA–790	...	S39274	...	...	10H	1
37	25Cr–7Ni–3Mo–W–Cu–N	Wld. pipe	SA–790	...	S39274	...	...	10H	1
38	25Cr–7Ni–4Mo–N	Forgings	SA–182	F53	S32750	...	...	10H	1
39	25Cr–7Ni–4Mo–N	Plate, sheet	SA–240	...	S32750	...	...	10H	1
40	25Cr–7Ni–4Mo–N	Smls. tube	SA–789	...	S32750	...	≤25	10H	1
41	25Cr–7Ni–4Mo–N	Wld. tube	SA–789	...	S32750	...	≤25	10H	1
42	25Cr–7Ni–4Mo–N	Smls. pipe	SA–790	...	S32750	...	≤25	10H	1
43	25Cr–7Ni–4Mo–N	Wld. pipe	SA–790	...	S32750	...	≤25	10H	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	NP	NP	816	343	HA–2	G5, G12, T5
2	515	205	NP	NP	816	343	HA–2	G12, T6
3	515	205	NP	NP	816	343	HA–2	G5, G12, T5
4	515	205	NP	NP	816	343	HA–2	G12, T6
5	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
6	515	205	NP	NP	816	343	HA–2	G12, G24, T6
7	515	205	NP	427	816	343	HA–2	G5, G12, T5, W12
8	515	205	NP	NP	816	343	HA–2	G12, T6
9	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
10	515	205	NP	NP	816	343	HA–2	G12, G24, T6
11	515	205	NP	NP	538	343	HA–2	G5, G12, G22
12	515	205	NP	NP	538	343	HA–2	G12, G22
13	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
14	515	205	NP	NP	816	343	HA–2	G12, G24, T6
15	515	205	NP	NP	816	343	HA–2	G5, G12, G13, G24, T5
16	515	205	NP	NP	816	343	HA–2	G12, G24, T6
17	655	450	NP	NP	316	316	HA–5	G1, G19
18	620	515	NP	NP	260	260	HA–5	G19
19	620	515	NP	NP	260	260	HA–5	G19, G24
20	690	485	NP	316	NP	NP	HA–5	G19, G29
21	760	550	NP	NP	260	260	HA–5	G19
22	760	550	NP	NP	260	260	HA–5	G19
23	760	550	NP	NP	260	260	HA–5	G19
24	760	550	NP	NP	260	260	HA–5	G19, G24
25	760	550	NP	NP	260	260	HA–5	G19
26	760	550	NP	NP	260	260	HA–5	G19, G24
27	690	450	NP	NP	316	316	HA–5	G19
28	690	450	NP	NP	343	343	HA–5	G19
29	690	450	NP	NP	343	343	HA–5	G19, G24
30	690	450	NP	NP	343	343	HA–5	G19
31	690	450	NP	NP	343	343	HA–5	G19, G24
32	690	485	NP	NP	343	343	HA–5	G19
33	800	550	NP	NP	329	329	HA–8	G19
34	800	550	NP	NP	329	329	HA–8	G19
35	800	550	NP	NP	329	329	HA–8	G19, G24
36	800	550	NP	NP	329	329	HA–8	G19
37	800	550	NP	NP	329	329	HA–8	G19, G24
38	800	550	NP	NP	316	NP	HA–5	G19
39	800	550	NP	NP	316	NP	HA–5	G19
40	800	550	NP	NP	316	316	HA–5	G19
41	800	550	NP	NP	316	316	HA–5	G19, G24
42	800	550	NP	NP	316	316	HA–5	G19
43	800	550	NP	NP	316	316	HA–5	G19, G24

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
2	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
3	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
4	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
5	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
6	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
7	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
8	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
9	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
10	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
11	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
12	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
13	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
14	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
15	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
16	117	110	101	97.5	94.3	88.7	84.7	82.1	80.8	79.8	79.1	77.9	77.3	76.1	74.8
17	187	187	186	180	173	167	167	167	167	...	...	...	...	...	...
18	177	175	171	166	162	156	152	...	...	...	...	...	...	...	...
19	151	149	145	141	137	132	129	...	...	...	...	...	...	...	...
20	197	197	197	195	192	190	190	189	189	...	...	...	...	...	...
21	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
22	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
23	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
24	184	184	183	178	173	168	166	...	...	...	...	...	...	...	...
25	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
26	184	184	183	178	173	168	166	...	...	...	...	...	...	...	...
27	197	197	197	192	187	182	180	180	180	...	...	...	...	...	...
28	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
29	168	168	167	163	158	155	155	154	154	154	...	...	...	...	...
30	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
31	168	168	167	163	158	155	155	154	154	154	...	...	...	...	...
32	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
33	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
34	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
35	194	194	193	188	185	184	184	184	184	184	...	...	...	...	...
36	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
37	194	194	193	188	185	184	184	184	184	184	...	...	...	...	...
38	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
39	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
40	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
41	194	194	192	188	183	177	174	173	172	...	...	...	...	...	...
42	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
43	194	194	192	188	183	177	174	173	172	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
2	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
3	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
4	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
5	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
6	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
7	115	*89.4*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
8	86.7	78.5	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...
9	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
10	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
11	115	89.4	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	86.7	78.5	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
14	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
15	98.9	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
16	73.5	64.8	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(13)	1	25Cr–7.5Ni–3.5Mo–N–Cu–W	Forgings	SA–182	F55	S32760	...	...	10H	1
(13)	2	25Cr–7.5Ni–3.5Mo–N–Cu–W	Plate	SA–240	...	S32760	...	...	10H	1
(13)	3	25Cr–7.5Ni–3.5Mo–N–Cu–W	Bar	SA–479	...	S32760	Annealed	...	10H	1
(13)	4	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. tube	SA–789	...	S32760	...	...	10H	1
(13)	5	25Cr–7.5Ni–3.5Mo–N–Cu–W	Wld. tube	SA–789	...	S32760	...	...	10H	1
(13)	6	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. pipe	SA–790	...	S32760	...	...	10H	1
(13)	7	25Cr–7.5Ni–3.5Mo–N–Cu–W	Wld. pipe	SA–790	...	S32760	...	...	10H	1
(13)	8	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. fittings	SA–815	...	S32760	...	...	10H	1
	9	25Cr–12Ni	Castings	SA–351	CH8	J93400	...	...	8	2
	10	25Cr–12Ni	Castings	SA–351	CH8	J93400	...	...	8	2
	11	25Cr–12Ni	Cast pipe	SA–451	CPH8	J93400	...	...	8	2
	12	25Cr–12Ni	Castings	SA–351	CH20	J93402	...	...	8	2
	13	25Cr–12Ni	Castings	SA–351	CH20	J93402	...	...	8	2
	14	25Cr–12Ni	Cast pipe	SA–451	CPH20	J93402	...	...	8	2
	15	25Cr–20Ni	Castings	SA–351	CK20	J94202	...	...	8	2
	16	25Cr–20Ni	Castings	SA–351	CK20	J94202	...	...	8	2
	17	25Cr–20Ni	Cast pipe	SA–451	CPK20	J94202	...	...	8	2
	18	25Cr–20Ni	Forgings	SA–182	F310	S31000	...	>125	8	2
	19	25Cr–20Ni	Forgings	SA–182	F310	S31000	...	≤125	8	2
	20	25Cr–20Ni	Forgings	SA–965	F310	S31000	...	...	8	2
	21	25Cr–20Ni	Smls. tube	SA–213	TP310S	S31008	...	...	8	2
	22	25Cr–20Ni	Smls. tube	SA–213	TP310S	S31008	...	...	8	2
	23	25Cr–20Ni	Plate	SA–240	310S	S31008	...	...	8	2
	24	25Cr–20Ni	Plate	SA–240	310S	S31008	...	...	8	2
	25	25Cr–20Ni	Wld. tube	SA–249	TP310S	S31008	...	...	8	2
	26	25Cr–20Ni	Wld. tube	SA–249	TP310S	S31008	...	...	8	2
	27	25Cr–20Ni	Smls. & wld. pipe	SA–312	TP310S	S31008	...	...	8	2
	28	25Cr–20Ni	Smls. pipe	SA–312	TP310S	S31008	...	...	8	2
	29	25Cr–20Ni	Wld. pipe	SA–312	TP310S	S31008	...	...	8	2
	30	25Cr–20Ni	Wld. pipe	SA–312	TP310S	S31008	...	...	8	2
	31	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	1	...	8	2
	32	25Cr–20Ni	Smls. & wld. fittings	SA–403	310S	S31008	...	...	8	2
	33	25Cr–20Ni	Bar	SA–479	310S	S31008	...	...	8	2
	34	25Cr–20Ni	Bar	SA–479	310S	S31008	...	...	8	2
	35	25Cr–20Ni	Wld. pipe	SA–813	TP310S	S31008	...	...	8	2
	36	25Cr–20Ni	Wld. pipe	SA–813	TP310S	S31008	...	...	8	2
	37	25Cr–20Ni	Wld. pipe	SA–814	TP310S	S31008	...	...	8	2
	38	25Cr–20Ni	Wld. pipe	SA–814	TP310S	S31008	...	...	8	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	750	550	NP	NP	316	NP	HA–9	G19, H4
2	750	550	NP	NP	316	NP	HA–9	G19
3	750	550	NP	NP	316	NP	HA–9	G19
4	750	550	NP	NP	316	NP	HA–9	G19
5	750	550	NP	NP	316	NP	HA–9	G19, G24
6	750	550	NP	NP	316	NP	HA–9	G19
7	750	550	NP	NP	316	NP	HA–9	G19, G24
8	750	550	NP	NP	316	NP	HA–9	G19, W14
9	450	195	NP	427	816	343	HA–3	G1, G5, G12, G16, G17, G19, T6
10	450	195	NP	NP	816	343	HA–3	G1, G12, G19, T7
11	450	195	NP	427	NP	NP	HA–3	G5, G16, G17, G19
12	485	205	NP	427	816	343	HA–2	G1, G5, G12, G16, G17, T6
13	485	205	NP	NP	816	343	HA–2	G1, G12, T7
14	485	205	NP	427	NP	NP	HA–2	G5, G16, G17
15	450	195	NP	427	816	343	HA–3	G1, G5, G12, G16, G17, T6
16	450	195	NP	NP	816	343	HA–3	G1, G12, T8
17	450	195	NP	427	NP	NP	HA–3	G5, G16, G17
18	485	205	NP	427	NP	NP	HA–2	G5
19	515	205	NP	427	816	343	HA–2	G5, G12, G14, T5
20	515	205	NP	427	816	343	HA–2	G5, G12, T5
21	515	205	816	NP	816	343	HA–2	G5, G12, T5
22	515	205	816	NP	816	343	HA–2	G12, T6
23	515	205	816	427	816	343	HA–2	G5, G12, T5
24	515	205	816	NP	816	343	HA–2	G12, T6
25	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
26	515	205	NP	NP	816	343	HA–2	G12, G24, T6
27	515	205	816	427	816	343	HA–2	G5, G12, T5, W12, W14
28	515	205	816	NP	816	343	HA–2	G12, T6
29	515	205	816	NP	816	343	HA–2	G3, G5, G12, G14, G24, T5
30	515	205	816	NP	816	343	HA–2	G3, G12, G14, G24, T6
31	515	205	NP	427	NP	NP	HA–2	G5, W12
32	515	205	NP	427	816	343	HA–2	G5, G12, T5, W12, W14
33	515	205	538	NP	538	343	HA–2	G12, G22, T6
34	515	205	538	427	538	343	HA–2	G5, G12, G22, T5
35	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
36	515	205	NP	NP	816	343	HA–2	G12, G24, T6
37	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
38	515	205	NP	NP	816	343	HA–2	G12, G24, T6

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
2	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
3	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
4	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
5	182	182	179	175	173	171	170	170	170	...	...	...	...	...	...
6	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
7	182	182	179	175	173	171	170	170	170	...	...	...	...	...	...
8	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
9	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	96.9
10	128	116	104	99.5	97.1	93.4	90.7	88.5	86.9	85.0	83.2	81.3	78.8	76.2	74.3
11	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	...
12	138	132	125	120	117	114	114	114	114	114	113	112	110	107	104
13	138	124	111	106	104	100	97.1	94.6	93.2	91.0	88.6	86.8	84.3	81.8	79.3
14	138	132	125	120	117	114	114	114	114	114	113	112	110	107	...
15	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	96.9
16	128	116	104	99.5	97.1	93.4	90.7	88.5	86.9	85.0	83.2	81.3	78.8	76.2	74.3
17	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	...
18	138	138	136	133	130	128	128	128	127	125	123	122	120	118	...
19	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
20	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
21	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
22	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
23	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
24	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
25	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
26	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
27	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
28	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
29	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
30	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
31	138	138	138	138	138	138	135	129	127	125	123	122	120	119	...
32	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
33	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
34	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
35	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
36	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
37	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
38	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
9	92.7	84.6	*68.4*	*54.3*	*42.1*	*33.2*	*25.9*	*20.3*	*16.4*	*13.3*	*10.2*	*7.25*	*5.74*	*5.33*	...	...	...	
10	72.0	69.5	63.9	*54.3*	*42.1*	*33.2*	*25.9*	*20.3*	*16.4*	*13.3*	*10.2*	*7.25*	*5.74*	*5.33*	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	100	88.5	*68.2*	*53.7*	*42.1*	*33.2*	*25.9*	*20.3*	*16.4*	*13.3*	*10.2*	*7.25*	*5.74*	*5.33*	...	...	...	
13	76.8	74.3	68.2	*53.7*	*42.1*	*33.2*	*25.9*	*20.3*	*16.4*	*13.3*	*10.2*	*7.25*	*5.74*	*5.33*	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	92.7	84.7	*72.8*	*64.5*	*56.8*	*49.1*	*41.0*	*33.6*	*25.5*	*18.3*	*12.8*	*8.93*	*6.59*	*4.84*	...	...	...	
16	72.1	69.5	67.0	63.2	*56.8*	*49.1*	*41.0*	*33.6*	*25.5*	*18.3*	*12.8*	*8.93*	*6.59*	*4.84*	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
20	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
21	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
22	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
23	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
24	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
25	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
26	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
27	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
28	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
29	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
30	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
33	85.3	77.8	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	112	*87.2*	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
36	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
37	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
38	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	25Cr–20Ni	Smls. tube	SA–213	TP310H	S31009	...	...	8	2
2	25Cr–20Ni	Plate	SA–240	310H	S31009	...	...	8	2
3	25Cr–20Ni	Plate	SA–240	310H	S31009	...	...	8	2
4	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...	...	8	2
5	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...	...	8	2
6	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...	...	8	2
7	25Cr–20Ni	Smls. pipe	SA–312	TP310H	S31009	...	...	8	2
8	25Cr–20Ni	Smls. pipe	SA–312	TP310H	S31009	...	...	8	2
9	25Cr–20Ni	Wld. pipe	SA–312	TP310H	S31009	...	...	8	2
10	25Cr–20Ni	Wld. pipe	SA–312	TP310H	S31009	...	...	8	2
11	25Cr–20Ni	Bar	SA–479	310H	S31009	...	...	8	2
12	25Cr–20Ni	Bar	SA–479	310H	S31009	...	...	8	2
13	25Cr–20Ni	Bar	SA/JIS G4303	SUS310S	...	...	...	8	2
14	25Cr–20Ni–Cb	Smls. tube	SA–213	TP310Cb	S31040	...	...	8	2
15	25Cr–20Ni–Cb	Smls. tube	SA–213	TP310Cb	S31040	...	...	8	2
16	25Cr–20Ni–Cb	Plate	SA–240	310Cb	S31040	...	...	8	2
17	25Cr–20Ni–Cb	Plate	SA–240	310Cb	S31040	...	...	8	2
18	25Cr–20Ni–Cb	Wld. tube	SA–249	TP310Cb	S31040	...	...	8	2
19	25Cr–20Ni–Cb	Wld. tube	SA–249	TP310Cb	S31040	...	...	8	2
20	25Cr–20Ni–Cb	Smls. & wld. pipe	SA–312	TP310Cb	S31040	...	...	8	2
21	25Cr–20Ni–Cb	Smls. pipe	SA–312	TP310Cb	S31040	...	...	8	2
22	25Cr–20Ni–Cb	Wld. pipe	SA–312	TP310Cb	S31040	...	...	8	2
23	25Cr–20Ni–Cb	Wld. pipe	SA–312	TP310Cb	S31040	...	...	8	2
24	25Cr–20Ni–Cb	Bar	SA–479	310Cb	S31040	...	...	8	2
25	25Cr–20Ni–Cb	Bar	SA–479	310Cb	S31040	...	...	8	2
26	25Cr–20Ni–Cb	Wld. pipe	SA–813	TP310Cb	S31040	...	...	8	2
27	25Cr–20Ni–Cb	Wld. pipe	SA–813	TP310Cb	S31040	...	...	8	2
28	25Cr–20Ni–Cb	Wld. pipe	SA–814	TP310Cb	S31040	...	...	8	2
29	25Cr–20Ni–Cb	Wld. pipe	SA–814	TP310Cb	S31040	...	...	8	2
30	25Cr–20Ni–Cb–N	Smls. tube	SA–213	TP310HCbN	S31042	...	...	8	3
31	25Cr–20Ni–Cb–N	Smls. tube	SA–213	TP310HCbN	S31042	...	...	8	3
32	25Cr–22Ni–2Mo–N	Forgings	SA–182	F310MoLN	S31050	...	...	8	2
33	25Cr–22Ni–2Mo–N	Forgings	SA–182	F310MoLN	S31050	...	...	8	2
34	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
35	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
(**13**) 36	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t > 6$	8	2
(**13**) 37	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t > 6$	8	2
38	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
39	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
40	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
41	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	$6 < t \le 32$	8	2

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	515	205	816	427	816	NP	HA–2	G5, T6
2	515	205	816	NP	816	NP	HA–2	G5, T6
3	515	205	816	NP	816	NP	HA–2	T7
4	515	205	NP	427	NP	NP	HA–2	G5, W12
5	515	205	NP	NP	816	NP	HA–2	G5, G12, G24, T6
6	515	205	NP	NP	816	NP	HA–2	G12, G24, T7
7	515	205	816	NP	816	NP	HA–2	G5, T6
8	515	205	816	NP	816	NP	HA–2	T7
9	515	205	816	NP	816	NP	HA–2	G3, G5, G24, T6
10	515	205	816	NP	816	NP	HA–2	G3, G24, T7
11	515	205	816	NP	816	NP	HA–2	G5, T6
12	515	205	816	NP	816	NP	HA–2	T7
13	520	205	538	427	538	NP	HA–2	G5, G12, G22, T5
14	515	205	NP	NP	816	343	HA–2	G5, G12, T5
15	515	205	NP	NP	816	343	HA–2	G12, T6
16	515	205	NP	NP	816	343	HA–2	G5, G12, T5
17	515	205	NP	NP	816	343	HA–2	G12, T6
18	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
19	515	205	NP	NP	816	343	HA–2	G12, G24, T6
20	515	205	NP	427	816	343	HA–2	G5, G12, T5, W12, W14
21	515	205	NP	NP	816	343	HA–2	G12, T6
22	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
23	515	205	NP	NP	816	343	HA–2	G12, G14, G24, T6
24	515	205	NP	NP	538	343	HA–2	G5, G12, G22, T5
25	515	205	NP	NP	538	343	HA–2	G12, G22, T6
26	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
27	515	205	NP	NP	816	343	HA–2	G12, G24, T6
28	515	205	NP	NP	816	343	HA–2	G5, G12, G24, T5
29	515	205	NP	NP	816	343	HA–2	G12, G24, T6
30	655	295	732	NP	NP	NP	HA–2	G5, G12, S4, T8
31	655	295	732	NP	NP	NP	HA–2	G12, S4, T9
32	540	255	NP	NP	316	316	HA–2	G5
33	540	255	NP	NP	316	316	HA–2	...
34	540	255	NP	NP	482	343	HA–2	G5
35	540	255	NP	NP	482	343	HA–2	...
36	540	255	NP	NP	316	316	HA–2	G5
37	540	255	NP	NP	316	316	HA–2	...
38	540	255	NP	NP	482	343	HA–2	G5, G24
39	540	255	NP	NP	482	343	HA–2	G24
40	540	255	NP	NP	482	343	HA–2	G5, G24
41	540	255	NP	NP	482	343	HA–2	G24

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
2	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
3	138	129	120	115	111	105	99.5	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
4	138	138	138	138	138	138	135	129	127	125	123	122	120	119	...
5	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.6
6	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
7	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
8	138	129	120	115	111	105	99.5	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
9	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.6
10	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
11	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
12	138	129	120	115	111	105	99.5	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
13	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
14	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
15	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
16	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
17	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
18	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
19	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
20	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
21	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
22	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
23	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
24	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
25	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
26	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
27	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
28	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
29	117	110	102	97.8	94.3	88.7	84.1	81.4	80.2	79.0	77.7	76.5	75.9	74.7	74.0
30	187	187	184	179	175	170	167	165	165	165	164	164	163	162	160
31	187	177	163	156	149	140	133	129	127	126	124	123	121	120	119
32	154	153	151	147	143	138	135	132	130	...	...	...	...	...	...
33	154	150	143	137	131	123	117	111	109	...	...	...	...	...	...
34	154	153	151	147	143	138	135	132	130	129	129	128	127	126	124
35	154	150	143	137	131	123	117	111	109	106	104	102	99.5	96.9	95.0
36	154	153	151	147	143	138	135	132	130	...	...	...	...	...	...
37	154	150	143	137	131	123	117	111	109	...	...	...	...	...	...
38	130	130	128	125	122	118	114	112	111	110	110	109	108	107	105
39	130	127	121	116	111	105	99.6	94.5	92.3	90.6	88.6	86.1	84.2	82.3	81.0
40	130	130	128	125	122	118	114	112	111	110	110	109	108	107	105
41	130	127	121	116	111	105	99.6	94.5	92.3	90.6	88.6	86.1	84.2	82.3	81.0

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	116	104	*84.7*	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
2	116	104	*84.7*	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
3	85.3	84.0	79.8	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	98.4	90.6	*71.3*	*55.7*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...	
6	72.9	71.6	66.5	*55.8*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...	
7	116	104	*84.7*	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
8	85.3	84.0	79.8	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
9	98.4	90.6	*71.3*	*55.7*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...	
10	72.9	71.6	66.5	*55.8*	*41.5*	*31.0*	*23.2*	*18.2*	*13.8*	*10.4*	*8.27*	*6.50*	*5.05*	*4.01*	...	...	...	
11	116	104	*84.7*	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
12	85.3	84.0	79.8	*64.7*	*48.6*	*36.2*	*27.3*	*21.1*	*15.9*	*12.5*	*9.92*	*7.64*	*5.97*	*4.67*	...	...	...	
13	112	*87.2*	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
15	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
16	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
17	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
18	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
19	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
20	112	*87.2*	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
21	85.3	77.8	*59.2*	*44.2*	*31.8*	*23.7*	*16.9*	*10.7*	*6.10*	*3.78*	*2.96*	*2.40*	*1.76*	*1.15*	...	...	...	
22	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
23	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
24	112	*87.2*	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	85.3	77.8	*59.2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
27	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
28	98.5	*74.7*	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
29	72.8	64.5	*50.6*	*37.4*	*27.5*	*20.4*	*14.2*	*9.27*	*5.22*	*3.23*	*2.53*	*2.06*	*1.52*	*0.960*	...	...	...	
30	158	156	153	150	*118*	*90.2*	*68.9*	*52.9*	*41.1*	*32.2*	*25.2*	...	...	...	...	...	...	
31	117	115	114	112	110	*90.2*	*68.9*	*52.9*	*41.1*	*32.2*	*25.2*	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	122	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	103	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	79.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	103	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	79.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	≤6, wall	8	2
	2	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	≤6, wall	8	2
(13)	3	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t \le 6$	8	2
(13)	4	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t \le 6$	8	2
	5	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	≤6, wall	8	2
	6	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	≤6, wall	8	2
	7	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	≤6, wall	8	2
	8	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	≤6, wall	8	2
	9	26Cr–4Ni–Mo	Plate	SA–240	329	S32900	...	...	10H	1
	10	26Cr–4Ni–Mo	Wld. tube	SA–789	...	S32900	...	...	10H	1
	11	26Cr–4Ni–Mo	Smls. tube	SA–789	...	S32900	...	...	10H	1
	12	26Cr–4Ni–Mo	Wld. pipe	SA–790	...	S32900	...	...	10H	1
	13	26Cr–4Ni–Mo	Smls. pipe	SA–790	...	S32900	...	...	10H	1
	14	26Cr–4Ni–Mo–N	Plate	SA–240	...	S32950	...	...	10H	1
	15	26Cr–4Ni–Mo–N	Wld. tube	SA–789	...	S32950	...	...	10H	1
	16	26Cr–4Ni–Mo–N	Smls. tube	SA–789	...	S32950	...	...	10H	1
	17	26Cr–4Ni–Mo–N	Wld. pipe	SA–790	...	S32950	...	...	10H	1
	18	26Cr–4Ni–Mo–N	Smls. pipe	SA–790	...	S32950	...	...	10H	1
	19	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...	≥10	10H	1
	20	29Cr–6.5Ni–2Mo–N	Bar	SA–479	...	S32906	...	...	10H	1
	21	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...	≥10	10H	1
	22	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...	≥10	10H	1
	23	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...	<10	10H	1
	24	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...	<10	10H	1
	25	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...	<10	10H	1

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	580	270	NP	NP	482	343	HA–2	G5
2	580	270	NP	NP	482	343	HA–2	...
3	580	270	NP	NP	316	316	HA–2	G5
4	580	270	NP	NP	316	316	HA–2	...
5	580	270	NP	NP	482	343	HA–2	G5, G24
6	580	270	NP	NP	482	343	HA–2	G24
7	580	270	NP	NP	482	343	HA–2	G5, G24
8	580	270	NP	NP	482	343	HA–2	G24
9	620	485	NP	NP	260	260	HA–5	G19
10	620	485	NP	NP	260	260	HA–5	G19, G24
11	620	485	NP	NP	260	260	HA–5	G19
12	620	485	NP	NP	260	260	HA–5	G19, G24
13	620	485	NP	NP	260	260	HA–5	G19
14	690	485	NP	NP	316	316	HA–5	G19
15	690	485	NP	NP	316	316	HA–5	G19, G24
16	690	485	NP	NP	316	316	HA–5	G19
17	690	485	NP	NP	316	316	HA–5	G19, G24
18	690	485	NP	NP	316	316	HA–5	G19
19	750	550	NP	NP	316	316	HA–5	G19
20	750	550	NP	NP	316	316	HA–5	G19
21	750	550	NP	NP	316	316	HA–5	G19
22	750	550	NP	NP	316	316	HA–5	G19
23	800	650	NP	NP	316	316	HA–5	G19
24	800	650	NP	NP	316	316	HA–5	G19
25	800	650	NP	NP	316	316	HA–5	G19

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	165	165	163	158	154	149	146	142	141	140	138	138	137	135	134
2	165	159	151	144	138	130	123	117	115	112	110	107	105	102	100
3	165	165	163	158	154	149	146	142	141	...	...	...	...	...	...
4	165	159	151	144	138	130	123	117	115	...	...	...	...	...	...
5	141	141	139	135	132	126	123	121	120	119	118	117	116	115	113
6	141	135	128	123	118	110	104	100	97.6	95.3	93.4	90.9	89.1	87.2	85.3
7	141	141	139	135	132	126	123	121	120	119	118	117	116	115	113
8	141	135	128	123	118	110	104	100	97.6	95.3	93.4	90.9	89.1	87.2	85.3
9	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
10	151	151	151	148	145	142	142	...	...	...	...	...	...	...	...
11	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
12	151	151	151	148	145	142	142	...	...	...	...	...	...	...	...
13	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
14	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
15	168	167	166	163	158	155	155	155	155	...	...	...	...	...	...
16	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
17	168	167	166	163	158	155	155	155	155	...	...	...	...	...	...
18	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
19	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
20	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
21	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
22	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
23	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...
24	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...
25	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Ferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	132	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	98.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
5	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	83.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	83.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

NOTES TO TABLE 1A

GENERAL NOTES

(a) The following abbreviations are used: Norm. rld., Normalized rolled; Smls., Seamless; and Wld., Welded.

(b) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(c) For Section VIII and XII applications, stress values in restricted shear such as dowel bolts or similar construction in which the shearing member is so restricted that the section under consideration would fail without reduction of area shall be 0.80 times the values in the above Table.

(d) For Section VIII and XII applications, stress values in bearing shall be 1.60 times the values in the above Table.

(e) Stress values for –30°C to 40°C are applicable for colder temperatures when the toughness requirements of Section III, VIII, or XII are met.

(f) An alternative typeface is used for stress values obtained from time–dependent properties (see Notes T1 through T11).

(g) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–516/SA–516M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–516 Grade 70 shall be used when SA–516M Grade 485 is used in construction.

(h) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (i) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 To these stress values a casting quality factor as specified in PG–25 of Section I, UG–24 of Section VIII, Division 1, or TM–190 of Section XII shall be applied.

G2 These stress values include a joint efficiency factor of 0.60.

G3 These stress values include a joint efficiency factor of 0.85.

G4 For Section I applications, these stresses apply when used for boiler, water wall, superheater, and economizer tubes that are enclosed within a setting. A joint efficiency factor of 0.85 is included in values above 450°C.

G5 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}$% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. For Section III applications, Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G6 Creep–fatigue, thermal ratcheting, and environmental effects are increasingly significant failure modes at temperatures in excess of 825°C and shall be considered in the design.

(**13**) G7 For Section VIII applications, these stress values are based on expected minimum values of 310 MPa tensile strength and yield strength of 140 MPa resulting from loss of strength due to thermal treatment required for the glass coating operation. UG–85 does not apply.

(**13**) G8 These stress values are established from a consideration of strength only and will be satisfactory for average service. For bolted joints where freedom from leakage over a long period of time without retightening is required, lower stress values may be necessary as determined from the flexibility of the flange and bolts and corresponding relaxation properties.

G9 For Section III applications, the use of these materials shall be limited to materials for tanks covered in Subsections NC and ND, component supports, and for nonpressure–retaining attachments (NC/ND–2190).

G10 Upon prolonged exposure to temperatures above 425°C, the carbide phase of carbon steel may be converted to graphite. See Nonmandatory Appendix A, A–201 and A–202.

G11 Upon prolonged exposure to temperatures above 475°C, the carbide phase of carbon–molybdenum steel may be converted to graphite. See Nonmandatory Appendix A, A–201 and A–202.

G12 At temperatures above 550°C, these stress values apply only when the carbon is 0.04% or higher on heat analysis.

G13 These stress values at 575°C and above shall be used only when the grain size is ASTM No. 6 or coarser.

G14 These stress values shall be used when the grain size is not determined or is determined to be finer than ASTM No. 6.

G15 For Section I applications, use is limited to stays as defined in PG–13 except as permitted by PG–11.

G16 For Section III Class 3 applications, these *S* values do not include a casting quality factor. Statically and centrifugally cast products meeting the requirements of NC–2570 shall receive a casting quality factor of 1.00.

G17 For Section III Class 3 applications, statically and centrifugally cast products meeting the requirements of NC–2571(a) and (b), and cast pipe fittings, pumps, and valves with inlet piping connections of DN 50 and less, shall receive a casting quality factor of 1.00. Other casting quality factors shall be in accordance with the following:

(a) for visual examination, 0.80

(b) for magnetic particle examination, 0.85

(c) for liquid penetrant examination, 0.85

(d) for radiography, 1.00

(e) for ultrasonic examination, 1.00

(f) for magnetic particle or liquid penetrant plus ultrasonic examination or radiography, 1.00

G18 See Table Y–1 for yield strength values as a function of thickness over this range. Allowable stresses are independent of yield strength in this thickness range.

NOTES TO TABLE 1A (CONT'D)

NOTES – GENERAL REQUIREMENTS (CONT'D)

(**13**) G19 This steel may be expected to develop embrittlement after service at moderately elevated temperature. See Nonmandatory Appendix A, A–207 and A–208.

(**13**) G20 These stresses are based on weld metal properties.

(**13**) G21 For Section I, use is limited to PEB–5.3. See PG–5.5 for cautionary note.

G22 For Section I applications, use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.

G23 For temperatures above the maximum temperature shown on the external pressure chart for this material, Fig. CS–2 may be used for the design using this material.

G24 A factor of 0.85 has been applied in arriving at the maximum allowable stress values in tension for this material. Divide tabulated values by 0.85 for maximum allowable longitudinal tensile stress.

G25 For Section III applications, for both Class 2 and Class 3, the completed vessel after final heat treatment shall be examined by the ultrasonic method in accordance with NB–2542 except that angle beam examination in both the circumferential and the axial directions may be performed in lieu of the straight beam examination in the axial direction. The tensile strength shall not exceed 860 MPa.

G26 Material that conforms to Class 10, 11, or 12 is not permitted.

G27 Material that conforms to Class 11 or 12 is not permitted.

G28 Supplementary Requirement S15 of SA–781, Alternate Mechanical Test Coupons and Specimen Locations for Castings, is mandatory.

G29 For Section III applications, impact testing in accordance with the requirements of NC–2300 is required for Class 2 components and in accordance with ND–2300 for Class 3 components.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating to the minimum temperature specified in the material specification, but not lower than 1040°C, and quenching in water or rapidly cooling by other means.

H2 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating to a minimum temperature of 1095°C, and quenching in water or rapidly cooling by other means.

(**13**) H3 Normalized and tempered.

(**13**) H4 Solution treated and quenched.

H5 For Section III applications, if heat treatment is performed after forming or fabrication, it shall be performed at 825°C to 1000°C for a period of time not to exceed 10 min at temperature, followed by rapid cooling.

NOTES – SIZE REQUIREMENTS

S1 For Section I applications, stress values at temperatures of 450°C and above are permissible but, except for tubular products 75 mm O.D. or less enclosed within the boiler setting, use of these materials at these temperatures is not current practice.

S2 For Section I applications, stress values at temperatures of 475°C and above are permissible but, except for tubular products 75 mm O.D. or less enclosed within the boiler setting, use of these materials at these temperatures is not current practice.

S3 For Section I applications, stress values at temperatures of 550°C and above are permissible but, except for tubular products 75 mm O.D. or less enclosed within the boiler setting, use of these materials at these temperatures is not current practice.

S4 For Section I applications, stress values at temperatures of 625°C and above are permissible but, except for tubular products 75 mm O.D. or less enclosed within the boiler setting, use of these materials at these temperatures is not current practice.

S5 Material that conforms to Class 10, 11, or 12 is not permitted when the nominal thickness of the material exceeds 19 mm.

S6 Material that conforms to Class 10, 11, or 12 is not permitted when the nominal thickness of the material exceeds 32 mm.

S7 The maximum thickness of unheat–treated forgings shall not exceed 95 mm. The maximum thickness as–heat–treated may be 100 mm.

S8 The maximum section thickness shall not exceed 75 mm for double–normalized–and–tempered forgings, or 125 mm for quenched–and–tempered forgings.

S9 Both DN 200 and larger, and schedule 140 and heavier.

S10 The maximum pipe size shall be NPS 4 (DN 100) and the maximum thickness in any pipe size shall be Schedule 80.

(**13**) S11 Either DN 200 and larger and less than schedule 140 wall, or less than DN 200 and all wall thicknesses.

NOTES – TIME–DEPENDENT PROPERTIES [See General Note (f)]

T1 Allowable stresses for temperatures of 370°C and above are values obtained from time–dependent properties.

T2 Allowable stresses for temperatures of 400°C and above are values obtained from time–dependent properties.

T3 Allowable stresses for temperatures of 455°C and above are values obtained from time–dependent properties.

T4 Allowable stresses for temperatures of 480°C and above are values obtained from time–dependent properties.

T5 Allowable stresses for temperatures of 510°C and above are values obtained from time–dependent properties.

T6 Allowable stresses for temperatures of 540°C and above are values obtained from time–dependent properties.

T7 Allowable stresses for temperatures of 565°C and above are values obtained from time–dependent properties.

T8 Allowable stresses for temperatures of 595°C and above are values obtained from time–dependent properties.

T9 Allowable stresses for temperatures of 620°C and above are values obtained from time–dependent properties.

T10 Allowable stresses for temperatures of 425°C and above are values obtained from time–dependent properties.

(**13**) T11 Allowable stresses for temperatures of 350°C and above are values obtained from time–dependent properties.

NOTES – WELDING REQUIREMENTS

W1 Not for welded construction.

W2 Not for welded construction in Section III.

W3 Welded.

W4 Nonwelded, or welded if the tensile strength of the Section IX reduced section tension test is not less than 690 MPa.

W5 Welded, with the tensile strength of the Section IX reduced tension test less than 690 MPa but not less than 655 MPa.

NOTES TO TABLE 1A (CONT'D)

NOTES – WELDING REQUIREMENTS (CONT'D)

W6 This material may be welded by the resistance technique.

W7 In welded construction for temperatures above 450°C, the weld metal shall have a carbon content of greater than 0.05%.

W8 Welding and oxygen or other thermal cutting processes are not permitted when carbon content exceeds 0.35% by heat analysis.

W9 For Section I applications, for pressure retaining welds in 2¼Cr–1Mo materials, other than circumferential butt welds less than or equal to 89 mm in outside diameter, when the design metal temperatures exceed 450°C, the weld metal shall have a carbon content greater than 0.05%.

W10 For Section III applications, material that conforms to Class 10, 13, 20, 23, 30, 33, 40, 43, 50, or 53 is not permitted for Class 2 and Class 3 construction when a weld efficiency factor of 1.00 is used in accordance with Note W12.

W11 For Section VIII applications, Section IX, QW–250 Variables QW–404.12, QW–406.3, QW–407.2, and QW–409.1 shall also apply to this material. These variables shall be applied in accordance with the rules for welding of Part UF.

W12 These *S* values do not include a longitudinal weld efficiency factor. For Section III applications, for materials welded without filler metal, ultrasonic examination, radiographic examination, or eddy current examination, in accordance with NC–2550, shall provide a longitudinal weld efficiency factor of 1.00. Materials welded with filler metal meeting the requirements of NC–2560 shall receive a longitudinal weld efficiency factor of 1.00. Other longitudinal weld efficiency factors shall be in accordance with the following:

(a) for single butt weld, with filler metal, 0.80

(b) for single or double butt weld, without filler metal, 0.85

(c) for double butt weld, with filler metal, 0.90

(d) for single or double butt weld, with radiography, 1.00

W13 For Section I applications, electric resistance and autogenous welded tubing may be used with these stresses, provided the following additional restrictions and requirements are met:

(a) The tubing shall be used for boiler, waterwall, superheater, and economizer tubes that are enclosed within the setting.

(b) The maximum outside diameter shall be 89 mm.

(c) The weld seam of each tube shall be subjected to an angle beam ultrasonic inspection per SA–450.

(d) A complete volumetric inspection of the entire length of each tube shall be performed in accordance with SA–450.

(e) Material test reports shall be supplied.

W14 These *S* values do not include a weld factor. For Section VIII, Division 1, and Section XII applications using welds made without filler metal, the tabulated tensile stress values shall be multiplied by 0.85. For welds made with filler metal, consult UW–12 for Section VIII, Division 1, or TW–130.4 for Section XII, as applicable.

W15 The Nondestructive Electric Test requirements of SA–53 Type E pipe are required for all sizes. The pipe shall be additionally marked "NDE" and so noted on the material specification.

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Table 1B
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	...	Plate, sheet	SB–209	...	Alclad 3003	O
2	...	Plate, sheet	SB–209	...	Alclad 3003	O
3	...	Plate, sheet	SB–209	...	Alclad 3003	H112
4	...	Plate, sheet	SB–209	...	Alclad 3003	H112
5	...	Plate, sheet	SB–209	...	Alclad 3003	H112
6	...	Plate, sheet	SB–209	...	Alclad 3003	H12
7	...	Plate, sheet	SB–209	...	Alclad 3003	H12
8	...	Plate, sheet	SB–209	...	Alclad 3003	H14
9	...	Plate, sheet	SB–209	...	Alclad 3003	H14
10	...	Drawn smls. tube	SB–210	...	Alclad 3003	O
11	...	Drawn smls. tube	SB–210	...	Alclad 3003	H113
12	...	Drawn smls. tube	SB–210	...	Alclad 3003	H14
13	...	Drawn smls. tube	SB–210	...	Alclad 3003	H18
14	...	Cond. & heat exch. tubes	SB–234	...	Alclad 3003	H14
15	...	Cond. & heat exch. tubes	SB–234	...	Alclad 3003	H25
16	...	Smls. extr. tube	SB–241	...	Alclad 3003	O
17	...	Smls. extr. tube	SB–241	...	Alclad 3003	H112
18	...	Plate, sheet	SB–209	...	Alclad 3004	O
19	...	Plate, sheet	SB–209	...	Alclad 3004	O
20	...	Plate, sheet	SB–209	...	Alclad 3004	H112
21	...	Plate, sheet	SB–209	...	Alclad 3004	H112
22	...	Plate, sheet	SB–209	...	Alclad 3004	H32
23	...	Plate, sheet	SB–209	...	Alclad 3004	H32
24	...	Plate, sheet	SB–209	...	Alclad 3004	H34
25	...	Plate, sheet	SB–209	...	Alclad 3004	H34
26	...	Plate, sheet	SB–209	...	Alclad 6061	T4
27	...	Plate, sheet	SB–209	...	Alclad 6061	T451
28	...	Plate, sheet	SB–209	...	Alclad 6061	T451
29	...	Plate, sheet	SB–209	...	Alclad 6061	T4 wld.
30	...	Plate, sheet	SB–209	...	Alclad 6061	T451 wld.
31	...	Plate, sheet	SB–209	...	Alclad 6061	T6
32	...	Plate, sheet	SB–209	...	Alclad 6061	T651
33	...	Plate, sheet	SB–209	...	Alclad 6061	T651
34	...	Plate, sheet	SB–209	...	Alclad 6061	T651
35	...	Plate, sheet	SB–209	...	Alclad 6061	T6 wld.
36	...	Plate, sheet	SB–209	...	Alclad 6061	T651 wld.
37	...	Castings	SB–26	...	A02040	T4
38	...	Castings	SB–108	...	A02040	T4
39	...	Castings	SB–26	...	A03560	T71
40	...	Castings	SB–26	...	A03560	T6
41	...	Castings	SB–108	...	A03560	T6
42	...	Castings	SB–26	...	A24430	F

Table 1B
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	0.15–12.69	21	90	31	NP	121 (Cl. 3 only)	204	204	NFA–7	G16
2	12.70–76.20	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–7	G25
3	6.35–12.69	21	110	62	NP	149 (Cl. 3 only)	204	204	NFA–7	G16, W3
4	12.70–50.80	21	100	41	NP	93 (Cl. 3 only)	204	204	NFA–7	G26, W3
5	50.81–76.2	21	100	41	NP	93 (Cl. 3 only)	204	204	NFA–7	G26, W3
6	0.43–12.69	21	110	76	NP	149 (Cl. 3 only)	204	204	NFA–7	G16, W3
7	12.70–50.80	21	120	83	NP	149 (Cl. 3 only)	204	204	NFA–7	G25, W3
8	0.23–12.69	21	130	110	NP	121 (Cl. 3 only)	204	204	NFA–7	G16, W3
9	12.70–25.40	21	140	120	NP	121 (Cl. 3 only)	204	204	NFA–7	G25, W3
10	0.25–12.7	21	90	31	NP	121 (Cl. 3 only)	204	204	NFA–7	G16
11	1.27–12.7	21	90	31	NP	121 (Cl. 3 only)	204	204	NFA–7	G16, W3
12	0.25–12.7	21	130	110	NP	121 (Cl. 3 only)	204	204	NFA–1	G16, W3
13	0.25–12.7	21	180	160	NP	121 (Cl. 3 only)	204	204	NFA–1	G16, W3
14	0.25–5.08	21	130	110	NP	121 (Cl. 3 only)	204	204	NFA–1	G16, W4
15	0.25–5.08	21	145	125	NP	121 (Cl. 3 only)	204	204	NFA–1	G16, W4
16	...	21	90	31	NP	121 (Cl. 3 only)	204	204	NFA–7	G16
17	...	21	90	31	NP	121 (Cl. 3 only)	204	204	NFA–7	G16, W3
18	1.30–12.69	22	145	55	NP	149 (Cl. 3 only)	204	204	NFA–7	G16
19	12.70–76.20	22	150	59	NP	149 (Cl. 3 only)	204	204	NFA–7	G25
20	6.35–12.69	22	150	59	NP	149 (Cl. 3 only)	204	204	NFA–7	G16, W3
21	12.70–76.20	22	160	62	NP	149 (Cl. 3 only)	204	204	NFA–7	G25, W3
22	1.30–12.69	22	185	140	NP	121 (Cl. 3 only)	204	204	NFA–7	G16, W3
23	12.70–50.80	22	195	145	NP	121 (Cl. 3 only)	204	204	NFA–7	G25, W3
24	1.30–12.69	22	210	165	NP	121 (Cl. 3 only)	204	204	NFA–7	G16, W3
25	12.70–25.40	22	220	170	NP	121 (Cl. 3 only)	204	204	NFA–7	G25, W3
26	1.30–6.34	23	185	97	NP	204 (Cl. 3 only)	204	204	NFA–12	G16, G24, W4
27	6.35–12.69	23	185	97	NP	204 (Cl. 3 only)	204	204	NFA–12	G16, G24, W4
28	12.70–76.20	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, G25, W4
29	1.30–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, W7
30	6.35–76.2	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, W7
31	1.30–6.34	23	260	220	NP	204 (Cl. 3 only)	204	204	NFA–12	G16, G24, W4
32	6.35–12.69	23	260	220	NP	204 (Cl. 3 only)	204	204	NFA–12	G16, G24, W4
33	12.70–101.60	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, G25, W4
34	101.61–127	23	275	240	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, G26, W4
35	1.30–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, W7
36	6.35–127	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, W7
37	≤50.8	...	310	195	NP	NP	66	66	NFA–12	G15, W4
38	≤50.8	...	330	200	NP	NP	66	66	NFA–12	G15, W4
39	...	...	170	125	NP	177 (Cl. 3 only)	204	204	NFA–1	G15, W4
40	...	...	205	140	NP	121 (Cl. 3 only)	121	121	NFA–12	G15, W4
41	...	...	230	150	NP	NP	121	121	NFA–12	G15, W4
42	...	...	120	41	NP	204 (Cl. 3 only)	204	204	NFA–1	G15, W4

Table 1B
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	20.7	20.7	20.2	18.3	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
2	20.7	20.7	20.2	18.3	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
3	29.6	29.6	29.2	25.7	22.6	18.9	15.1	11.4	...	...	...	...	...	...	...	...	...	...
4	26.9	26.9	26.1	19.7	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
5	26.2	26.2	24.7	19.2	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
6	29.6	29.6	29.2	25.7	22.6	18.9	15.1	11.4	...	...	...	...	...	...	...	...	...	...
7	29.6	29.6	29.2	25.7	22.6	18.9	15.1	11.4	...	...	...	...	...	...	...	...	...	...
8	35.2	35.2	34.6	30.5	26.6	19.0	15.0	11.5	...	...	...	...	...	...	...	...	...	...
9	35.2	35.2	34.6	30.5	26.6	19.0	15.0	11.5	...	...	...	...	...	...	...	...	...	...
10	20.7	20.7	20.2	18.3	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
11	20.7	20.7	20.2	18.3	15.0	11.2	9.24	7.47	...	...	...	...	...	...	...	...	...	...
12	35.2	35.2	34.6	30.5	26.6	19.0	15.0	11.5	...	...	...	...	...	...	...	...	...	...
13	48.3	48.3	46.5	39.0	32.7	22.6	16.7	11.4	...	...	...	...	...	...	...	...	...	...
14	35.2	35.2	34.6	30.5	26.6	19.0	15.0	11.5	...	...	...	...	...	...	...	...	...	...
15	39.3	39.3	38.5	32.2	26.6	19.0	15.0	11.5	...	...	...	...	...	...	...	...	...	...
16	20.7	20.7	20.4	18.2	15.0	11.2	8.67	6.26	...	...	...	...	...	...	...	...	...	...
17	20.7	20.7	20.4	18.2	15.0	11.2	8.67	6.26	...	...	...	...	...	...	...	...	...	...
18	34.5	34.5	34.5	34.3	30.8	24.0	15.9	7.84	...	...	...	...	...	...	...	...	...	...
19	34.5	34.5	34.5	34.3	30.8	24.0	15.9	7.84	...	...	...	...	...	...	...	...	...	...
20	35.9	35.9	35.9	35.6	31.4	24.0	15.9	7.85	...	...	...	...	...	...	...	...	...	...
21	40.7	40.7	40.1	35.9	31.5	24.0	15.9	7.85	...	...	...	...	...	...	...	...	...	...
22	49.6	49.6	48.7	41.8	35.5	24.1	15.8	7.94	...	...	...	...	...	...	...	...	...	...
23	49.6	49.6	48.7	41.8	35.5	24.1	15.8	7.94	...	...	...	...	...	...	...	...	...	...
24	56.5	56.5	55.2	44.6	35.4	24.1	15.8	7.92	...	...	...	...	...	...	...	...	...	...
25	56.5	56.5	55.2	44.6	35.4	24.1	15.8	7.92	...	...	...	...	...	...	...	...	...	...
26	53.8	53.8	53.1	47.3	42.6	39.7	29.7	18.8	...	...	...	...	...	...	...	...	...	...
27	53.8	53.8	53.1	47.3	42.6	39.7	29.7	18.8	...	...	...	...	...	...	...	...	...	...
28	53.8	53.8	53.1	47.3	42.6	39.7	29.7	18.8	...	...	...	...	...	...	...	...	...	...
29	41.4	41.4	41.3	40.5	37.7	32.2	25.4	18.5	...	...	...	...	...	...	...	...	...	...
30	41.4	41.4	41.3	40.5	37.7	32.2	25.4	18.5	...	...	...	...	...	...	...	...	...	...
31	75.2	75.2	73.6	61.6	51.9	40.1	29.4	18.9	...	...	...	...	...	...	...	...	...	...
32	75.2	75.2	73.6	61.6	51.9	40.1	29.4	18.9	...	...	...	...	...	...	...	...	...	...
33	75.2	75.2	73.6	61.6	51.9	40.1	29.4	18.9	...	...	...	...	...	...	...	...	...	...
34	71.0	71.0	69.4	57.8	50.7	40.1	29.4	18.9	...	...	...	...	...	...	...	...	...	...
35	41.4	41.4	41.3	40.5	37.7	32.2	25.4	18.5	...	...	...	...	...	...	...	...	...	...
36	41.4	41.4	41.3	40.5	37.7	32.2	25.4	18.5	...	...	...	...	...	...	...	...	...	...
37	57.9	49.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	71.0	59.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	49.6	49.6	48.8	42.5	37.0	28.9	18.5	7.84	...	...	...	...	...	...	...	...	...	...
40	59.3	59.3	57.3	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	65.5	64.2	55.7	42.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	27.6	27.6	27.4	25.9	24.0	21.5	19.6	17.8	...	...	...	...	...	...	...	...	...	...

Table 1B
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	1	...	Plate, sheet	SB–209	...	A91060	O
	2	...	Plate, sheet	SB–209	...	A91060	H112
	3	...	Plate, sheet	SB–209	...	A91060	H112
	4	...	Plate, sheet	SB–209	...	A91060	H112
	5	...	Plate, sheet	SB–209	...	A91060	H12
	6	...	Plate, sheet	SB–209	...	A91060	H14
	7	...	Drawn smls. tube	SB–210	...	A91060	O
	8	...	Drawn smls. tube	SB–210	...	A91060	H14
	9	...	Drawn smls. tube	SB–210	...	A91060	H113
	10	...	Bar, rod, shapes	SB–221	...	A91060	O
	11	...	Bar, rod, shapes	SB–221	...	A91060	H112
	12	...	Cond. & heat exch. tubes	SB–234	...	A91060	H14
	13	...	Smls. extr. tube	SB–241	...	A91060	O
	14	...	Smls. extr. tube	SB–241	...	A91060	H112
	15	...	Plate, sheet	SB–209	...	A91100	O
	16	...	Plate, sheet	SB–209	...	A91100	H112
	17	...	Plate, sheet	SB–209	...	A91100	H112
	18	...	Plate, sheet	SB–209	...	A91100	H112
	19	...	Plate, sheet	SB–209	...	A91100	H12
	20	...	Plate, sheet	SB–209	...	A91100	H14
	21	...	Bar, rod, shapes	SB–221	...	A91100	O
	22	...	Bar, rod, shapes	SB–221	...	A91100	H112
	23	...	Smls. extr. tube	SB–241	...	A91100	O
	24	...	Smls. extr. tube	SB–241	...	A91100	H112
	25	...	Die forgings	SB–247	...	A92014	T4
	26	...	Die forgings	SB–247	...	A92014	T6
(13)	27	...	Die forgings	SB–247	...	A92014	T6
	28	...	Bar, rod, wire	SB–211	...	A92024	T4
	29	...	Bar, rod, wire	SB–211	...	A92024	T4
	30	...	Bar, rod, wire	SB–211	...	A92024	T4
	31	...	Bar, rod, wire	SB–211	...	A92024	T4
	32	...	Bar, rod, shapes	SB–221	...	A92024	T3
	33	...	Bar, rod, shapes	SB–221	...	A92024	T3
	34	...	Bar, rod, shapes	SB–221	...	A92024	T3
	35	...	Bar, rod, shapes	SB–221	...	A92024	T3
	36	...	Plate, sheet	SB–209	...	A93003	O
	37	...	Plate, sheet	SB–209	...	A93003	H112
	38	...	Plate, sheet	SB–209	...	A93003	H112
	39	...	Plate, sheet	SB–209	...	A93003	H112
	40	...	Plate, sheet	SB–209	...	A93003	H12
	41	...	Plate, sheet	SB–209	...	A93003	H14

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	1.30–76.2	21	55	17	NP	149 (Cl. 3 only)	204	204	NFA–7	T3
2	6.35–12.69	21	76	48	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
3	12.70–25.40	21	69	34	NP	149 (Cl. 3 only)	204	204	NFA–7	T4, W3
4	25.41–76.2	21	62	28	NP	121 (Cl. 3 only)	204	204	NFA–7	T3, W3
5	1.30–50.8	21	76	62	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
6	1.30–25.4	21	83	69	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
7	0.46–12.7	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	T3
8	0.46–12.7	...	83	69	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
9	0.46–12.7	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
10	...	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	G13, T3
11	...	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	G13, T3, W3
12	0.25–5.08	21	83	69	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W4
13	...	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	T3
14	...	21	59	17	NP	149 (Cl. 3 only)	204	204	NFA–7	T3, W3
15	0.15–76.2	21	76	24	NP	121 (Cl. 3 only)	204	204	NFA–7	T4
16	6.35–12.69	21	90	48	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
17	12.70–50.80	21	83	34	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
18	50.81–76.2	21	79	28	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
19	1.30–50.8	21	97	76	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
20	0.23–25.4	21	110	97	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
21	...	21	76	21	NP	121 (Cl. 3 only)	204	204	NFA–7	T4
22	...	21	76	21	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
23	...	21	76	21	NP	121 (Cl. 3 only)	204	204	NFA–7	T4
24	...	21	76	21	NP	121 (Cl. 3 only)	204	204	NFA–7	T4, W3
25	≤101.6	...	380	205	NP	204 (Cl. 3 only)	204	204	NFA–6	T3, W4
26	≤50.8	...	450	385	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
27	50.81–101.6	...	435	370	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
28	3.18–12.69	...	425	310	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
29	12.70–114.30	...	425	290	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
30	114.31–165.10	...	425	275	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
31	165.11–203.2	...	400	260	NP	204 (Cl. 3 only)	204	204	NFA–6	T2, W4
32	≤6.34	...	395	290	NP	204 (Cl. 3 only)	204	204	NFA–6	G24, T2, W4
33	6.35–19.04	...	415	305	NP	204 (Cl. 3 only)	204	204	NFA–6	G24, T2, W4
34	19.05–38.09	...	450	315	NP	204 (Cl. 3 only)	204	204	NFA–6	G24, T2, W4
35	≥38.10	...	470	330	NP	204 (Cl. 3 only)	204	204	NFA–6	G24, T2, W4
36	0.15–76.2	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3
37	6.35–12.69	21	120	69	NP	149 (Cl. 3 only)	204	204	NFA–1	T4, W3
38	12.70–50.80	21	100	41	NP	93 (Cl. 3 only)	204	204	NFA–1	T3, W3
39	50.81–76.2	21	100	41	NP	93 (Cl. 3 only)	204	204	NFA–1	T3, W3
40	0.43–50.8	21	120	83	NP	149 (Cl. 3 only)	204	204	NFA–1	T4, W3
41	0.23–25.4	21	140	120	NP	121 (Cl. 3 only)	204	204	NFA–2	T4, W3

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
2	22.1	20.7	15.9	14.2	12.4	*11.2*	*7.64*	*3.78*	...	...	...	...	...	...	...	...	...	...
3	20.0	18.7	14.5	12.9	11.7	9.80	7.35	*4.85*	...	...	...	...	...	...	...	...	...	...
4	17.9	16.6	12.7	11.6	10.3	*7.74*	*5.82*	*4.00*	...	...	...	...	...	...	...	...	...	...
5	22.1	22.1	17.1	15.7	14.4	*12.6*	*8.43*	*3.97*	...	...	...	...	...	...	...	...	...	...
6	23.4	23.4	23.1	20.3	17.8	*12.7*	*8.88*	*5.25*	...	...	...	...	...	...	...	...	...	...
7	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
8	23.4	23.4	23.1	20.3	17.8	*12.7*	*8.88*	*5.25*	...	...	...	...	...	...	...	...	...	...
9	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
10	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
11	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
12	23.4	23.4	23.1	20.3	17.8	*12.7*	*8.88*	*5.25*	...	...	...	...	...	...	...	...	...	...
13	11.7	11.7	10.9	10.2	8.91	*7.68*	*5.87*	*3.97*	...	...	...	...	...	...	...	...	...	...
14	11.7	11.7	10.7	9.45	8.22	*6.98*	*5.74*	*4.50*	...	...	...	...	...	...	...	...	...	...
15	15.9	15.9	15.9	15.6	12.3	9.80	7.35	*4.84*	...	...	...	...	...	...	...	...	...	...
16	25.5	25.5	24.5	18.0	16.4	12.1	7.63	*3.35*	...	...	...	...	...	...	...	...	...	...
17	22.8	22.8	21.9	16.7	15.1	12.0	7.68	*3.31*	...	...	...	...	...	...	...	...	...	...
18	18.6	18.6	18.1	16.1	12.3	9.80	7.35	*4.84*	...	...	...	...	...	...	...	...	...	...
19	27.6	27.6	26.8	21.5	19.2	14.2	9.13	*4.21*	...	...	...	...	...	...	...	...	...	...
20	31.7	31.7	30.9	24.5	19.1	14.1	9.16	*4.19*	...	...	...	...	...	...	...	...	...	...
21	13.8	13.8	13.8	13.7	12.3	9.83	7.33	*4.86*	...	...	...	...	...	...	...	...	...	...
22	13.8	13.8	13.8	13.7	12.3	9.83	7.33	*4.86*	...	...	...	...	...	...	...	...	...	...
23	13.8	13.8	13.8	13.7	12.3	9.83	7.33	*4.86*	...	...	...	...	...	...	...	...	...	...
24	13.8	13.8	13.8	13.7	12.3	9.83	7.33	*4.86*	...	...	...	...	...	...	...	...	...	...
25	108	108	89.2	85.3	78.7	*48.8*	*29.5*	*12.5*	...	...	...	...	...	...	...	...	...	...
26	128	128	125	98.4	*78.2*	*48.6*	*29.7*	*12.4*	...	...	...	...	...	...	...	...	...	...
27	124	124	121	95.1	*78.1*	*48.6*	*29.7*	*12.4*	...	...	...	...	...	...	...	...	...	...
28	122	122	118	90.6	*70.7*	*46.3*	*32.7*	*21.2*	...	...	...	...	...	...	...	...	...	...
29	122	122	118	90.6	*70.7*	*46.3*	*32.7*	*21.2*	...	...	...	...	...	...	...	...	...	...
30	122	122	118	90.6	*70.7*	*46.3*	*32.7*	*21.2*	...	...	...	...	...	...	...	...	...	...
31	114	114	111	84.6	*66.0*	*43.3*	*30.7*	*19.5*	...	...	...	...	...	...	...	...	...	...
32	112	112	109	83.2	*64.6*	*42.6*	*30.6*	*20.0*	...	...	...	...	...	...	...	...	...	...
33	118	118	114	87.2	*68.0*	*44.7*	*32.0*	*20.9*	...	...	...	...	...	...	...	...	...	...
34	128	128	124	94.4	*73.4*	*48.3*	*34.3*	*22.0*	...	...	...	...	...	...	...	...	...	...
35	134	134	130	99.1	*76.8*	*50.4*	*36.3*	*24.0*	...	...	...	...	...	...	...	...	...	...
36	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
37	33.8	33.8	32.9	26.9	24.7	21.0	17.2	*13.5*	...	...	...	...	...	...	...	...	...	...
38	26.2	26.2	25.0	21.3	16.3	*12.6*	*10.1*	*7.63*	...	...	...	...	...	...	...	...	...	...
39	24.8	24.8	23.9	21.4	16.3	*12.6*	*10.1*	*7.63*	...	...	...	...	...	...	...	...	...	...
40	33.8	33.8	32.9	26.9	24.7	21.0	17.2	*13.5*	...	...	...	...	...	...	...	...	...	...
41	39.3	39.3	38.5	33.1	29.4	21.1	17.0	*13.6*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Drawn smls. tube	SB–210	...	A93003	O
2	...	Drawn smls. tube	SB–210	...	A93003	H113
3	...	Drawn smls. tube	SB–210	...	A93003	H12
4	...	Drawn smls. tube	SB–210	...	A93003	H14
5	...	Drawn smls. tube	SB–210	...	A93003	H18
6	...	Bar, rod, shapes	SB–221	...	A93003	O
7	...	Bar, rod, shapes	SB–221	...	A93003	H112
8	...	Cond. & heat exch. tubes	SB–234	...	A93003	H14
9	...	Cond. & heat exch. tubes	SB–234	...	A93003	H25
10	...	Smls. extr. tube	SB–241	...	A93003	O
11	...	Smls. extr. tube	SB–241	...	A93003	H112
12	...	Smls. pipe	SB–241	...	A93003	H112
13	...	Smls. pipe	SB–241	...	A93003	H18
14	...	Die forgings	SB–247	...	A93003	H112
15	...	Die forgings	SB–247	...	A93003	H112 wld.
16	...	Plate, sheet	SB–209	...	A93004	O
17	...	Plate, sheet	SB–209	...	A93004	H112
18	...	Plate, sheet	SB–209	...	A93004	H32
19	...	Plate, sheet	SB–209	...	A93004	H34
20	...	Plate, sheet	SB–209	...	A95052	O
21	...	Plate, sheet	SB–209	...	A95052	H112
22	...	Plate, sheet	SB–209	...	A95052	H112
23	...	Plate, sheet	SB–209	...	A95052	H32
24	...	Plate, sheet	SB–209	...	A95052	H34
25	...	Drawn smls. tube	SB–210	...	A95052	O
26	...	Drawn smls. tube	SB–210	...	A95052	H32
27	...	Drawn smls. tube	SB–210	...	A95052	H34
28	...	Cond. & heat exch. tubes	SB–234	...	A95052	H32
29	...	Cond. & heat exch. tubes	SB–234	...	A95052	H34
30	...	Smls. extr. tube	SB–241	...	A95052	O
31	...	Plate, sheet	SB–209	...	A95083	O
32	...	Plate, sheet	SB–209	...	A95083	O
33	...	Plate, sheet	SB–209	...	A95083	O
34	...	Plate, sheet	SB–209	...	A95083	O
35	...	Plate, sheet	SB–209	...	A95083	O
36	...	Plate, sheet	SB–209	...	A95083	H112
37	...	Plate, sheet	SB–209	...	A95083	H112
38	...	Plate, sheet	SB–209	...	A95083	H32
39	...	Plate, sheet	SB–209	...	A95083	H32
40	...	Bar, rod, shapes	SB–221	...	A95083	O
41	...	Bar, rod, shapes	SB–221	...	A95083	H111
42	...	Bar, rod, shapes	SB–221	...	A95083	H112

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	0.25–12.7	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3
2	0.25–12.7	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3, W3
3	0.25–12.7	21	120	83	NP	149 (Cl. 3 only)	204	204	NFA–1	T4, W3
4	0.25–12.7	21	140	120	NP	121 (Cl. 3 only)	204	204	NFA–2	T4, W3
5	0.25–12.7	21	185	165	NP	121 (Cl. 3 only)	204	204	NFA–2	T4, W3
6	...	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3
7	...	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3, W3
8	0.25–5.08	21	140	120	NP	121 (Cl. 3 only)	204	204	NFA–2	T4, W4
9	0.25–5.08	21	150	130	NP	121 (Cl. 3 only)	204	204	NFA–2	T4, W4
10	...	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3
11	...	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3, W3
12	≥25.4	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3, W4
13	<25.4	21	185	165	NP	121 (Cl. 3 only)	204	204	NFA–1	T4, W4
14	≤101.6	21	97	34	NP	121 (Cl. 3 only)	204	204	NFA–1	T3
15	≤101.6	21	97	...	NP	121 (Cl. 3 only)	204	204	NFA–1	T3, W7
16	0.15–76.2	22	150	59	NP	149 (Cl. 3 only)	204	204	NFA–3	...
17	6.35–76.2	22	160	62	NP	149 (Cl. 3 only)	204	204	NFA–3	W3
18	1.30–50.8	22	195	145	NP	121 (Cl. 3 only)	204	204	NFA–3	W3
19	1.30–25.4	22	220	170	NP	121 (Cl. 3 only)	204	204	NFA–4	W3
20	1.30–76.2	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA–8	...
21	6.35–12.69	22	195	110	NP	121 (Cl. 3 only)	204	204	NFA–8	W3
22	12.70–76.20	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA–8	W3
23	1.30–50.8	22	210	160	NP	93 (Cl. 3 only)	204	204	NFA–3	W3
24	1.30–25.4	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA–4	W3
25	0.46–11.43	22	170	69	NP	149 (Cl. 3 only)	204	204	NFA–8	...
26	0.46–11.43	22	210	160	NP	93 (Cl. 3 only)	204	204	NFA–8	W4
27	0.46–11.43	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA–8	W4
28	0.25–5.08	22	210	160	NP	93 (Cl. 3 only)	204	204	NFA–8	W4
29	0.25–5.08	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA–8	W4
30	...	22	170	69	NP	121 (Cl. 3 only)	204	204	NFA–8	...
31	1.30–38.10	25	275	125	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
32	38.11–76.20	25	270	120	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
33	76.21–127.00	25	260	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
34	127.01–177.80	25	255	100	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
35	177.81–203.2	25	250	97	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
36	6.35–38.10	25	275	125	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
37	38.11–76.20	25	270	120	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
38	4.78–38.10	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
39	38.11–76.20	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
40	≤127.0	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
41	≤127.0	25	275	165	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
42	≤127.0	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
2	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
3	33.8	33.8	32.9	26.9	24.7	21.0	17.2	*13.5*	...	...	...	...	...	...	...	...	...	...
4	39.3	39.3	38.5	33.1	29.4	21.1	17.0	*13.6*	...	...	...	...	...	...	...	...	...	...
5	53.8	53.8	51.6	42.4	36.8	24.8	18.1	*12.3*	...	...	...	...	...	...	...	...	...	...
6	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
7	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
8	39.3	39.3	38.5	33.1	29.4	21.1	17.0	*13.6*	...	...	...	...	...	...	...	...	...	...
9	43.4	43.4	42.5	35.5	29.3	21.1	17.1	*13.6*	...	...	...	...	...	...	...	...	...	...
10	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
11	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
12	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
13	53.8	53.8	51.6	42.4	36.8	24.8	18.1	*12.3*	...	...	...	...	...	...	...	...	...	...
14	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
15	23.4	23.4	23.1	20.1	16.4	*12.6*	*10.1*	*7.64*	...	...	...	...	...	...	...	...	...	...
16	39.3	39.3	39.1	37.6	34.2	26.8	18.1	9.40	...	...	...	...	...	...	...	...	...	...
17	41.4	41.4	41.2	39.6	34.9	26.8	18.1	9.41	...	...	...	...	...	...	...	...	...	...
18	55.2	55.2	54.3	47.2	39.5	27.0	17.9	9.50	...	...	...	...	...	...	...	...	...	...
19	62.7	62.7	62.0	53.3	39.4	26.9	18.0	9.46	...	...	...	...	...	...	...	...	...	...
20	43.4	43.4	43.4	43.2	38.3	29.0	18.4	7.87	...	...	...	...	...	...	...	...	...	...
21	55.2	55.2	54.2	47.5	42.3	29.2	18.3	7.97	...	...	...	...	...	...	...	...	...	...
22	43.4	43.4	43.4	43.4	41.0	29.1	18.3	7.95	...	...	...	...	...	...	...	...	...	...
23	61.4	61.4	60.1	50.3	42.3	29.1	18.3	7.95	...	...	...	...	...	...	...	...	...	...
24	66.9	66.9	66.1	56.6	42.1	29.0	18.4	7.91	...	...	...	...	...	...	...	...	...	...
25	46.2	46.2	45.7	42.3	38.3	29.0	17.9	6.67	...	...	...	...	...	...	...	...	...	...
26	61.4	61.4	60.1	50.2	41.6	29.1	17.8	6.72	...	...	...	...	...	...	...	...	...	...
27	66.9	66.9	66.0	55.8	41.4	29.0	17.8	6.68	...	...	...	...	...	...	...	...	...	...
28	61.4	61.4	60.1	50.3	42.3	29.1	18.3	7.95	...	...	...	...	...	...	...	...	...	...
29	66.9	66.9	66.1	56.6	42.1	29.0	18.4	7.91	...	...	...	...	...	...	...	...	...	...
30	46.2	46.2	45.9	42.9	38.3	29.0	17.9	6.66	...	...	...	...	...	...	...	...	...	...
31	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	86.9	86.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Smls. extr. tube	SB–241	...	A95083	O
2	...	Smls. extr. tube	SB–241	...	A95083	H111
3	...	Smls. extr. tube	SB–241	...	A95083	H112
4	...	Die & hand forgings	SB–247	...	A95083	H111
5	...	Die & hand forgings	SB–247	...	A95083	H112
6	...	Die & hand forgings	SB–247	...	A95083	H111 wld.
7	...	Die & hand forgings	SB–247	...	A95083	H112 wld.
8	...	Plate, sheet	SB–209	...	A95086	O
9	...	Plate, sheet	SB–209	...	A95086	H112
10	...	Plate, sheet	SB–209	...	A95086	H112
11	...	Plate, sheet	SB–209	...	A95086	H112
12	...	Plate, sheet	SB–209	...	A95086	H112
13	...	Plate, sheet	SB–209	...	A95086	H116
14	...	Plate, sheet	SB–209	...	A95086	H32
15	...	Plate, sheet	SB–209	...	A95086	H34
16	...	Bar, rod, shapes	SB–221	...	A95086	H112
17	...	Smls. extr. tube	SB–241	...	A95086	O
18	...	Smls. extr. tube	SB–241	...	A95086	H111
19	...	Smls. extr. tube	SB–241	...	A95086	H112
20	...	Plate, sheet	SB–209	...	A95154	O
21	...	Plate, sheet	SB–209	...	A95154	H112
22	...	Plate, sheet	SB–209	...	A95154	H112
23	...	Plate, sheet	SB–209	...	A95154	H32
24	...	Plate, sheet	SB–209	...	A95154	H34
25	...	Drawn smls. tube	SB–210	...	A95154	O
26	...	Drawn smls. tube	SB–210	...	A95154	H34
27	...	Bar, rod, shapes	SB–221	...	A95154	O
28	...	Bar, rod, shapes	SB–221	...	A95154	H112
29	...	Plate, sheet	SB–209	...	A95254	O
30	...	Plate, sheet	SB–209	...	A95254	H112
31	...	Plate, sheet	SB–209	...	A95254	H112
32	...	Plate, sheet	SB–209	...	A95254	H32
33	...	Plate, sheet	SB–209	...	A95254	H34
34	...	Plate, sheet	SB–209	...	A95454	O
35	...	Plate, sheet	SB–209	...	A95454	H112
36	...	Plate, sheet	SB–209	...	A95454	H112
37	...	Plate, sheet	SB–209	...	A95454	H32
38	...	Plate, sheet	SB–209	...	A95454	H34
39	...	Bar, rod, shapes	SB–221	...	A95454	O
40	...	Bar, rod, shapes	SB–221	...	A95454	H111
41	...	Bar, rod, shapes	SB–221	...	A95454	H112

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19
2	...	25	275	165	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
3	...	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
4	≤101.6	25	270	140	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W4
5	≤101.6	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W4
6	≤101.6	25	260	...	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W7
7	≤101.6	25	260	...	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W7
8	1.30–50.8	25	240	97	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19
9	4.78–12.69	25	250	125	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19, W3
10	12.70–25.40	25	240	110	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19, W3
11	25.41–50.80	25	240	97	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19, W3
12	50.81–76.2	25	235	97	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19
13	1.60–50.8	25	275	195	NP	NP	66	66	NFA–11	G18, G19, W3
14	1.30–50.8	25	275	195	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
15	1.30–25.4	25	305	235	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
16	≤127.0	25	240	97	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19, W4
17	≤127.0	25	240	97	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19
18	≤127.0	25	250	145	NP	66 (Cl. 3 only)	66	66	NFA–9	G18, G19, W3
19	≤127.0	25	240	97	NP	66 (Cl. 3 only)	66	66	NFA–9	...
20	1.30–76.2	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19
21	6.35–12.69	22	220	125	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
22	12.70–76.20	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19, W3
23	1.30–50.8	22	250	180	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
24	1.30–25.4	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
25	0.25–11.43	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19
26	0.25–11.43	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19, W3
27	...	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19
28	...	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19, W3
29	1.30–76.2	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19
30	6.35–12.69	22	220	125	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
31	12.70–76.20	22	205	76	NP	66 (Cl. 3 only)	66	66	NFA–5	G18, G19, W3
32	1.30–50.8	22	250	180	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
33	1.30–25.4	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA–11	G18, G19, W3
34	1.30–76.2	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1
35	6.35–12.69	22	220	125	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
36	12.70–76.20	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
37	1.30–50.8	22	250	180	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
38	1.30–25.4	22	270	200	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
39	≤127.0	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1
40	≤127.0	22	230	130	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
41	≤127.0	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	75.2	75.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	75.2	75.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	71.0	71.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	78.6	78.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	86.9	86.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	71.0	71.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	62.7	62.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	71.0	71.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	62.7	62.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	50.3	50.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	71.0	71.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	76.5	76.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
35	62.7	62.7	61.5	*49.6*	*37.5*	*28.8*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
36	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
37	71.0	71.0	68.4	*49.0*	*37.5*	*28.8*	*21.8*	*15.1*	...	...	...	...	...	...	...	...	...	...
38	76.5	76.5	73.1	*48.5*	*37.6*	*28.8*	*21.8*	*15.1*	...	...	...	...	...	...	...	...	...	...
39	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
40	64.8	64.8	63.2	*49.5*	*37.5*	*28.8*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
41	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Cond. & heat exch. tubes	SB–234	...	A95454	H32
2	...	Cond. & heat exch. tubes	SB–234	...	A95454	H34
3	...	Smls. extr. tube	SB–241	...	A95454	O
4	...	Smls. extr. tube	SB–241	...	A95454	H111
5	...	Smls. extr. tube	SB–241	...	A95454	H112
6	...	Plate, sheet	SB–209	...	A95456	O
7	...	Plate, sheet	SB–209	...	A95456	O
8	...	Plate, sheet	SB–209	...	A95456	O
9	...	Plate, sheet	SB–209	...	A95456	O
10	...	Plate, sheet	SB–209	...	A95456	O
11	...	Plate, sheet	SB–209	...	A95456	H112
12	...	Plate, sheet	SB–209	...	A95456	H112
13	...	Plate, sheet	SB–209	...	A95456	H321
14	...	Plate, sheet	SB–209	...	A95456	H321
15	...	Plate, sheet	SB–209	...	A95456	H321
16	...	Bar, rod, shapes	SB–221	...	A95456	O
17	...	Bar, rod, shapes	SB–221	...	A95456	H111
18	...	Bar, rod, shapes	SB–221	...	A95456	H112
19	...	Smls. extr. tube	SB–241	...	A95456	O
20	...	Smls. extr. tube	SB–241	...	A95456	H111
21	...	Smls. extr. tube	SB–241	...	A95456	H112
22	...	Plate, sheet	SB–209	...	A95652	O
23	...	Plate, sheet	SB–209	...	A95652	H112
24	...	Plate, sheet	SB–209	...	A95652	H112
25	...	Plate, sheet	SB–209	...	A95652	H32
26	...	Plate, sheet	SB–209	...	A95652	H34
27	...	Plate, sheet	SB–209	...	A96061	T4
28	...	Plate, sheet	SB–209	...	A96061	T451
29	...	Plate, sheet	SB–209	...	A96061	T6
30	...	Plate, sheet	SB–209	...	A96061	T651
31	...	Plate, sheet	SB–209	...	A96061	T651
32	...	Plate, sheet	SB–209	...	A96061	T4 wld.
33	...	Plate, sheet	SB–209	...	A96061	T451 wld.
34	...	Plate, sheet	SB–209	...	A96061	T6 wld.
35	...	Plate, sheet	SB–209	...	A96061	T651 wld.
36	...	Drawn smls. tube	SB–210	...	A96061	T4
37	...	Drawn smls. tube	SB–210	...	A96061	T6
38	...	Drawn smls. tube	SB–210	...	A96061	T4 wld.
39	...	Drawn smls. tube	SB–210	...	A96061	T6 wld.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	0.25–6.35	22	250	180	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W4
2	0.25–6.35	22	270	200	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W4
3	≤127.0	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1
4	≤127.0	22	230	130	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
5	≤127.0	22	210	83	NP	121 (Cl. 3 only)	204	204	NFA–6	T1, W3
6	1.30–38.10	25	290	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
7	38.11–76.20	25	285	125	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
8	76.21–127.00	25	275	120	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
9	127.01–177.80	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
10	177.81–203.2	25	260	100	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
11	6.35–38.10	25	290	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
12	38.11–76.20	25	285	125	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
13	4.78–12.69	25	315	230	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
14	12.70–38.10	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
15	38.11–76.20	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
16	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
17	≤127.0	25	290	180	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
18	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
19	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19
20	≤127.0	25	290	180	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
21	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA–10	G18, G19, W3
22	1.30–76.2	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA–8	T2
23	6.35–12.69	22	195	110	NP	121 (Cl. 3 only)	204	204	NFA–8	T1, W3
24	12.70–76.20	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA–8	T2, W3
25	1.30–50.8	22	210	160	NP	93 (Cl. 3 only)	204	204	NFA–3	T1, W3
26	1.30–25.4	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA–4	T1, W3
27	1.30–6.34	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W4
28	6.35–76.2	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W4
29	1.30–6.34	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, T3, W4
30	6.35–101.60	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W4, W16
31	101.61–152.4	23	275	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W4, W16
32	1.30–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W7
33	6.35–76.2	23	165	...	NP	NP	204	204	NFA–13	G24, T3, W7
34	1.30–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, T3, W7
35	6.35–152.4	23	165	...	NP	NP	204	204	NFA–12,13	G24, T3, W7, W16
36	0.64–12.7	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA–13	T3, W4
37	0.64–12.7	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
38	0.64–12.7	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–13	T3, W7
39	0.64–12.7	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W7, W16

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	71.0	71.0	68.4	*49.0*	*37.5*	*28.8*	*21.8*	*15.1*	...	...	...	...	...	...	...	...	...	...
2	76.5	76.5	73.1	*48.5*	*37.6*	*28.8*	*21.8*	*15.1*	...	...	...	...	...	...	...	...	...	...
3	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
4	64.8	64.8	63.2	*49.5*	*37.5*	*28.8*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
5	55.2	55.2	54.4	*50.6*	*37.4*	*28.7*	*21.9*	*15.1*	...	...	...	...	...	...	...	...	...	...
6	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	77.9	77.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	90.3	90.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	86.9	86.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	43.4	43.4	43.4	43.3	*41.8*	*29.2*	*18.2*	*8.00*	...	...	...	...	...	...	...	...	...	...
23	55.2	55.2	54.9	*50.7*	*41.5*	*29.1*	*18.3*	*7.92*	...	...	...	...	...	...	...	...	...	...
24	43.4	43.4	43.4	43.3	*41.8*	*29.2*	*18.2*	*8.00*	...	...	...	...	...	...	...	...	...	...
25	61.4	61.4	60.1	*50.3*	*41.6*	*29.1*	*18.3*	*7.93*	...	...	...	...	...	...	...	...	...	...
26	66.9	66.9	64.7	*49.8*	*41.6*	*29.1*	*18.3*	*7.94*	...	...	...	...	...	...	...	...	...	...
27	59.3	59.3	58.1	50.1	47.4	*43.8*	*33.3*	*21.6*	...	...	...	...	...	...	...	...	...	...
28	59.3	59.3	58.1	50.1	47.4	*43.8*	*33.3*	*21.6*	...	...	...	...	...	...	...	...	...	...
29	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
30	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
31	78.6	78.6	76.9	64.5	56.1	*44.3*	*32.4*	*20.7*	...	...	...	...	...	...	...	...	...	...
32	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
33	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
34	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
35	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
36	59.3	59.3	58.1	50.1	47.4	*43.8*	*33.3*	*21.6*	...	...	...	...	...	...	...	...	...	...
37	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
38	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
39	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Bar, rod, wire	SB–211	...	A96061	T6
2	...	Bar, rod, wire	SB–211	...	A96061	T651
3	...	Bar, rod, wire	SB–211	...	A96061	T6 wld.
4	...	Bar, rod, wire	SB–211	...	A96061	T651 wld.
5	...	Bar, rod, shapes	SB–221	...	A96061	T4
6	...	Bar, rod, shapes	SB–221	...	A96061	T6
7	...	Bar, rod, shapes	SB–221	...	A96061	T4 wld.
8	...	Bar, rod, shapes	SB–221	...	A96061	T6 wld.
9	...	Cond. & heat exch. tubes	SB–234	...	A96061	T4
10	...	Cond. & heat exch. tubes	SB–234	...	A96061	T6
11	...	Cond. & heat exch. tubes	SB–234	...	A96061	T4 wld.
12	...	Cond. & heat exch. tubes	SB–234	...	A96061	T6 wld.
13	...	Smls. extr. tube	SB–241	...	A96061	T4
14	...	Smls. extr. tube	SB–241	...	A96061	T6
15	...	Smls. extr. tube	SB–241	...	A96061	T4 wld.
16	...	Smls. extr. tube	SB–241	...	A96061	T6 wld.
17	...	Smls. pipe	SB–241	...	A96061	T6
18	...	Smls. pipe	SB–241	...	A96061	T6
19	...	Smls. pipe	SB–241	...	A96061	T6 wld.
20	...	Die forgings	SB–247	...	A96061	T6
21	...	Hand forgings	SB–247	...	A96061	T6
22	...	Hand forgings	SB–247	...	A96061	T6
23	...	Die & hand forgings	SB–247	...	A96061	T6 wld.
24	...	Shapes	SB–308	...	A96061	T6
25	...	Shapes	SB–308	...	A96061	T6 wld.
26	...	Drawn smls. tube	SB–210	...	A96063	T6
27	...	Drawn smls. tube	SB–210	...	A96063	T6 wld.
28	...	Bar, rod, shapes	SB–221	...	A96063	T1
29	...	Bar, rod, shapes	SB–221	...	A96063	T1
30	...	Bar, rod, shapes	SB–221	...	A96063	T5
31	...	Bar, rod, shapes	SB–221	...	A96063	T5
32	...	Bar, rod, shapes	SB–221	...	A96063	T6
33	...	Bar, rod, shapes	SB–221	...	A96063	T5 wld.
34	...	Bar, rod, shapes	SB–221	...	A96063	T6 wld.
35	...	Smls. extr. tube	SB–241	...	A96063	T1
36	...	Smls. extr. tube	SB–241	...	A96063	T1
37	...	Smls. extr. tube	SB–241	...	A96063	T5
38	...	Smls. extr. tube	SB–241	...	A96063	T5
39	...	Smls. extr. tube	SB–241	...	A96063	T6
40	...	Smls. extr. tube	SB–241	...	A96063	T5 wld.
41	...	Smls. extr. tube	SB–241	...	A96063	T6 wld.
42	...	Smls. pipe	SB–241	...	A96063	T6
43	...	Smls. pipe	SB–241	...	A96063	T6 wld.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	3.18–6.34	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12	G24, T3, W4
2	6.35–203.2	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W4, W16
3	3.18–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	G13, G24, T3, W7
4	6.35–203.2	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G13, G24, T3, W7, W16
5	...	23	180	110	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W4
6	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W4, W16
7	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W7
8	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G13, G24, T3, W7, W16
9	0.64–5.08	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA–13	T3, W4
10	0.64–5.08	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12	T3, W4
11	0.64–5.08	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–13	T3, W7
12	0.64–5.08	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12	T3, W7
13	...	23	180	110	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W4
14	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W4, W16
15	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–13	G24, T3, W7
16	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G24, T3, W7, W16
17	<25.4	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
18	≥25.4	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
19	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W7, W16
20	≤101.6	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
21	≤101.6	23	255	230	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
22	101.61–203.2	23	240	220	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
23	≤203.2	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W7, W16
24	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA–12,13	T3, W4, W16
25	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA–12,13	G13, T3, W7, W16
26	0.64–12.7	23	230	195	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W4
27	0.64–12.7	23	120	...	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W7
28	≤12.70	23	120	62	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W4
29	12.71–25.4	23	110	55	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W4
30	≤12.70	23	150	110	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W4
31	12.71–25.4	23	145	100	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W4
32	≤25.4	23	205	170	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W4
33	≤25.4	23	120	...	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W7
34	≤25.4	23	120	...	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W7
35	≤12.70	23	120	62	NP	177 (Cl. 3 only)	NP	NP	NFA–1	T3, W4
36	12.71–25.4	23	110	55	NP	177 (Cl. 3 only)	NP	NP	NFA–1	T3, W4
37	≤12.70	23	150	110	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W4
38	12.71–25.4	23	145	100	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W4
39	≤25.4	23	205	170	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W4
40	≤25.4	23	120	...	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W7
41	≤25.4	23	120	...	NP	177 (Cl. 3 only)	204	204	NFA–1	T3, W7
42	...	23	205	170	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W4
43	...	23	120	...	NP	204 (Cl. 3 only)	204	204	NFA–1	T3, W7

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
2	82.7	82.7	80.1	66.5	57.5	*45.0*	*33.1*	*21.4*	...	...	...	...	...	...	...	...	...	...
3	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
4	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
5	51.0	51.0	50.0	43.3	41.4	*40.3*	*32.7*	*24.3*	...	...	...	...	...	...	...	...	...	...
6	75.2	75.2	73.4	61.1	54.1	*44.2*	*33.0*	*21.8*	...	...	...	...	...	...	...	...	...	...
7	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
8	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
9	59.3	59.3	58.1	50.1	47.4	*43.8*	*33.3*	*21.6*	...	...	...	...	...	...	...	...	...	...
10	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
11	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
12	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
13	51.0	51.0	50.0	43.3	41.4	*40.3*	*32.7*	*24.3*	...	...	...	...	...	...	...	...	...	...
14	75.2	75.2	73.4	61.1	54.1	*44.2*	*33.0*	*21.8*	...	...	...	...	...	...	...	...	...	...
15	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
16	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
17	82.7	82.7	80.7	66.4	57.5	*44.3*	*32.9*	*21.9*	...	...	...	...	...	...	...	...	...	...
18	75.2	75.2	73.4	61.1	54.1	*44.2*	*33.0*	*21.8*	...	...	...	...	...	...	...	...	...	...
19	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
20	75.2	75.2	73.4	61.1	54.1	*44.2*	*33.0*	*21.8*	...	...	...	...	...	...	...	...	...	...
21	73.1	73.1	71.3	59.1	52.8	*44.1*	*33.1*	*21.8*	...	...	...	...	...	...	...	...	...	...
22	68.9	68.9	67.4	56.5	50.8	*42.7*	*32.8*	*22.8*	...	...	...	...	...	...	...	...	...	...
23	41.4	41.4	41.3	40.5	37.7	*32.2*	*25.4*	*18.5*	...	...	...	...	...	...	...	...	...	...
24	75.2	75.2	72.8	56.6	49.3	*39.3*	*29.3*	*19.4*	...	...	...	...	...	...	...	...	...	...
25	41.4	40.7	38.8	36.9	34.3	*29.3*	*23.2*	*16.9*	...	...	...	...	...	...	...	...	...	...
26	64.8	64.8	63.0	48.9	37.4	*24.2*	*15.2*	*6.74*	...	...	...	...	...	...	...	...	...	...
27	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...
28	33.8	33.8	32.9	29.0	29.0	*24.0*	*15.4*	*6.61*	...	...	...	...	...	...	...	...	...	...
29	31.7	31.7	31.0	27.6	27.6	*23.8*	*15.6*	*6.50*	...	...	...	...	...	...	...	...	...	...
30	43.4	43.4	42.2	34.3	31.5	*24.0*	*15.3*	*6.66*	...	...	...	...	...	...	...	...	...	...
31	41.4	41.4	40.3	32.9	29.5	*23.9*	*15.4*	*6.60*	...	...	...	...	...	...	...	...	...	...
32	59.3	59.3	57.7	44.9	34.0	*24.1*	*15.3*	*6.67*	...	...	...	...	...	...	...	...	...	...
33	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...
34	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...
35	33.8	33.8	32.9	29.0	29.0	*24.0*	*15.4*	...	...	...	...	...	...	...	...	...	...	...
36	31.7	31.7	31.0	27.6	27.6	*23.8*	*15.6*	...	...	...	...	...	...	...	...	...	...	...
37	43.4	43.4	42.2	34.3	31.5	*24.0*	*15.3*	*6.66*	...	...	...	...	...	...	...	...	...	...
38	41.4	41.4	40.3	33.0	30.2	*24.0*	*15.4*	*6.62*	...	...	...	...	...	...	...	...	...	...
39	59.3	59.3	57.7	44.9	34.0	*24.1*	*15.3*	*6.67*	...	...	...	...	...	...	...	...	...	...
40	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...
41	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...
42	59.3	59.3	57.7	44.9	34.0	*24.1*	*15.3*	*6.67*	...	...	...	...	...	...	...	...	...	...
43	29.6	29.6	29.5	28.8	26.7	*21.1*	*14.9*	*8.69*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
(13)	1	...	Rod	SB–187	...	C10200	O60
	2	...	Smls. tube	SB–75	...	C10200	O60
	3	...	Smls. pipe	SB–42	...	C10200	O61
	4	...	Plate, sheet, strip	SB–152	...	C10200	H00
	5	...	Plate, sheet, strip	SB–152	...	C10200	H01
	6	...	Plate, sheet, strip	SB–152	...	C10200	H02
	7	...	Plate, sheet, strip	SB–152	...	C10200	H03
	8	...	Plate, sheet, strip	SB–152	...	C10200	H04
	9	...	Plate, sheet, strip	SB–152	...	C10200	O25
(13)	10	...	Smls. pipe	SB–42	...	C10200	H55
	11	...	Smls. tube	SB–75	...	C10200	H55
	12	...	Smls. cond. tube	SB–111	...	C10200	H55
(13)	13	...	Smls. U–bend tube	SB–395	...	C10200	H55
(13)	14	...	Smls. pipe	SB–42	...	C10200	H80
(13)	15	...	Smls. tube	SB–75	...	C10200	H80
(13)	16	...	Smls. cond. tube	SB–111	...	C10200	H80
	17	...	Plate, sheet, strip	SB–152	...	C10400	H00
	18	...	Plate, sheet, strip	SB–152	...	C10400	H01
	19	...	Plate, sheet, strip	SB–152	...	C10400	H02
	20	...	Plate, sheet, strip	SB–152	...	C10400	H03
	21	...	Plate, sheet, strip	SB–152	...	C10400	H04
	22	...	Plate, sheet, strip	SB–152	...	C10400	O25
	23	...	Plate, sheet, strip	SB–152	...	C10500	H00
	24	...	Plate, sheet, strip	SB–152	...	C10500	H01
	25	...	Plate, sheet, strip	SB–152	...	C10500	H02
	26	...	Plate, sheet, strip	SB–152	...	C10500	H03
	27	...	Plate, sheet, strip	SB–152	...	C10500	H04
	28	...	Plate, sheet, strip	SB–152	...	C10500	O25
	29	...	Plate, sheet, strip	SB–152	...	C10700	H00
	30	...	Plate, sheet, strip	SB–152	...	C10700	H01
	31	...	Plate, sheet, strip	SB–152	...	C10700	H02
	32	...	Plate, sheet, strip	SB–152	...	C10700	H03
	33	...	Plate, sheet, strip	SB–152	...	C10700	H04
	34	...	Plate, sheet, strip	SB–152	...	C10700	O25
(13)	35	...	Bar, rod	SB–187	...	C11000	H04
(13)	36	...	Bar, rod	SB–187	...	C11000	O60
	37	...	Plate, sheet, strip, bar	SB–152	...	C11000	H00
	38	...	Plate, sheet, strip, bar	SB–152	...	C11000	H01
	39	...	Plate, sheet, strip, bar	SB–152	...	C11000	H02
	40	...	Plate, sheet, strip, bar	SB–152	...	C11000	H03
	41	...	Plate, sheet, strip, bar	SB–152	...	C11000	H04
	42	...	Plate, sheet, strip, bar	SB–152	...	C11000	O25
	43	...	Smls. tube	SB–75	...	C12000	O50
	44	...	Smls. tube	SB–75	...	C12000	O60
	45	...	Smls. pipe	SB–42	...	C12000	O61

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	31	195	55	NP	149	204	204	NFC–1	T3
2	...	31	205	62	204	149 (Cl. 3 only)	204	204	NFC–1	G1, T3, W10
3	6 < DN ≤ 50	31	205	62	204	149	204	204	NFC–1	G1, T3, W10
4	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
5	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
6	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
7	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
8	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
9	...	31	205	69	NP	149 (Cl. 3 only)	204	204	NFC–1	T2
10	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC–6	G1, G9, W9, W10
11	...	31	250	205	204	204 (Cl. 3 only)	204	204	NFC–6	G1, G9, W9, W10
12	<75	31	250	205	NP	204	204	204	NFC–6	G9, W9
13	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC–6	G9, W9
14	6 < DN ≤ 50	31	310	275	204	149	204	204	NFC–6	G1, G6, G9, T4, W9, W10
15	<100	31	310	275	204	177	204	204	NFC–6	G1, G6, G9, T4, W9, W10
16	<75	31	310	275	NP	149	204	204	NFC–6	G6, G9, T4, W9
17	...	31	205	69	NP	149	204	204	NFC–1	T2
18	...	31	205	69	NP	149	204	204	NFC–1	T2
19	...	31	205	69	NP	149	204	204	NFC–1	T2
20	...	31	205	69	NP	149	204	204	NFC–1	T2
21	...	31	205	69	NP	149	204	204	NFC–1	T2
22	...	31	205	69	NP	149	204	204	NFC–1	T2
23	...	31	205	69	NP	149	204	204	NFC–1	T2
24	...	31	205	69	NP	149	204	204	NFC–1	T2
25	...	31	205	69	NP	149	204	204	NFC–1	T2
26	...	31	205	69	NP	149	204	204	NFC–1	T2
27	...	31	205	69	NP	149	204	204	NFC–1	T2
28	...	31	205	69	NP	149	204	204	NFC–1	T2
29	...	31	205	69	NP	149	204	204	NFC–1	T2
30	...	31	205	69	NP	149	204	204	NFC–1	T2
31	...	31	205	69	NP	149	204	204	NFC–1	T2
32	...	31	205	69	NP	149	204	204	NFC–1	T2
33	...	31	205	69	NP	149	204	204	NFC–1	T2
34	...	31	205	69	NP	149	204	204	NFC–1	T2
35	...	31	195	55	NP	149	204	204	NFC–1	T3
36	...	31	195	55	NP	149	204	204	NFC–1	T3
37	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
38	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
39	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
40	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
41	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
42	≤50	31	205	69	NP	NP	204	204	NFC–1	T2
43	...	31	205	62	NP	149 (Cl. 3 only)	NP	NP	NFC–1	...
44	...	31	205	62	204	149 (Cl. 3 only)	204	204	NFC–1	G1, T3, W10
45	6 < DN ≤ 50	31	205	62	204	149	204	204	NFC–1	G1, T3, W10

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	36.8	31.1	29.7	29.2	28.8	*28.0*	*21.8*	*16.7*	...	...	...	...	...	...	...	...	...	...
2	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
3	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
4	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
5	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
6	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
7	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
8	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
9	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
10	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
11	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
12	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
13	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
14	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
15	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
16	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
17	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
18	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
19	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
20	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
21	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
22	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
23	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
24	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
25	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
26	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
27	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
28	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
29	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
30	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
31	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
32	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
33	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
34	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
35	36.8	31.1	29.7	29.2	28.8	*28.0*	*21.8*	*16.7*	...	...	...	...	...	...	...	...	...	...
36	36.8	31.1	29.7	29.2	28.8	*28.0*	*21.8*	*16.7*	...	...	...	...	...	...	...	...	...	...
37	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
38	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
39	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
40	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
41	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
42	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
43	41.4	35.2	33.6	33.1	32.3	...	...	...	...	...	...	...	...	...	...	...	...	...
44	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
45	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
(13)	1	...	Smls. pipe	SB–42	...	C12000	H55
	2	...	Smls. tube	SB–75	...	C12000	H55
	3	...	Smls. cond. tube	SB–111	...	C12000	H55
(13)	4	...	Smls. U–bend tube	SB–395	...	C12000	H55
(13)	5	...	Smls. pipe	SB–42	...	C12000	H80
(13)	6	...	Smls. tube	SB–75	...	C12000	H80
(13)	7	...	Smls. cond. tube	SB–111	...	C12000	H80
	8	...	Smls. tube	SB–75	...	C12200	O50
	9	...	Smls. tube	SB–75	...	C12200	O60
	10	...	Smls. pipe	SB–42	...	C12200	O61
	11	...	Finned tube	SB–359	...	C12200	O61
	12	...	Wld. cond. tube	SB–543	...	C12200	W061
	13	...	Plate, sheet, strip	SB–152	...	C12200	H00
	14	...	Plate, sheet, strip	SB–152	...	C12200	H01
	15	...	Plate, sheet, strip	SB–152	...	C12200	H02
	16	...	Plate, sheet, strip	SB–152	...	C12200	H03
	17	...	Plate, sheet, strip	SB–152	...	C12200	H04
	18	...	Plate, sheet, strip	SB–152	...	C12200	O25
	19	...	Wld. cond. tube	SB–543	...	C12200	WC55
(13)	20	...	Smls. pipe	SB–42	...	C12200	H55
	21	...	Smls. tube	SB–75	...	C12200	H55
	22	...	Smls. cond. tube	SB–111	...	C12200	H55
	23	...	Finned tube	SB–359	...	C12200	H55
(13)	24	...	Smls. U–bend tube	SB–395	...	C12200	H55
(13)	25	...	Smls. pipe	SB–42	...	C12200	H80
(13)	26	...	Smls. cond. tube	SB–75	...	C12200	H80
(13)	27	...	Smls. tube	SB–111	...	C12200	H80
	28	...	Plate, sheet, strip, bar	SB–152	...	C12300	H00
	29	...	Plate, sheet, strip, bar	SB–152	...	C12300	H01
	30	...	Plate, sheet, strip, bar	SB–152	...	C12300	H02
	31	...	Plate, sheet, strip, bar	SB–152	...	C12300	H03
	32	...	Plate, sheet, strip, bar	SB–152	...	C12300	H04
	33	...	Plate, sheet, strip, bar	SB–152	...	C12300	O25
	34	...	Plate, sheet, strip	SB–152	...	C14200	O25
	35	...	Smls. cond. tube	SB–111	...	C14200	H55
(13)	36	...	Smls. U–bend tube	SB–395	...	C14200	H55
(13)	37	...	Smls. cond. tube	SB–111	...	C14200	H80
	38	...	Smls. cond. tube	SB–111	...	C19200	O61
	39	...	Smls. U–bend tube	SB–395	...	C19200	O61
	40	...	Wld. cond. tube	SB–543	...	C19400	WO61
	41	...	Wld. cond. tube	SB–543	...	C19400	WC55
	42	...	Smls. pipe	SB–43	...	C23000	H58
	43	...	Smls. tube	SB–135	...	C23000	O50
	44	...	Smls. red brass tube	SB–135	...	C23000	O60

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC–6	G1, G9, W9, W10
2	...	31	250	205	204	204 (Cl. 3 only)	204	204	NFC–6	G1, G9, W9, W10
3	<75	31	250	205	NP	204	204	204	NFC–6	G9, W9
4	<50	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC–6	G9, W9
5	6 < DN ≤ 50	31	310	275	204	149	204	204	NFC–6	G1, G6, G9, T4, W9, W10
6	...	31	310	275	204	177 (Cl. 3 only)	204	204	NFC–6	G1, G6, G9, T4, W9, W10
7	<75	31	310	275	NP	149	204	204	NFC–6	G6, G9, T4, W9
8	...	31	205	62	NP	149	204	204	NFC–7	T3
9	...	31	205	62	204	149	NP	NP	NFC–1	G1, T3, W10
10	6 < DN ≤ 50	31	205	62	204	149	204	204	NFC–1	G1, T3, W10
11	...	31	205	62	NP	149 (Cl. 3 only)	204	NP	NFC–1	G1, T3, W10
12	...	31	205	62	NP	149 (Cl. 3 only)	204	204	NFC–1	G14, W11
13	...	31	205	69	NP	149	204	204	NFC–1	T2
14	...	31	205	69	NP	149	204	204	NFC–1	T2
15	...	31	205	69	NP	149	204	204	NFC–1	T2
16	...	31	205	69	NP	149	204	204	NFC–1	T2
17	...	31	205	69	NP	149	204	204	NFC–1	T2
18	...	31	205	69	NP	149	204	204	NFC–1	T2
19	...	31	220	100	NP	149 (Cl. 3 only)	204	204	NFC–1	G14, W3
20	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC–6	G1, G9, W9, W10
21	...	31	250	205	204	204 (Cl. 3 only)	204	204	NFC–6	G1, G9, W9, W10
22	<75	31	250	205	NP	204	204	204	NFC–6	G9, W9
23	...	31	250	205	NP	149 (Cl. 3 only)	204	NP	NFC–6	G1, G9, W9, W10
24	<50	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC–6	G9, W9
25	6 < DN ≤ 75	31	310	275	204	149	204	204	NFC–6	G1, G6, G9, T4, W9, W10
26	<100	31	310	275	204	177 (Cl. 3 only)	204	204	NFC–6	G1, G6, G9, T4, W9, W10
27	<75	31	310	275	NP	149	204	204	NFC–6	G6, G9, T4, W9
28	...	31	205	69	NP	149	204	204	NFC–1	T2
29	...	31	205	69	NP	149	204	204	NFC–1	T2
30	...	31	205	69	NP	149	204	204	NFC–1	T2
31	...	31	205	69	NP	149	204	204	NFC–1	T2
32	...	31	205	69	NP	149	204	204	NFC–1	T2
33	...	31	205	69	NP	149	204	204	NFC–1	T2
34	...	31	205	69	NP	149 (Cl. 3 only)	NP	NP	NFC–1	T2
35	<75	31	250	205	NP	204	204	204	NFC–6	G9, W9
36	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC–6	G9, W9
37	<75	31	310	275	NP	149	204	204	NFC–6	G6, G9, T4, W9
38	<75	31	260	83	NP	NP	149	149	NFC–1	...
39	...	31	260	83	NP	NP	149	149	NFC–1	...
40	...	31	310	100	NP	NP	204	204	NFC–5	G14, G15
41	...	31	310	150	NP	149 (Cl. 3 only)	204	204	NFC–5	G14, G15
42	...	32	275	83	232	149 (Cl. 3 only)	232	232	NFC–1	G1, T3, W10
43	...	32	275	83	NP	149 (Cl. 3 only)	NP	NP	NFC–1	...
44	...	32	275	83	NP	149 (Cl. 3 only)	232	232	NFC–1	T3

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
2	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
3	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
4	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
5	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
6	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
7	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
8	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
9	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
10	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
11	41.4	35.2	33.6	33.1	32.3	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
12	35.2	29.7	28.3	28.3	27.5	23.8	18.8	13.8	...	...	...	...	...	...	...	...	...	...
13	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
14	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
15	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
16	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
17	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
18	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
19	53.8	53.8	53.8	53.6	51.7	50.7	24.4	...	...	...	...	...	...	...	...	...	...	...
20	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
21	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
22	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
23	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
24	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
25	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
26	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
27	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
28	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
29	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
30	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
31	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
32	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
33	46.2	38.7	37.1	36.4	*34.3*	*28.0*	*21.8*	*15.6*	...	...	...	...	...	...	...	...	...	...
34	46.2	38.7	37.1	36.4	*34.3*	...	...	...	...	...	...	...	...	...	...	...	...	...
35	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
36	71.0	71.0	71.0	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
37	88.9	88.9	88.9	88.8	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
38	55.2	49.0	45.7	43.9	42.7	...	...	...	...	...	...	...	...	...	...	...	...	...
39	55.2	49.0	45.7	43.9	42.7	...	...	...	...	...	...	...	...	...	...	...	...	...
40	58.6	57.9	57.0	55.6	53.7	52.6	43.5	33.0	...	...	...	...	...	...	...	...	...	...
41	75.2	75.2	74.7	73.0	69.2	54.1	43.0	32.8	...	...	...	...	...	...	...	...	...	...
42	55.2	55.2	55.2	55.2	55.1	*48.9*	*37.2*	*19.4*	*0.422*	...	...	...	...	...	...	...	...	...
43	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...	...	...	...	...	...	...	...
44	55.2	55.2	55.2	55.2	55.1	*48.9*	*37.2*	*19.4*	*0.422*	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Smls. pipe	SB–43	...	C23000	O61
2	...	Smls. cond. tube	SB–111	...	C23000	O61
3	...	Smls. tube	SB–395	...	C23000	O61
4	...	Wld. cond. tube	SB–543	...	C23000	WO61
5	...	Wld. cond. tube	SB–543	...	C23000	WC55
6	...	Smls. tube	SB–111	...	C28000	O61
7	...	Plate	SB–171	...	C36500	M20
8	...	Plate	SB–171	...	C36500	O25
9	...	Plate	SB–171	...	C36500	M20
10	...	Plate	SB–171	...	C36500	O25
11	...	Plate	SB–171	...	C36500	M20
12	...	Plate	SB–171	...	C36500	O25
13	...	Forgings, brass	SB–283	...	C37700	M10
14	...	Forgings, brass	SB–283	...	C37700	M11
15	...	Forgings, brass	SB–283	...	C37700	O20
16	...	Forgings, brass	SB–283	...	C37700	TQ50
17	...	Forgings, brass	SB–283	...	C37700	M10
18	...	Forgings, brass	SB–283	...	C37700	M11
19	...	Forgings, brass	SB–283	...	C37700	O20
20	...	Forgings, brass	SB–283	...	C37700	TQ50
21	...	Plate	SB–171	...	C44300	M20
22	...	Plate	SB–171	...	C44300	O25
23	...	Smls. cond. tube	SB–111	...	C44300	O61
24	...	Finned tube	SB–359	...	C44300	O61
25	...	Smls. U–bend tube	SB–395	...	C44300	O61
26	...	Wld. cond. tube	SB–543	...	C44300	WO61
27	...	Plate	SB–171	...	C44400	M20
28	...	Plate	SB–171	...	C44400	O25
29	...	Smls. cond. tube	SB–111	...	C44400	O61
30	...	Finned tube	SB–359	...	C44400	O61
31	...	Smls. U–bend tube	SB–395	...	C44400	O61
32	...	Wld. cond. tube	SB–543	...	C44400	WO61
33	...	Plate	SB–171	...	C44500	M20
34	...	Plate	SB–171	...	C44500	O25
35	...	Smls. cond. tube	SB–111	...	C44500	O61
36	...	Finned tube	SB–359	...	C44500	O61
37	...	Smls. U–bend tube	SB–395	...	C44500	O61
38	...	Wld. cond. tube	SB–543	...	C44500	WO61
39	...	Plate	SB–171	...	C46400	M20
40	...	Plate	SB–171	...	C46400	O25
41	...	Plate	SB–171	...	C46400	M20
42	...	Plate	SB–171	...	C46400	O25

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	32	275	83	232	149 (Cl. 3 only)	232	232	NFC–1	G1, T3, W10
2	<75	32	275	83	NP	149 (Cl. 3 only)	232	232	NFC–1	T3
3	...	32	275	83	NP	149 (Cl. 3 only)	232	232	NFC–1	T3
4	...	32	275	83	NP	149 (Cl. 3 only)	232	232	NFC–1	G14, G15, T3
5	...	32	290	140	NP	149 (Cl. 3 only)	232	232	NFC–2	G14, G15, T3
6	...	32	345	140	204	177 (Cl. 3 only)	204	204	NFC–3	G1, G6, T3, W10
7	89 < *t* ≤ 125	32	275	83	NP	177 (Cl. 3 only)	204	204	NFC–2	G7, T4
8	89 < *t* ≤ 125	32	275	83	NP	177 (Cl. 3 only)	204	204	NFC–2	G7, T4
9	50 < *t* ≤ 89	32	310	100	NP	177 (Cl. 3 only)	204	204	NFC–2	T4
10	50 < *t* ≤ 89	32	310	100	NP	177 (Cl. 3 only)	204	204	NFC–2	T4
11	≤50	32	345	140	NP	177 (Cl. 3 only)	204	204	NFC–2	T3
12	≤50	32	345	140	NP	177 (Cl. 3 only)	204	204	NFC–2	T3
13	>38	...	315	100	NP	NP	93	93	NFC–2	W14
14	>38	...	315	100	NP	NP	93	93	NFC–2	W14
15	>38	...	315	100	NP	NP	93	93	NFC–2	W14
16	>38	...	315	100	NP	NP	93	93	NFC–2	W14
17	≤38	...	345	125	NP	NP	93	93	NFC–2	W14
18	≤38	...	345	125	NP	NP	93	93	NFC–2	W14
19	≤38	...	345	125	NP	NP	93	93	NFC–2	W14
20	≤38	...	345	125	NP	NP	93	93	NFC–2	W14
21	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
22	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
23	<75	32	310	100	232	177 (Cl. 3 only)	232	232	NFC–2	G1, G6, T3, W10
24	...	32	310	100	NP	177 (Cl. 3 only)	232	NP	NFC–2	G1, G6, T3, W10
25	...	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
26	...	32	310	100	NP	NP	232	232	NFC–2	G7, G14, G15, T3
27	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
28	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
29	<75	32	310	100	232	177 (Cl. 3 only)	232	232	NFC–2	G1, G6, T3, W10
30	...	32	310	100	NP	177 (Cl. 3 only)	232	NP	NFC–2	G1, G6, T3, W10
31	...	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
32	...	32	310	100	NP	NP	232	232	NFC–2	G7, G14, G15, T3
33	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
34	≤100	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
35	<75	32	310	100	232	177 (Cl. 3 only)	232	232	NFC–2	G1, G6, T3, W10
36	...	32	310	100	NP	177 (Cl. 3 only)	232	NP	NFC–2	G1, G6, T3, W10
37	...	32	310	100	NP	177 (Cl. 3 only)	232	232	NFC–2	T3
38	...	32	310	100	NP	NP	232	232	NFC–2	G7, G14, G15, T3
39	75 < *t* ≤ 125	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
40	75 < *t* ≤ 125	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
41	≤75	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
42	≤75	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC–2	T3

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	55.2	55.2	55.2	55.2	55.1	*48.9*	*37.2*	*19.4*	*0.422*	...	...	...	...	...	...	...	...	...
2	55.2	55.2	55.2	55.2	55.1	*48.9*	*37.2*	*19.4*	*0.422*	...	...	...	...	...	...	...	...	...
3	55.2	55.2	55.2	55.2	55.1	*48.9*	*37.2*	*19.4*	*0.422*	...	...	...	...	...	...	...	...	...
4	46.9	46.9	46.9	46.9	46.8	*41.9*	*32.0*	*16.6*	*0.134*	...	...	...	...	...	...	...	...	...
5	46.9	46.9	46.9	46.9	46.8	*41.9*	*32.0*	*16.6*	*0.134*	...	...	...	...	...	...	...	...	...
6	91.7	91.7	91.7	91.7	91.6	*76.3*	*42.3*	*17.6*	...	...	...	...	...	...	...	...	...	...
7	55.2	55.2	55.2	55.2	55.2	55.2	40.3	*22.3*	...	...	...	...	...	...	...	...	...	...
8	55.2	55.2	55.2	55.2	55.2	55.2	40.3	*22.3*	...	...	...	...	...	...	...	...	...	...
9	68.9	68.9	68.9	68.9	68.9	68.9	43.0	*11.7*	...	...	...	...	...	...	...	...	...	...
10	68.9	68.9	68.9	68.9	68.9	68.9	43.0	*11.7*	...	...	...	...	...	...	...	...	...	...
11	91.7	91.7	91.7	91.7	91.6	*76.3*	*42.3*	*17.6*	...	...	...	...	...	...	...	...	...	...
12	91.7	91.7	91.7	91.7	91.6	*76.3*	*42.3*	*17.6*	...	...	...	...	...	...	...	...	...	...
13	68.9	64.9	61.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	68.9	64.9	61.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	68.9	64.9	61.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	68.9	64.9	61.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	82.7	78.0	73.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	82.7	78.0	73.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	82.7	78.0	73.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	82.7	78.0	73.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
22	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
23	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
24	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
25	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
26	58.6	58.6	58.6	58.6	58.6	*57.8*	*25.1*	*14.0*	*6.04*	...	...	...	...	...	...	...	...	...
27	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
28	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
29	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
30	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
31	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
32	58.6	58.6	58.6	58.6	58.6	*57.8*	*25.1*	*14.0*	*6.04*	...	...	...	...	...	...	...	...	...
33	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
34	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
35	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
36	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
37	68.9	68.9	68.9	68.9	68.9	*68.3*	*29.4*	*16.4*	*9.10*	...	...	...	...	...	...	...	...	...
38	58.6	58.6	58.6	58.6	58.6	*57.8*	*25.1*	*14.0*	*6.04*	...	...	...	...	...	...	...	...	...
39	82.7	82.7	82.7	82.7	82.2	*46.0*	*20.6*	...	...	...	...	...	...	...	...	...	...	...
40	82.7	82.7	82.7	82.7	82.2	*46.0*	*20.6*	...	...	...	...	...	...	...	...	...	...	...
41	91.7	91.7	91.7	91.7	91.0	*46.4*	*20.3*	...	...	...	...	...	...	...	...	...	...	...
42	91.7	91.7	91.7	91.7	91.0	*46.4*	*20.3*	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Plate	SB–171	...	C46500	M20
2	...	Plate	SB–171	...	C46500	O25
3	...	Plate	SB–171	...	C46500	M20
4	...	Plate	SB–171	...	C46500	O25
5	...	Smls. cond. tube	SB–111	...	C60800	O61
6	...	Smls. U–bend tube	SB–395	...	C60800	O61
7	...	Plate	SB–171	...	C61400	M20
8	...	Plate	SB–171	...	C61400	O25
9	...	Plate, sheet	SB–169	...	C61400	O25 or O60
10	...	Plate	SB–171	...	C61400	M20
11	...	Plate	SB–171	...	C61400	O25
12	...	Plate, sheet	SB–169	...	C61400	O25 or O60
13	...	Plate, sheet	SB–169	...	C61400	O25 or O60
14	...	Plate	SB–171	...	C63000	M20
15	...	Plate	SB–171	...	C63000	O25
16	...	Plate	SB–171	...	C63000	M20
17	...	Plate	SB–171	...	C63000	O25
18	...	Plate	SB–171	...	C63000	M20
19	...	Plate	SB–171	...	C63000	O25
20	...	Forgings	SB–283	...	C64200	M10
21	...	Forgings	SB–283	...	C64200	M11
22	...	Forgings	SB–283	...	C64200	O20
23	...	Forgings	SB–283	...	C64200	TQ50
24	...	Forgings	SB–283	...	C64200	M10
25	...	Forgings	SB–283	...	C64200	M11
26	...	Forgings	SB–283	...	C64200	O20
27	...	Forgings	SB–283	...	C64200	TQ50
28	...	Bar, rod	SB–98	...	C65100	O60
29	...	Bar, rod	SB–98	...	C65100	H02
30	...	Smls. pipe & tube	SB–315	...	C65500	O61
31	...	Plate, sheet	SB–96	...	C65500	O61
32	...	Bar, rod	SB–98	...	C65500	O60
33	...	Bar, rod	SB–98	...	C65500	H02
34	...	Bar, rod	SB–98	...	C66100	O60
35	...	Bar, rod	SB–98	...	C66100	H02
36	...	Smls. cond. tube	SB–111	...	C68700	O61
37	...	Smls. U–bend tube	SB–395	...	C68700	O61
38	...	Wld. cond. tube	SB–543	...	C68700	WO61
39	...	Smls. cond. tube	SB–111	...	C70400	O61
40	...	Wld. tube	SB–543	...	C70400	WO61
41	...	Smls. cond. tube	SB–111	...	C70400	H55
42	...	Smls. pipe & tube	SB–466	...	C70600	O60
43	...	Wld. pipe	SB–467	...	C70600	WO61
44	...	Bar, rod	SB–151	...	C70600	O60

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	75 < *t* ≤ 125	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
2	75 < *t* ≤ 125	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
3	≤75	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
4	≤75	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC–2	T3
5	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC–3	G6, T4
6	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC–2	T4
7	50 < *t* ≤ 125	35	450	195	NP	260 (Cl. 3 only)	260	260	NFC–8	...
8	50 < *t* ≤ 125	35	450	195	NP	260 (Cl. 3 only)	260	260	NFC–8	...
9	50 < *t* ≤ 125	35	450	195	NP	260 (Cl. 3 only)	260	260	NFC–8	...
10	≤50	35	485	205	NP	260 (Cl. 3 only)	260	260	NFC–8	...
11	≤50	35	485	205	NP	260 (Cl. 3 only)	260	260	NFC–8	...
12	13 < *t* ≤ 50	35	485	205	NP	260 (Cl. 3 only)	260	260	NFC–8	...
13	≤13	35	495	220	NP	232 (Cl. 3 only)	260	260	NFC–8	...
14	89 < *t* ≤ 125	35	550	205	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
15	89 < *t* ≤ 125	35	550	205	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
16	50 < *t* ≤ 89	35	585	230	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
17	50 < *t* ≤ 89	35	585	230	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
18	≤50	35	620	250	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
19	≤50	35	620	250	NP	260 (Cl. 3 only)	371	343	NFC–8	T6
20	>38	...	470	160	NP	NP	260	260	NFC–3	G10, W14
21	>38	...	470	160	NP	NP	260	260	NFC–3	G10, W14
22	>38	...	470	160	NP	NP	260	260	NFC–3	G10, W14
23	>38	...	470	160	NP	NP	260	260	NFC–3	G10, W14
24	≤38	...	485	170	NP	NP	260	260	NFC–3	W14
25	≤38	...	485	170	NP	NP	260	260	NFC–3	W14
26	≤38	...	485	170	NP	NP	260	260	NFC–3	W14
27	≤38	...	485	170	NP	NP	260	260	NFC–3	W14
28	...	33	275	83	NP	149	177	177	NFC–1	G17
29	...	33	380	140	NP	149	177	177	NFC–2	G17, W9
30	...	33	345	100	NP	149 (Cl. 3 only)	204	204	NFC–2	G17
31	≤50	33	345	125	NP	149 (Cl. 3 only)	177	177	NFC–2	G17
32	...	33	360	100	NP	149	177	177	NFC–2	G17
33	...	33	485	260	NP	149	177	177	NFC–2	G17
34	...	33	360	100	NP	149	177	177	NFC–2	G17
35	...	33	485	260	NP	149	177	177	NFC–2	G17, W9
36	<75	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC–2	...
37	...	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC–2	...
38	...	32	345	125	NP	NP	232	232	NFC–2	G14, G15
39	<75	34	260	83	NP	66 (Cl. 3 only)	66	66	NFC–2	...
40	...	34	260	83	NP	NP	66	66	NFC–2	G14, G15
41	<75	34	275	205	NP	66 (Cl. 3 only)	66	66	NFC–2	G7, W9
42	...	34	260	90	NP	204	316	316	NFC–3	T6
43	>114	34	260	90	NP	232 (Cl. 3 only)	316	316	NFC–3	G14, G15
44	...	34	260	100	NP	93	NP	NP	NFC–3	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	82.7	82.7	82.7	82.7	82.2	*46.0*	*20.6*	...	...	...	...	...	...	...	...	...	...	...
2	82.7	82.7	82.7	82.7	82.2	*46.0*	*20.6*	...	...	...	...	...	...	...	...	...	...	...
3	91.7	91.7	91.7	91.7	91.0	*46.4*	*20.3*	...	...	...	...	...	...	...	...	...	...	...
4	91.7	91.7	91.7	91.7	91.0	*46.4*	*20.3*	...	...	...	...	...	...	...	...	...	...	...
5	87.6	84.2	84.2	84.2	82.5	70.4	45.2	*30.4*	*19.0*	*6.23*	...	...	...	...	...	...	...	...
6	87.6	84.2	84.2	84.2	82.5	70.4	45.2	*30.4*	*19.0*	*6.23*	...	...	...	...	...	...	...	...
7	128	128	127	126	125	125	124	121	118	115	...	...	...	...	...	...	...	...
8	128	128	127	126	125	125	124	121	118	115	...	...	...	...	...	...	...	...
9	128	128	127	126	125	125	124	121	118	115	...	...	...	...	...	...	...	...
10	138	137	136	136	134	134	133	131	128	124	...	...	...	...	...	...	...	...
11	138	137	136	136	134	134	133	131	128	124	...	...	...	...	...	...	...	...
12	138	137	136	136	134	134	133	131	128	124	...	...	...	...	...	...	...	...
13	142	142	142	142	142	142	140	135	131	127	...	...	...	...	...	...	...	...
14	138	137	135	133	132	131	130	128	124	117	*99.3*	*73.8*	*54.7*	*38.9*	...	...	...	...
15	138	137	135	133	132	131	130	128	124	117	*99.3*	*73.8*	*54.7*	*38.9*	...	...	...	...
16	152	150	148	146	145	144	143	140	137	123	*97.9*	*74.1*	*54.7*	*38.9*	...	...	...	...
17	152	150	148	146	145	144	143	140	137	123	*97.9*	*74.1*	*54.7*	*38.9*	...	...	...	...
18	165	164	162	160	158	157	156	153	151	128	*96.7*	*74.4*	*54.6*	*38.9*	...	...	...	...
19	165	164	162	160	158	157	156	153	151	128	*96.7*	*74.4*	*54.6*	*38.9*	...	...	...	...
20	105	93.2	88.7	86.1	86.1	82.9	78.1	58.1	40.8	27.6	...	...	...	...	...	...	...	...
21	105	93.2	88.7	86.1	86.1	82.9	78.1	58.1	40.8	27.6	...	...	...	...	...	...	...	...
22	105	93.2	88.7	86.1	86.1	82.9	78.1	58.1	40.8	27.6	...	...	...	...	...	...	...	...
23	105	93.2	88.7	86.1	86.1	82.9	78.1	58.1	40.8	27.6	...	...	...	...	...	...	...	...
24	115	100	95.7	93.0	93.0	89.9	79.2	57.5	41.5	25.1	...	...	...	...	...	...	...	...
25	115	100	95.7	93.0	93.0	89.9	79.2	57.5	41.5	25.1	...	...	...	...	...	...	...	...
26	115	100	95.7	93.0	93.0	89.9	79.2	57.5	41.5	25.1	...	...	...	...	...	...	...	...
27	115	100	95.7	93.0	93.0	89.9	79.2	57.5	41.5	25.1	...	...	...	...	...	...	...	...
28	55.2	55.2	55.2	54.9	47.8	35.3	22.8	...	...	...	...	...	...	...	...	...	...	...
29	91.7	91.7	91.7	86.2	68.2	55.9	43.7	...	...	...	...	...	...	...	...	...	...	...
30	68.9	68.9	68.9	68.9	67.6	35.4	34.4	34.4	...	...	...	...	...	...	...	...	...	...
31	82.7	82.1	80.8	80.2	67.9	36.7	5.30	...	...	...	...	...	...	...	...	...	...	...
32	68.9	68.9	68.9	68.5	67.7	36.9	5.65	...	...	...	...	...	...	...	...	...	...	...
33	138	138	138	138	137	74.0	9.88	...	...	...	...	...	...	...	...	...	...	...
34	68.9	68.9	68.9	68.9	68.5	37.0	4.94	...	...	...	...	...	...	...	...	...	...	...
35	138	138	138	138	137	74.0	9.88	...	...	...	...	...	...	...	...	...	...	...
36	82.7	82.1	81.1	80.7	80.2	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
37	82.7	82.1	81.1	80.7	80.2	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
38	70.3	69.6	68.7	68.3	67.9	39.9	20.5	11.8	4.01	...	...	...	...	...	...	...	...	...
39	55.2	55.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	46.9	46.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	60.0	57.9	56.2	54.9	53.7	53.1	51.9	51.1	50.8	49.2	*45.8*	*38.8*	...	...	...	...	...	...
43	51.0	49.7	47.9	46.8	46.2	44.9	44.2	43.6	43.1	41.6	35.5	26.2	...	...	...	...	...	...
44	68.9	67.2	65.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Plate	SB–171	...	C70600	M20
2	...	Plate, sheet	SB–171	...	C70600	M20
3	...	Plate	SB–171	...	C70600	M20
4	...	Plate	SB–171	...	C70600	O25
5	...	Plate, sheet	SB–171	...	C70600	O25
6	...	Plate	SB–171	...	C70600	O25
7	...	Smls. cond. tube	SB–111	...	C70600	O61
8	...	Smls. cond. tube	SB–111	...	C70600	O61
9	...	Finned tube	SB–359	...	C70600	O61
10	...	Smls. U–bend tube	SB–395	...	C70600	O61
11	...	Wld. pipe	SB–467	...	C70600	WO61
12	...	Wld. tube	SB–543	...	C70600	WO61
13	...	Finned wld. tube	SB–956	...	C70600	WO61
14	...	Wld. pipe	SB–467	...	C70600	WM50
15	...	Smls. tube	SB–111	...	C70600	H55
(13) 16	...	Smls. pipe & tube	SB–466	...	C70600	H55
17	...	Wld. tube	SB–543	...	C70600	WC55
18	...	Finned wld. tube	SB–956	...	C70600	WC55
19	...	Wld. pipe	SB–467	...	C70600	Wld. fr. cold rld. strip
20	...	Smls. tube	SB–466	...	C71000	O60
21	...	Smls. cond. tube	SB–111	...	C71000	O61
22	...	Finned tube	SB–359	...	C71000	O61
23	...	Smls. tube	SB–395	...	C71000	O61
24	...	Wld. pipe	SB–467	...	C71500	WO61
25	...	Plate, sheet	SB–171	...	C71500	M20
26	...	Plate, sheet	SB–171	...	C71500	O25
27	...	Plate, sheet	SB–171	...	C71500	M20
28	...	Plate, sheet	SB–171	...	C71500	O25
29	...	Wld. pipe	SB–467	...	C71500	WO61
30	...	Smls. pipe & tube	SB–466	...	C71500	O60
31	...	Smls. cond. tube	SB–111	...	C71500	O61
32	...	Finned tube	SB–359	...	C71500	O61
33	...	Smls. U–bend tube	SB–395	...	C71500	O61
34	...	Wld. cond. tube	SB–543	...	C71500	WO61
35	...	Finned wld. cond. tube	SB–956	...	C71500	WO61
36	...	Smls. cond. tube	SB–111	...	C71500	HR50
37	...	Smls. U–bend tube	SB–395	...	C71500	HR58
38	...	Smls. cond. tube	SB–111	...	C72200	O61
39	...	Castings	SB–62	...	C83600	M01
40	...	Castings	SB–61	...	C92200	M01
41	...	Castings	SB–584	...	C92200	M01

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	≤125	34	275	100	NP	204	NP	NP	NFC–3	...
2	≤125	34	275	100	NP	232 (Cl. 3 only)	NP	NP	NFC–3	...
3	≤125	34	275	100	NP	NP	316	316	NFC–3	T5
4	≤125	34	275	100	NP	204	NP	NP	NFC–3	...
5	≤125	34	275	100	NP	232 (Cl. 3 only)	NP	NP	NFC–3	...
6	≤125	34	275	100	NP	NP	316	316	NFC–3	T5
7	...	34	275	100	316	204	NP	NP	NFC–3	G1, T5, W10
8	...	34	275	100	NP	232 (Cl. 3 only)	316	316	NFC–3	T5
9	...	34	275	100	NP	232 (Cl. 3 only)	316	NP	NFC–3	G1, T5, W10
10	...	34	275	100	NP	232 (Cl. 3 only)	316	316	NFC–3	T5
11	≤114	34	275	100	NP	232 (Cl. 3 only)	316	316	NFC–3	G14, G15
12	...	34	275	100	NP	232 (Cl. 3 only)	316	316	NFC–3	G14, G15
13	...	34	275	100	NP	NP	316	NP	NFC–3	G14
14	≤114	34	310	205	NP	NP	316	316	NFC–3	G14
15	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC–3	T5
16	...	34	310	240	NP	NP	316	NP	NFC–3	T5
17	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC–3	G14, G15
18	...	34	310	240	NP	NP	316	NP	NFC–3	G14
19	≤114	34	370	310	NP	NP	316	316	NFC–3	G14
20	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC–3	T7
21	...	34	310	110	371	371 (Cl. 3 only)	371	343	NFC–3	G1, T7, W10
22	...	34	310	110	NP	371 (Cl. 3 only)	371	NP	NFC–3	G1, T7, W10
23	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC–3	T7
24	>114	34	310	100	NP	316 (Cl. 3 only)	NP	NP	NFC–3	G14
25	64 < *t* ≤ 125	34	310	125	NP	371	371	343	NFC–4	...
26	64 < *t* ≤ 125	34	310	125	NP	371	371	343	NFC–4	...
27	≤64	34	345	140	NP	371	371	343	NFC–4	...
28	≤64	34	345	140	NP	371	371	343	NFC–4	...
29	≤114	34	345	140	NP	316 (Cl. 3 only)	NP	NP	NFC–4	G14
30	...	34	360	125	NP	371	371	343	NFC–4	...
31	...	34	360	125	371	371	371	343	NFC–4	G1, W10
32	...	34	360	125	NP	371 (Cl. 3 only)	371	NP	NFC–4	G1, W10
33	...	34	360	125	NP	371 (Cl. 3 only)	371	343	NFC–4	...
34	...	34	360	125	NP	316 (Cl. 3 only)	316	316	NFC–4	G14, G15
35	...	34	360	125	NP	NP	316	NP	NFC–4	G14
36	≤79	34	495	345	NP	371	427	343	NFC–4	T9, W9
37	...	34	495	345	NP	371	427	343	NFC–8	T9, W9
38	≤50	34	310	110	NP	NP	66	66	NFC–3	...
39	...	...	205	97	232	232 (Cl. 3 only)	232	232	NFC–1	G1, G3, G15, W10, W14
40	...	...	235	110	288	260 (Cl. 3 only)	288	288	NFN–1	G1, G3, G15, W10, W14
41	...	...	235	110	NP	260 (Cl. 3 only)	288	288	NFN–1	G15

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
2	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
3	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
4	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
5	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
6	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
7	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
8	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
9	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
10	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
11	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
12	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
13	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
14	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
15	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
16	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	*51.7*	*45.2*	*39.0*	...	...	...	...	...	...
17	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
18	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
19	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
20	73.8	73.1	72.3	71.5	70.3	69.7	68.5	66.7	64.9	62.7	60.0	*56.4*	*51.9*	*47.6*	...	...	...	...
21	73.8	73.1	72.3	71.5	70.3	69.7	68.5	66.7	64.9	62.7	60.0	*56.4*	*51.9*	*47.6*	...	...	...	...
22	73.8	73.1	72.3	71.5	70.3	69.7	68.5	66.7	64.9	62.7	60.0	*56.4*	*51.9*	*47.6*	...	...	...	...
23	73.8	73.1	72.3	71.5	70.3	69.7	68.5	66.7	64.9	62.7	60.0	*56.4*	*51.9*	*47.6*	...	...	...	...
24	58.6	56.6	54.8	53.6	52.4	51.8	50.5	49.8	48.8	47.8	47.3	46.6	...	...	...	...	...	...
25	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
26	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
27	91.7	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	74.1	73.6	72.8	71.5	...	...	...	...
28	91.7	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	74.1	73.6	72.8	71.5	...	...	...	...
29	77.9	75.2	73.3	71.5	70.3	69.1	67.1	66.4	65.4	64.0	63.1	62.5	...	...	...	...	...	...
30	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
31	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
32	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
33	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	67.0	65.9	65.4	64.7	...	...	...	...
34	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
35	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
36	142	142	142	142	142	139	136	133	131	129	128	127	126	123	118	*63.0*	*7.30*	...
37	142	142	142	142	142	139	136	133	131	129	128	127	126	123	118	*63.0*	*7.30*	...
38	73.8	71.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	59.3	59.3	59.3	59.1	57.2	56.0	48.4	47.1	46.5	...	...	...	...	...	...	...	...	...
40	66.9	66.9	66.9	66.9	66.9	66.9	57.9	54.0	50.9	42.8	27.3	...	...	...	...	...	...	...
41	66.9	66.9	66.9	66.9	66.9	66.9	57.9	54.0	50.9	42.8	27.3	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (13)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	1	...	Castings	SB–584	...	C93700	M01
	2	...	Castings	SB–148	...	C95200	M01
	3	...	Castings	SB–271	...	C95200	M02
	4	...	Castings	SB–505	...	C95200	M07
	5	...	Castings	SB–148	...	C95400	M01
	6	...	Castings	SB–271	...	C95400	M02
	7	...	Castings	SB–369	...	C96200	M01
	8	...	Castings	SB–584	...	C97600	M01
	9	99Ni	Smls. pipe & tube	SB–161	...	N02200	Annealed
	10	99Ni	Smls. & wld. fittings	SB–366	...	N02200	Annealed
	11	99Ni	Bar, rod	SB–160	...	N02200	Annealed
	12	99Ni	Smls. pipe & tube	SB–161	...	N02200	Annealed
	13	99Ni	Plate, sheet, strip	SB–162	...	N02200	Annealed
	14	99Ni	Smls. tube	SB–163	...	N02200	Annealed
	15	99Ni	Plate, sheet, strip	SB–162	...	N02200	As rolled
	16	99Ni	Bar, rod	SB–160	...	N02200	Hot rolled
(**13**)	17	99Ni	Smls. pipe & tube	SB–161	...	N02200	Stress rel.
(**13**)	18	99Ni	Smls. tube	SB–163	...	N02200	Stress rel.
	19	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed
	20	99Ni–Low C	Smls. & wld. fittings	SB–366	...	N02201	Annealed
	21	99Ni–Low C	Bar, rod	SB–160	...	N02201	Hot rolled/ann.
	22	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed
	23	99Ni–Low C	Smls. tube	SB–163	...	N02201	Annealed
	24	99Ni–Low C	Plate, sheet, strip	SB–162	...	N02201	Hot rolled/ann.
	25	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Stress rel.
	26	99Ni–Low C	Smls. pipe & tube	SB–163	...	N02201	Stress rel.
(**13**)	27	67Ni–30Cu	Bar	SB–164	...	N04400	Annealed
(**13**)	28	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed
(**13**)	29	67Ni–30Cu	Forgings	SB–564	...	N04400	Annealed
(**13**)	30	67Ni–30Cu	Plate	SB–127	...	N04400	Annealed
(**13**)	31	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Annealed
(**13**)	32	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed
(**13**)	33	67Ni–30Cu	Smls. & wld. fittings	SB–366	...	N04400	Annealed
	34	67Ni–30Cu	Bar	SB–164	...	N04400	Hot worked
	35	67Ni–30Cu	Plate	SB–127	...	N04400	As rolled
	36	67Ni–30Cu	Bar, rod	SB–164	...	N04400	Hot worked
	37	67Ni–30Cu	Bar, rod	SB–164	...	N04400	Hot worked
	38	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Stress rel.
	39	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Stress rel.
	40	67Ni–30Cu–S	Bar	SB–164	...	N04405	Annealed
	41	67Ni–30Cu–S	Bar	SB–164	...	N04405	Hot worked

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	...	205	83	NP	204 (SPT)	204	204	NFC–1	G15, W15
2	...	35	450	170	288	260 (Cl. 3 only)	316	316	NFC–4	G15
3	...	35	450	170	NP	260 (Cl. 3 only)	316	316	NFC–4	G15
4	...	35	470	180	NP	260 (Cl. 3 only)	NP	NP	NFC–4	G15
5	...	35	515	205	288	232 (Cl. 3 only)	316	316	NFC–4	G15, W8
6	...	35	515	205	NP	232 (Cl. 3 only)	NP	NP	NFC–4	G15, W8
7	...	34	310	170	NP	93 (Cl. 3 only)	NP	NP	NFC–4	G15
8	...	...	275	120	NP	NP	149	149	NFC–1	G15, W15
9	>125 O.D.	41	380	83	NP	316 (Cl. 3 only)	316	316	NFN–2	...
10	...	41	380	83	NP	NP	316	316	NFN–2	W12
11	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN–2	...
12	≤125 O.D.	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN–2	...
13	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN–2	...
14	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN–2	...
15	...	41	380	140	NP	316 (Cl. 3 only)	316	316	NFN–2	G20
16	...	41	415	100	NP	316 (Cl. 3 only)	316	316	NFN–2	...
17	...	41	450	275	NP	316 (Cl. 3 only)	316	316	NFN–25	G33
18	...	41	450	275	NP	316 (Cl. 3 only)	316	316	NFN–25	G33
19	>125 O.D.	41	345	69	NP	427 (Cl. 3 only)	649	343	NFN–1	T10
20	...	41	345	69	NP	NP	621	343	NFN–1	T10, W12
21	...	41	345	69	NP	427 (Cl. 3 only)	649	343	NFN–1	T10
22	≤125 O.D.	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN–1	T9
23	...	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN–1	T9
24	...	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN–1	T9
25	...	41	415	205	NP	316 (Cl. 3 only)	316	316	NFN–1	...
26	...	41	415	205	NP	427 (Cl. 3 only)	482	343	NFN–1	...
27	...	42	485	170	NP	427	482	343	NFN–3	T19
28	>125 O.D.	42	485	170	NP	427	482	343	NFN–3	T19
29	...	42	485	170	NP	427	482	343	NFN–3	T19
30	...	42	485	195	NP	427	482	343	NFN–3	T19
31	≤75	42	485	195	NP	427	482	343	NFN–3	T19
32	≤125 O.D.	42	485	195	NP	427	482	343	NFN–3	T19
33	...	42	485	195	NP	NP	482	343	NFN–3	T19, W12
34	...	42	515	205	NP	427	482	343	NFN–3	T9
35	...	42	515	275	NP	427	482	343	NFN–3	G12, G20, T9
36	...	42	515	275	NP	NP	482	343	NFN–3	T9
37	...	42	550	275	NP	427 (Cl. 3 only)	482	343	NFN–3	T9
38	...	42	585	380	NP	427	427	343	NFN–3	G11, T8
39	...	42	585	380	NP	427	260	260	NFN–3	G5, G21, T8
40	...	42	485	170	NP	427	482	343	NFN–3	T10
41	...	42	515	240	NP	427	482	343	NFN–3	T10

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	59.3	59.3	48.7	46.7	45.5	44.8	44.2	43.6	...	...	...	...	...	...	...	...	...	...
2	115	108	104	102	99.9	98.7	98.0	97.9	97.9	91.4	68.1	40.8	...	...	...	...	...	...
3	115	108	104	102	99.9	98.7	98.0	97.9	97.9	91.4	68.1	40.8	...	...	...	...	...	...
4	119	112	108	106	104	103	102	101	101	101	...	...	...	...	...	...	...	...
5	138	131	129	128	128	128	128	116	101	85.4	67.8	52.9	...	...	...	...	...	...
6	138	131	129	128	128	128	128	116	101	...	...	...	...	...	...	...	...	...
7	65.5	65.5	62.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	51.7	49.7	48.1	47.4	46.1	...	...	...	...	...	...	...	...	...	...	...	...	...
9	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
10	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
11	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
12	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
13	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
14	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
15	91.7	91.7	91.7	91.7	91.7	91.7	91.7	90.7	88.1	84.9	81.4	78.0	...	...	...	...	...	...
16	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
17	128	128	128	128	128	128	128	128	127	125	123	121	...	...	...	...	...	...
18	128	128	128	128	128	128	128	128	127	125	123	121	...	...	...	...	...	...
19	46.2	45.0	44.0	43.7	43.4	43.0	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4	40.3	*33.6*
20	46.2	45.0	44.0	43.7	43.4	43.0	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4	40.3	*33.6*
21	46.2	45.0	44.0	43.7	43.4	43.0	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4	40.3	*33.6*
22	55.2	54.1	52.8	52.1	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	*50.0*	*41.8*	*33.0*
23	55.2	54.1	52.8	52.1	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	*50.0*	*41.8*	*33.0*
24	55.2	54.1	52.8	52.1	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	*50.0*	*41.8*	*33.0*
25	118	118	118	118	117	117	117	117	116	115	114	107	...	...	...	...	...	...
26	118	118	118	118	117	117	117	117	116	115	114	107	95.4	91.8	88.1	83.7	81.1	77.7
27	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.2	89.5	88.9	87.9	*78.5*	*60.8*
28	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.2	89.5	88.9	87.9	*78.5*	*60.8*
29	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.2	89.5	88.9	87.9	*78.5*	*60.8*
30	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	*79.9*	*60.2*
31	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	*79.9*	*60.2*
32	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	*79.9*	*60.2*
33	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	*79.9*	*60.2*
34	138	136	133	131	128	126	124	122	122	121	120	119	118	117	116	*102*	*65.2*	*34.9*
35	148	148	148	148	148	148	148	148	148	148	148	148	147	141	127	*102*	*64.9*	*35.0*
36	148	148	148	148	148	148	148	148	148	148	148	148	147	141	127	*102*	*64.9*	*35.0*
37	158	158	158	158	158	158	158	158	158	158	158	158	157	149	127	*102*	*65.0*	*35.0*
38	168	168	168	168	168	168	168	168	168	167	166	164	162	154	*123*	*89.7*	*56.9*	...
39	168	168	168	168	168	168	168	168	168	167	166	164	162	154	*123*	*89.7*	*56.9*	...
40	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.2	89.5	88.9	87.9	78.5	*60.8*
41	148	148	148	148	148	146	144	143	142	141	140	139	138	136	127	102	64.9	*35.1*

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
19	*27.0*	*23.0*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	
20	*27.0*	*23.0*	*18.7*	*15.6*	*13.0*	*9.96*	...	...	...	...	...	...	...	...	...	...	...	
21	*27.0*	*23.0*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	
22	*27.3*	*22.9*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	
23	*27.3*	*22.9*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	
24	*27.3*	*22.9*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
29	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
30	*42.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
31	*42.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
32	*42.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
33	*42.1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	*8.09*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	*8.02*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	*8.02*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	*8.04*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	*8.01*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	47Ni–22Cr–9Mo–18Fe	Plate, sheet, strip	SB–435	...	N06002	Annealed
2	47Ni–22Cr–9Mo–18Fe	Plate, sheet, strip	SB–435	...	N06002	Annealed
3	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	...	N06002	Annealed
4	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	...	N06002	Annealed
5	47Ni–22Cr–9Mo–18Fe	Smls. & wld. fittings	SB–366	...	N06002	Annealed
6	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	...	N06002	Solution ann.
7	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	...	N06002	Solution ann.
8	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	...	N06002	Solution ann.
9	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	...	N06002	Solution ann.
10	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	...	N06002	Solution ann.
11	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	...	N06002	Solution ann.
12	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
13	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
14	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
15	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
16	47Ni–22Cr–19Fe–6Mo	Smls. & wld. fittings	SB–366	...	N06007	Annealed
17	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
18	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
19	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
20	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
21	47Ni–22Cr–19Fe–6Mo	Wld. pipe	SB–619	...	N06007	Solution ann.
22	47Ni–22Cr–19Fe–6Mo	Wld. pipe	SB–619	...	N06007	Solution ann.
23	47Ni–22Cr–19Fe–6Mo	Smls. pipe & tube	SB–622	...	N06007	Solution ann.
24	47Ni–22Cr–19Fe–6Mo	Smls. pipe & tube	SB–622	...	N06007	Solution ann.
25	47Ni–22Cr–19Fe–6Mo	Wld. tube	SB–626	...	N06007	Solution ann.
26	47Ni–22Cr–19Fe–6Mo	Wld. tube	SB–626	...	N06007	Solution ann.
27	55Ni–21Cr–13.5Mo	Smls. & wld. fittings	SB–366	...	N06022	Solution ann.
28	55Ni–21Cr–13.5Mo	Forgings	SB–462	...	N06022	Solution ann.
29	55Ni–21Cr–13.5Mo	Forgings	SB–462	...	N06022	Solution ann.
30	55Ni–21Cr–13.5Mo	Forgings	SB–564	...	N06022	Solution ann.
31	55Ni–21Cr–13.5Mo	Forgings	SB–564	...	N06022	Solution ann.
32	55Ni–21Cr–13.5Mo	Rod	SB–574	...	N06022	Solution ann.
33	55Ni–21Cr–13.5Mo	Rod	SB–574	...	N06022	Solution ann.
34	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	...	N06022	Solution ann.
35	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	...	N06022	Solution ann.
36	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	...	N06022	Solution ann.
37	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	...	N06022	Solution ann.
38	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	...	N06022	Solution ann.
39	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	...	N06022	Solution ann.
40	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	...	N06022	Solution ann.
41	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	...	N06022	Solution ann.
42	40Ni–29Cr–15Fe–5Mo	Smls. & wld. fittings	SB–366	...	N06030	Solution ann.
43	40Ni–29Cr–15Fe–5Mo	Forgings	SB–462	...	N06030	Solution ann.
44	40Ni–29Cr–15Fe–5Mo	Forgings	SB–462	...	N06030	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	43	655	240	NP	427	899	343	NFN–15	G4, G5, T15
2	...	43	655	240	NP	NP	899	343	NFN–15	G4, T16
3	...	43	655	240	NP	427	899	343	NFN–15	G4, G5, G13, T15
4	...	43	655	240	NP	NP	899	343	NFN–15	G4, G13, T16
5	...	43	690	275	NP	NP	899	343	NFN–15	G4, G5, T15, W12
6	...	43	690	275	NP	427	899	343	NFN–15	G4, G5, G14, T14, W5
7	...	43	690	275	NP	NP	899	343	NFN–15	G4, G14, T16
8	...	43	690	275	NP	427	899	343	NFN–15	G4, G5, T14
9	...	43	690	275	NP	NP	899	343	NFN–15	G4, T16
10	...	43	690	275	NP	427	899	343	NFN–15	G4, G5, G14, T14, W5
11	...	43	690	275	NP	NP	899	343	NFN–15	G4, G14, T16
12	>19	45	585	205	NP	NP	538	343	NFN–11	...
13	>19	45	585	205	NP	NP	538	343	NFN–11	G5
14	>19	45	585	205	NP	NP	538	343	NFN–11	...
15	>19	45	585	205	NP	NP	538	343	NFN–11	G5
16	...	45	620	240	NP	NP	538	343	NFN–11	G5, W12
17	≤19	45	620	240	NP	NP	538	343	NFN–11	...
18	≤19	45	620	240	NP	NP	538	343	NFN–11	G5
19	≤19	45	620	240	NP	NP	538	343	NFN–11	...
20	≤19	45	620	240	NP	NP	538	343	NFN–11	G5
21	...	45	620	240	NP	NP	538	343	NFN–11	G14
22	...	45	620	240	NP	NP	538	343	NFN–11	G5, G14
23	...	45	620	240	NP	NP	538	343	NFN–11	...
24	...	45	620	240	NP	NP	538	343	NFN–11	G5
25	...	45	620	240	NP	NP	538	343	NFN–11	G14
26	...	45	620	240	NP	NP	538	343	NFN–11	G5, G14
27	...	43	690	310	677	NP	677	343	NFN–10	G5, G27, G28, T15, W12
28	...	43	690	310	677	NP	677	NP	NFN–10	G5, G27, G28, T15
29	...	43	690	310	677	NP	677	NP	NFN–10	G27, G28, T15
30	...	43	690	310	677	427	677	343	NFN–10	G5, G27, G28, T15
31	...	43	690	310	677	NP	677	343	NFN–10	G27, G28, T15
32	...	43	690	310	677	427	677	343	NFN–10	G5, G27, G28, T15
33	...	43	690	310	677	NP	677	343	NFN–10	G27, G28, T15
34	...	43	690	310	677	427	677	343	NFN–10	G5, G27, G28, T15
35	...	43	690	310	677	NP	677	343	NFN–10	G27, G28, T15
36	...	43	690	310	677	427	677	343	NFN–10	G5, G14, G27, G28, T15, W6
37	...	43	690	310	677	NP	677	343	NFN–10	G14, G27, G28, T15
38	...	43	690	310	677	427	677	343	NFN–10	G5, G27, G28, T15
39	...	43	690	310	677	NP	677	343	NFN–10	G27, G28, T15
40	...	43	690	310	677	427	677	343	NFN–10	G5, G14, G27, G28, T15, W6
41	...	43	690	310	677	NP	677	343	NFN–10	G14, G27, G28, T15
42	...	45	585	240	NP	NP	427	343	NFN–19	G5, W12
43	...	45	585	240	NP	NP	427	NP	NFN–19	G5
44	...	45	585	240	NP	NP	427	NP	NFN–19	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	161	161	161	161	161	161	161	159	155	152	148	145	142	140	139	137	136	135
2	161	153	143	137	132	127	123	119	115	112	110	107	105	104	103	101	101	100
3	161	161	161	161	161	161	161	159	155	152	148	145	142	140	139	137	136	135
4	161	153	143	137	132	127	123	119	115	112	110	107	105	104	103	101	101	100
5	184	184	184	184	184	184	184	182	178	173	169	166	163	160	158	157	155	155
6	157	157	157	157	157	157	157	155	151	147	143	140	138	136	134	133	132	131
7	157	148	139	134	129	124	119	116	112	109	106	104	102	100	99.2	98.6	98.0	97.4
8	184	184	184	184	184	184	184	182	178	173	169	166	163	160	158	157	155	155
9	184	175	164	157	151	146	141	136	132	128	125	122	120	118	117	116	115	115
10	157	157	157	157	157	157	157	155	151	147	143	140	138	136	134	133	132	131
11	157	148	139	134	129	124	119	116	112	109	106	104	102	100	99.2	98.6	98.0	97.4
12	138	131	123	119	115	112	109	106	104	102	100	98.8	97.7	97.1	96.5	95.9	95.3	94.7
13	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129	128	128
14	138	131	123	119	115	112	109	106	104	102	100	98.8	97.7	97.1	96.5	95.9	95.3	94.7
15	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129	128	128
16	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
17	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110
18	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
19	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110
20	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
21	137	129	121	117	114	110	107	105	103	101	99.5	98.1	97.0	96.4	95.1	94.5	94.5	94.0
22	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128	127	126
23	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110
24	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
25	137	129	121	117	114	110	107	105	103	101	99.5	98.1	97.0	96.4	95.1	94.5	94.5	94.0
26	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128	127	126
27	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
28	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
29	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
30	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
31	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
32	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
33	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
34	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
35	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
36	168	168	167	166	165	162	160	158	156	155	153	152	151	150	149	148	147	146
37	168	162	155	149	144	139	134	131	127	124	122	119	117	115	113	112	111	109
38	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
39	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
40	168	168	167	166	165	162	160	158	156	155	153	152	151	150	149	148	147	146
41	168	162	155	149	144	139	134	131	127	124	122	119	117	115	113	112	111	109
42	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
43	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
44	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	135	134	133	131	*115*	*95.9*	*77.3*	*64.8*	*54.9*	*44.8*	*36.1*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
2	99.5	98.8	98.6	98.4	97.8	*95.9*	*77.3*	*64.8*	*54.9*	*44.8*	*36.1*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
3	135	134	133	131	*115*	*95.9*	*77.3*	*64.8*	*54.9*	*44.8*	*36.1*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
4	99.5	98.8	98.6	98.4	97.8	*95.9*	*77.3*	*64.8*	*54.9*	*44.8*	*36.1*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
5	153	153	151	143	*114*	*94.8*	*77.2*	*64.8*	*54.8*	*45.3*	*36.3*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
6	131	130	129	*122*	*96.8*	*80.3*	*65.6*	*55.1*	*46.3*	*38.1*	*30.9*	*24.7*	*20.1*	*16.6*	*12.7*	*9.19*	*6.79*
7	96.8	96.1	95.8	95.6	93.6	*80.3*	*65.6*	*55.1*	*46.3*	*38.1*	*30.9*	*24.7*	*20.1*	*16.6*	*12.7*	*9.19*	*6.79*
8	153	153	151	*143*	*114*	*94.8*	*77.2*	*64.8*	*54.8*	*45.3*	*36.3*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
9	114	113	113	112	110	*94.8*	*77.2*	*64.8*	*54.8*	*45.3*	*36.3*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*
10	131	130	129	*122*	*96.8*	*80.3*	*65.6*	*55.1*	*46.3*	*38.1*	*30.9*	*24.7*	*20.1*	*16.6*	*12.7*	*9.19*	*6.79*
11	96.8	96.1	95.8	95.6	93.6	*80.3*	*65.6*	*55.1*	*46.3*	*38.1*	*30.9*	*24.7*	*20.1*	*16.6*	*12.7*	*9.19*	*6.79*
12	94.0	93.8	93.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	127	126	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	94.0	93.8	93.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	127	126	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	149	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	93.3	93.1	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	126	126	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	93.3	93.1	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	126	126	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
28	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
29	128	127	126	124	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
30	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
31	128	127	126	124	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
32	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
33	128	127	126	124	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
34	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
35	128	127	126	124	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
36	145	144	142	126	*98.4*	*71.4*	*56.1*	*45.5*	*35.0*	...	...	...	...	...	...	...	...
37	108	108	108	105	*98.4*	*71.4*	*56.1*	*45.5*	*35.0*	...	...	...	...	...	...	...	...
38	171	169	167	148	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
39	128	127	126	124	*116*	*83.9*	*65.6*	*53.2*	*40.9*	...	...	...	...	...	...	...	...
40	145	144	142	126	*98.4*	*71.4*	*56.1*	*45.5*	*35.0*	...	...	...	...	...	...	...	...
41	108	108	108	105	*98.4*	*71.4*	*56.1*	*45.5*	*35.0*	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	40Ni–29Cr–15Fe–5Mo	Rod	SB–581	...	N06030	Solution ann.
2	40Ni–29Cr–15Fe–5Mo	Rod	SB–581	...	N06030	Solution ann.
3	40Ni–29Cr–15Fe–5Mo	Plate, sheet, strip	SB–582	...	N06030	Solution ann.
4	40Ni–29Cr–15Fe–5Mo	Plate, sheet, strip	SB–582	...	N06030	Solution ann.
5	40Ni–29Cr–15Fe–5Mo	Wld. pipe	SB–619	...	N06030	Solution ann.
6	40Ni–29Cr–15Fe–5Mo	Wld. pipe	SB–619	...	N06030	Solution ann.
7	40Ni–29Cr–15Fe–5Mo	Smls. pipe & tube	SB–622	...	N06030	Solution ann.
8	40Ni–29Cr–15Fe–5Mo	Smls. pipe & tube	SB–622	...	N06030	Solution ann.
9	40Ni–29Cr–15Fe–5Mo	Wld. tube	SB–626	...	N06030	Solution ann.
10	40Ni–29Cr–15Fe–5Mo	Wld. tube	SB–626	...	N06030	Solution ann.
11	58Ni–33Cr–8Mo	Smls. & wld. fittings	SB–366	...	N06035	Solution ann.
12	58Ni–33Cr–8Mo	Forgings	SB–462	...	N06035	Solution ann.
13	58Ni–33Cr–8Mo	Forgings	SB–462	...	N06035	Solution ann.
14	58Ni–33Cr–8Mo	Forgings	SB–564	...	N06035	Solution ann.
15	58Ni–33Cr–8Mo	Forgings	SB–564	...	N06035	Solution ann.
16	58Ni–33Cr–8Mo	Rod	SB–574	...	N06035	Solution ann.
17	58Ni–33Cr–8Mo	Rod	SB–574	...	N06035	Solution ann.
18	58Ni–33Cr–8Mo	Plate, sheet, strip	SB–575	...	N06035	Solution ann.
19	58Ni–33Cr–8Mo	Plate, sheet, strip	SB–575	...	N06035	Solution ann.
20	58Ni–33Cr–8Mo	Wld. pipe	SB–619	...	N06035	Solution ann.
21	58Ni–33Cr–8Mo	Wld. pipe	SB–619	...	N06035	Solution ann.
22	58Ni–33Cr–8Mo	Smls. pipe & tube	SB–622	...	N06035	Solution ann.
23	58Ni–33Cr–8Mo	Smls. pipe & tube	SB–622	...	N06035	Solution ann.
24	58Ni–33Cr–8Mo	Wld. tube	SB–626	...	N06035	Solution ann.
25	58Ni–33Cr–8Mo	Wld. tube	SB–626	...	N06035	Solution ann.
26	46Ni–27Cr–23Fe–2.75Si	Rod	SB–166	...	N06045	Solution ann.
27	46Ni–27Cr–23Fe–2.75Si	Rod	SB–166	...	N06045	Solution ann.
28	46Ni–27Cr–23Fe–2.75Si	Smls. pipe & tube	SB–167	...	N06045	Solution ann.
29	46Ni–27Cr–23Fe–2.75Si	Smls. pipe & tube	SB–167	...	N06045	Solution ann.
30	46Ni–27Cr–23Fe–2.75Si	Plate, sheet, strip	SB–168	...	N06045	Solution ann.
31	46Ni–27Cr–23Fe–2.75Si	Plate, sheet, strip	SB–168	...	N06045	Solution ann.
32	46Ni–27Cr–23Fe–2.75Si	Smls. & wld. fittings	SB–366	...	N06045	Solution ann.
33	46Ni–27Cr–23Fe–2.75Si	Forged fittings	SB–462	...	N06045	Solution ann.
34	46Ni–27Cr–23Fe–2.75Si	Forged fittings	SB–462	...	N06045	Solution ann.
35	46Ni–27Cr–23Fe–2.75Si	Wld. tube	SB–516	...	N06045	Solution ann.
36	46Ni–27Cr–23Fe–2.75Si	Wld. tube	SB–516	...	N06045	Solution ann.
37	46Ni–27Cr–23Fe–2.75Si	Wld. pipe	SB–517	...	N06045	Solution ann.
38	46Ni–27Cr–23Fe–2.75Si	Wld. pipe	SB–517	...	N06045	Solution ann.
39	46Ni–27Cr–23Fe–2.75Si	Forgings	SB–564	...	N06045	Solution ann.
40	46Ni–27Cr–23Fe–2.75Si	Forgings	SB–564	...	N06045	Solution ann.
41	59Ni–23Cr–16Mo	Fittings	SB–366	CR5923	N06059	Annealed
42	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923	N06059	Annealed
43	59Ni–23Cr–16Mo	Wld. fittings	SB–366	WP5923W	N06059	Annealed
44	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923WX	N06059	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	45	585	240	NP	427	427	343	NFN–19	G5
2	...	45	585	240	NP	NP	427	343	NFN–19	...
3	...	45	585	240	NP	427	427	343	NFN–19	G5
4	...	45	585	240	NP	NP	427	343	NFN–19	...
5	...	45	585	240	NP	427	427	343	NFN–19	G5, G14, W6
6	...	45	585	240	NP	NP	427	343	NFN–19	G14
7	...	45	585	240	NP	427	427	343	NFN–19	G5
8	...	45	585	240	NP	NP	427	343	NFN–19	...
9	...	45	585	240	NP	427	427	343	NFN–19	G5, G14, W6
10	...	45	585	240	NP	NP	427	343	NFN–19	G14
11	...	43	586	241	NP	NP	427	NP	NFN–27	G5, W12
12	...	43	586	241	NP	NP	427	NP	NFN–27	G5
13	...	43	586	241	NP	NP	427	NP	NFN–27	...
14	...	43	586	241	NP	NP	427	NP	NFN–27	G5
15	...	43	586	241	NP	NP	427	NP	NFN–27	...
16	...	43	586	241	NP	NP	427	NP	NFN–27	G5
17	...	43	586	241	NP	NP	427	NP	NFN–27	...
18	...	43	586	241	NP	NP	427	NP	NFN–27	G5
19	...	43	586	241	NP	NP	427	NP	NFN–27	...
20	...	43	586	241	NP	NP	427	NP	NFN–27	G5, G14
21	...	43	586	241	NP	NP	427	NP	NFN–27	G14
22	...	43	586	241	NP	NP	427	NP	NFN–27	G5
23	...	43	586	241	NP	NP	427	NP	NFN–27	...
24	...	43	586	241	NP	NP	427	NP	NFN–27	G5, G14
25	...	43	586	241	NP	NP	427	NP	NFN–27	G14
26	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11
27	...	46	620	240	816	NP	816	NP	NFN–8	T11
28	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11
29	...	46	620	240	816	NP	816	NP	NFN–8	T11
30	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11
31	...	46	620	240	816	NP	816	NP	NFN–8	T11
32	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11, W12
33	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11
34	...	46	620	240	816	NP	816	NP	NFN–8	T11
35	...	46	620	240	816	NP	816	NP	NFN–8	G5, G14, T11
36	...	46	620	240	816	NP	816	NP	NFN–8	G14, T11
37	...	46	620	240	816	NP	816	NP	NFN–8	G5, G14, T11
38	...	46	620	240	816	NP	816	NP	NFN–8	G14, T11
39	...	46	620	240	816	NP	816	NP	NFN–8	G5, T11
40	...	46	620	240	816	NP	816	NP	NFN–8	T11
41	...	43	690	310	NP	427	760	343	NFN–14	G5, G14, G23, T16
42	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16
43	...	43	690	310	NP	427	760	343	NFN–14	G5, G14, G23, T16
44	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
2	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
3	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
4	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
5	137	137	137	137	136	135	132	130	129	128	126	124	121	120	118	116	114	...
6	137	126	116	111	107	104	101	98.6	96.5	94.9	93.4	91.7	89.9	88.8	87.5	85.6	83.7	...
7	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
8	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
9	137	137	137	137	136	135	132	130	129	128	126	124	121	120	118	116	114	...
10	137	126	116	111	107	104	101	98.6	96.5	94.9	93.4	91.7	89.9	88.8	87.5	85.6	83.7	...
11	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
12	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
13	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
14	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
15	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
16	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
17	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
18	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
19	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
20	137	137	137	137	137	137	131	127	122	119	116	115	113	112	111	110	109	...
21	137	127	118	112	106	101	96.9	93.5	91.0	88.4	86.7	85.0	84.0	83.1	82.4	81.4	80.5	...
22	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
23	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
24	137	137	137	137	137	137	131	127	122	119	116	115	113	112	111	110	109	...
25	137	127	118	112	106	101	96.9	93.5	91.0	88.4	86.7	85.0	84.0	83.1	82.4	81.4	80.5	...
26	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
27	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
28	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
29	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
30	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
31	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
32	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
33	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
34	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
35	137	137	137	137	137	137	137	135	133	131	130	129	128	127	127	126	124	102
36	137	129	121	117	113	110	107	104	103	101	101	99.4	98.6	98.6	97.9	97.3	96.5	95.7
37	137	137	137	137	137	137	137	135	133	131	130	129	128	127	127	126	124	102
38	137	129	121	117	113	110	107	104	103	101	101	99.4	98.6	98.6	97.9	97.3	96.5	95.7
39	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
40	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
41	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
42	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
43	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
44	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
27	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
28	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
29	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
30	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
31	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
32	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
33	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
34	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
35	*83.5*	*64.6*	*48.1*	*38.3*	*31.2*	*24.7*	*20.5*	*16.8*	*13.6*	*11.0*	*9.00*	*7.11*	*5.54*	*4.38*	...	...	...
36	*83.5*	*64.6*	*48.1*	*38.3*	*31.2*	*24.7*	*20.5*	*16.8*	*13.6*	*11.0*	*9.00*	*7.11*	*5.54*	*4.38*	...	...	...
37	*83.5*	*64.6*	*48.1*	*38.3*	*31.2*	*24.7*	*20.5*	*16.8*	*13.6*	*11.0*	*9.00*	*7.11*	*5.54*	*4.38*	...	...	...
38	*83.5*	*64.6*	*48.1*	*38.3*	*31.2*	*24.7*	*20.5*	*16.8*	*13.6*	*11.0*	*9.00*	*7.11*	*5.54*	*4.38*	...	...	...
39	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
40	*98.1*	*76.1*	*56.8*	*45.1*	*36.5*	*29.3*	*23.9*	*19.6*	*15.7*	*13.1*	*10.6*	*8.45*	*6.81*	*5.28*	...	...	...
41	140	137	134	128	104	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
42	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
43	140	137	134	128	104	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
44	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	59Ni–23Cr–16Mo	Forged fittings	SB–462	...	N06059	Solution ann.
2	59Ni–23Cr–16Mo	Forged fittings	SB–462	...	N06059	Solution ann.
3	59Ni–23Cr–16Mo	Forgings	SB–564	...	N06059	Solution ann.
4	59Ni–23Cr–16Mo	Forgings	SB–564	...	N06059	Solution ann.
5	59Ni–23Cr–16Mo	Rod	SB–574	...	N06059	Solution ann.
6	59Ni–23Cr–16Mo	Rod	SB–574	...	N06059	Solution ann.
7	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	...	N06059	Solution ann.
8	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	...	N06059	Solution ann.
9	59Ni–23Cr–16Mo	Wld. pipe	SB–619	...	N06059	Solution ann.
10	59Ni–23Cr–16Mo	Wld. pipe	SB–619	...	N06059	Solution ann.
11	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	...	N06059	Solution ann.
12	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	...	N06059	Solution ann.
13	59Ni–23Cr–16Mo	Wld. tube	SB–626	...	N06059	Solution ann.
14	59Ni–23Cr–16Mo	Wld. tube	SB–626	...	N06059	Solution ann.
15	59Ni–23Cr–16Mo–1.6Cu	Smls. & wld. fittings	SB–366	...	N06200	Solution ann.
16	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–462	...	N06200	Solution ann.
17	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–462	...	N06200	Solution ann.
18	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–564	...	N06200	Solution ann.
19	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–564	...	N06200	Solution ann.
20	59Ni–23Cr–16Mo–1.6Cu	Rod	SB–574	...	N06200	Solution ann.
21	59Ni–23Cr–16Mo–1.6Cu	Rod	SB–574	...	N06200	Solution ann.
22	59Ni–23Cr–16Mo–1.6Cu	Plate, sheet, strip	SB–575	...	N06200	Solution ann.
23	59Ni–23Cr–16Mo–1.6Cu	Plate, sheet, strip	SB–575	...	N06200	Solution ann.
24	59Ni–23Cr–16Mo–1.6Cu	Wld. pipe	SB–619	...	N06200	Solution ann.
25	59Ni–23Cr–16Mo–1.6Cu	Wld. pipe	SB–619	...	N06200	Solution ann.
26	59Ni–23Cr–16Mo–1.6Cu	Smls. pipe & tube	SB–622	...	N06200	Solution ann.
27	59Ni–23Cr–16Mo–1.6Cu	Smls. pipe & tube	SB–622	...	N06200	Solution ann.
28	59Ni–23Cr–16Mo–1.6Cu	Wld. tube	SB–626	...	N06200	Solution ann.
29	59Ni–23Cr–16Mo–1.6Cu	Wld. tube	SB–626	...	N06200	Solution ann.
30	60Ni–19Cr–19Mo–1.8Ta	Smls. & wld. fittings	SB–366	...	N06210	Solution ann.
31	60Ni–19Cr–19Mo–1.8Ta	Forgings	SB–564	...	N06210	Solution ann.
32	60Ni–19Cr–19Mo–1.8Ta	Forgings	SB–564	...	N06210	Solution ann.
33	60Ni–19Cr–19Mo–1.8Ta	Rod	SB–574	...	N06210	Solution ann.
34	60Ni–19Cr–19Mo–1.8Ta	Rod	SB–574	...	N06210	Solution ann.
35	60Ni–19Cr–19Mo–1.8Ta	Plate, sheet, strip	SB–575	...	N06210	Solution ann.
36	60Ni–19Cr–19Mo–1.8Ta	Plate, sheet, strip	SB–575	...	N06210	Solution ann.
37	60Ni–19Cr–19Mo–1.8Ta	Wld. pipe	SB–619	...	N06210	Solution ann.
38	60Ni–19Cr–19Mo–1.8Ta	Wld. pipe	SB–619	...	N06210	Solution ann.
39	60Ni–19Cr–19Mo–1.8Ta	Smls. pipe & tube	SB–622	...	N06210	Solution ann.
40	60Ni–19Cr–19Mo–1.8Ta	Smls. pipe & tube	SB–622	...	N06210	Solution ann.
41	60Ni–19Cr–19Mo–1.8Ta	Wld. tube	SB–626	...	N06210	Solution ann.
42	60Ni–19Cr–19Mo–1.8Ta	Wld. tube	SB–626	...	N06210	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	43	690	310	NP	NP	760	343	NFN–14	G23, T16
2	...	43	690	310	NP	NP	760	343	NFN–14	G5, G23, T16
3	...	43	690	310	NP	427	760	343	NFN–14	G23, T16
4	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16
5	...	43	690	310	NP	427	760	343	NFN–14	G23, T16
6	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16
7	...	43	690	310	NP	427	760	343	NFN–14	G23, T16
8	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16
9	...	43	690	310	NP	427	760	343	NFN–14	G14, G23, T16
10	...	43	690	310	NP	427	760	343	NFN–14	G5, G14, G23, T16
11	...	43	690	310	NP	427	760	343	NFN–14	G23, T16
12	...	43	690	310	NP	427	760	343	NFN–14	G5, G23, T16
13	...	43	690	310	NP	427	760	343	NFN–14	G14, G23, T16
14	...	43	690	310	NP	427	760	343	NFN–14	G5, G14, G23, T16
15	...	43	690	310	NP	NP	427	NP	NFN–10	G5, W12
16	...	43	690	310	NP	NP	427	NP	NFN–10	...
17	...	43	690	310	NP	NP	427	NP	NFN–10	G5
18	...	43	690	310	NP	NP	427	NP	NFN–10	...
19	...	43	690	310	NP	NP	427	NP	NFN–10	G5
20	...	43	690	310	NP	NP	427	NP	NFN–10	...
21	...	43	690	310	NP	NP	427	NP	NFN–10	G5
22	...	43	690	310	NP	NP	427	NP	NFN–10	...
23	...	43	690	310	NP	NP	427	NP	NFN–10	G5
24	...	43	690	310	NP	NP	427	NP	NFN–10	G14
25	...	43	690	310	NP	NP	427	NP	NFN–10	G5, G14
26	...	43	690	310	NP	NP	427	NP	NFN–10	...
27	...	43	690	310	NP	NP	427	NP	NFN–10	G5
28	...	43	690	310	NP	NP	427	NP	NFN–10	G14
29	...	43	690	310	NP	NP	427	NP	NFN–10	G5, G14
30	...	43	690	310	NP	NP	427	NP	NFN–14	G5, W12
31	...	43	690	310	NP	NP	427	NP	NFN–14	...
32	...	43	690	310	NP	NP	427	NP	NFN–14	G5
33	...	43	690	310	NP	NP	427	NP	NFN–14	...
34	...	43	690	310	NP	NP	427	NP	NFN–14	G5
35	...	43	690	310	NP	NP	427	NP	NFN–14	...
36	...	43	690	310	NP	NP	427	NP	NFN–14	G5
37	...	43	690	310	NP	NP	427	NP	NFN–14	G14
38	...	43	690	310	NP	NP	427	NP	NFN–14	G5, G14
39	...	43	690	310	NP	NP	427	NP	NFN–14	...
40	...	43	690	310	NP	NP	427	NP	NFN–14	G5
41	...	43	690	310	NP	NP	427	NP	NFN–14	G14
42	...	43	690	310	NP	NP	427	NP	NFN–14	G5, G14

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
2	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
3	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
4	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
5	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
6	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
7	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
8	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
9	168	163	157	152	147	143	140	137	134	131	127	124	121	118	115	112	109	106
10	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
11	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
12	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
13	168	163	157	152	147	143	140	137	134	131	127	124	121	118	115	112	109	106
14	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
15	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
16	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
17	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
18	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
19	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
20	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
21	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
22	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
23	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
24	167	...	156	...	145	...	135	...	126	...	118	116	113	112	110	109	109	...
25	167	...	167	...	167	...	162	...	158	...	154	153	152	151	149	148	146	...
26	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
27	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
28	167	...	156	...	145	...	135	...	126	...	118	116	113	112	110	109	109	...
29	167	...	167	...	167	...	162	...	158	...	154	153	152	151	149	148	146	...
30	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
31	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
32	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
33	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
34	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
35	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
36	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
37	167	163	155	149	143	...	133	...	124	...	117	113	110	107	105	102	101	...
38	167	167	167	167	167	...	162	...	158	...	155	153	149	145	141	138	136	...
39	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
40	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
41	167	163	155	149	143	...	133	...	124	...	117	113	110	107	105	102	101	...
42	167	167	167	167	167	...	162	...	158	...	155	153	149	145	141	138	136	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	122	119	117	115	112	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
2	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
3	122	119	117	115	112	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
4	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
5	122	119	117	115	112	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
6	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
7	122	119	117	115	112	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
8	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
9	104	101	99.3	97.9	95.1	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
10	140	137	134	128	104	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
11	122	119	117	115	112	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
12	165	161	158	150	122	*97.8*	*79.3*	*65.7*	*53.1*	*43.0*	*35.7*	*29.0*	...	...	...	...	...
13	104	101	99.3	97.9	95.1	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
14	140	137	134	128	104	*83.1*	*67.7*	*55.9*	*45.2*	*36.5*	*30.4*	*25.0*	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	57Ni–22Cr–14W–2Mo–La	Smls. & wld. fittings	SB–366	...	N06230	Solution ann.
2	57Ni–22Cr–14W–2Mo–La	Plate, sheet, strip	SB–435	...	N06230	Solution ann.
3	57Ni–22Cr–14W–2Mo–La	Plate, sheet, strip	SB–435	...	N06230	Solution ann.
4	57Ni–22Cr–14W–2Mo–La	Forgings	SB–564	...	N06230	Solution ann.
5	57Ni–22Cr–14W–2Mo–La	Forgings	SB–564	...	N06230	Solution ann.
6	57Ni–22Cr–14W–2Mo–La	Bar	SB–572	...	N06230	Solution ann.
7	57Ni–22Cr–14W–2Mo–La	Bar	SB–572	...	N06230	Solution ann.
8	57Ni–22Cr–14W–2Mo–La	Wld. pipe	SB–619	...	N06230	Solution ann.
9	57Ni–22Cr–14W–2Mo–La	Wld. pipe	SB–619	...	N06230	Solution ann.
10	57Ni–22Cr–14W–2Mo–La	Smls. pipe & tube	SB–622	...	N06230	Solution ann.
11	57Ni–22Cr–14W–2Mo–La	Smls. pipe & tube	SB–622	...	N06230	Solution ann.
12	57Ni–22Cr–14W–2Mo–La	Wld. tube	SB–626	...	N06230	Solution ann.
13	57Ni–22Cr–14W–2Mo–La	Wld. tube	SB–626	...	N06230	Solution ann.
14	61Ni–16Mo–16Cr	Smls. & wld. fittings	SB–366	...	N06455	Annealed
15	61Ni–16Mo–16Cr	Rod	SB–574	...	N06455	Solution ann.
16	61Ni–16Mo–16Cr	Rod	SB–574	...	N06455	Solution ann.
17	61Ni–16Mo–16Cr	Plate, sheet, strip	SB–575	...	N06455	Solution ann.
18	61Ni–16Mo–16Cr	Plate, sheet, strip	SB–575	...	N06455	Solution ann.
19	61Ni–16Mo–16Cr	Wld. pipe	SB–619	...	N06455	Solution ann.
20	61Ni–16Mo–16Cr	Wld. pipe	SB–619	...	N06455	Solution ann.
21	61Ni–16Mo–16Cr	Smls. pipe & tube	SB–622	...	N06455	Solution ann.
22	61Ni–16Mo–16Cr	Smls. pipe & tube	SB–622	...	N06455	Solution ann.
23	61Ni–16Mo–16Cr	Wld. tube	SB–626	...	N06455	Solution ann.
24	61Ni–16Mo–16Cr	Wld. tube	SB–626	...	N06455	Solution ann.
25	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
26	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
27	72Ni–15Cr–8Fe	Smls. & wld. fittings	SB–366	...	N06600	Annealed
28	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.
29	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.
30	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
31	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
32	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
33	72Ni–15Cr–8Fe	Smls. tube	SB–163	...	N06600	Annealed
34	72Ni–15Cr–8Fe	Smls. tube	SB–163	...	N06600	Annealed
35	72Ni–15Cr–8Fe	Bar	SB–166	...	N06600	Annealed
36	72Ni–15Cr–8Fe	Bar	SB–166	...	N06600	Annealed
37	72Ni–15Cr–8Fe	Plate	SB–168	...	N06600	Annealed
38	72Ni–15Cr–8Fe	Plate, sheet, strip	SB–168	...	N06600	Annealed
39	72Ni–15Cr–8Fe	Wld. tube	SB–516	...	N06600	Annealed
40	72Ni–15Cr–8Fe	Wld. tube	SB–516	...	N06600	Annealed
41	72Ni–15Cr–8Fe	Forgings	SB–564	...	N06600	...
42	72Ni–15Cr–8Fe	Forgings	SB–564	...	N06600	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G31, T15, W12
2	...	43	760	310	899	NP	982	343	NFN–24	G4, G31, T16
3	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G31, T15
4	...	43	760	310	899	NP	982	343	NFN–24	G4, G31, T16
5	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G31, T15
6	...	43	760	310	899	NP	982	343	NFN–24	G4, G31, T16
7	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G31, T15
8	...	43	760	310	899	NP	982	343	NFN–24	G4, G14, G32, T16
9	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G14, G32, T15
10	...	43	760	310	899	NP	982	343	NFN–24	G4, G31, T16
11	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G31, T15
12	...	43	760	310	899	NP	982	343	NFN–24	G4, G14, G32, T16
13	...	43	760	310	899	NP	982	343	NFN–24	G4, G5, G14, G32, T15
14	...	43	690	275	NP	NP	427	343	NFN–14	G5, W12
15	...	43	690	275	NP	NP	427	343	NFN–14	...
16	...	43	690	275	NP	NP	427	343	NFN–14	G5
17	...	43	690	275	NP	NP	427	343	NFN–14	...
18	...	43	690	275	NP	NP	427	343	NFN–14	G5
19	...	43	690	275	NP	NP	427	343	NFN–14	G14
20	...	43	690	275	NP	NP	427	343	NFN–14	G5, G14
21	...	43	690	275	NP	NP	427	343	NFN–14	...
22	...	43	690	275	NP	NP	427	343	NFN–14	G5
23	...	43	690	275	NP	NP	427	343	NFN–14	G14
24	...	43	690	275	NP	NP	427	343	NFN–14	G5, G14
25	>125	43	515	170	NP	427	649	343	NFN–4	T12
26	>125	43	515	170	NP	427	649	343	NFN–4	G5, T11
27	...	43	550	205	NP	NP	649	343	NFN–4	G5, T11, W12
28	>125	43	550	205	NP	427 (Cl. 3 only)	649	343	NFN–4	T12
29	>125	43	550	205	NP	427 (Cl. 3 only)	649	343	NFN–4	G5, T11
30	...	43	550	205	NP	427	NP	NP	NFN–4	G5
31	≤125	43	550	205	NP	427 (Cl. 3 only)	649	343	NFN–4	G5, T11
32	≤125	43	550	205	NP	NP	649	343	NFN–4	T12
33	≤75	43	550	240	649	427	649	343	NFN–4	G5, T11
34	≤75	43	550	240	649	NP	649	343	NFN–4	T11
35	...	43	550	240	649	427	649	343	NFN–4	G5, T11
36	...	43	550	240	649	NP	649	343	NFN–4	T11
37	...	43	550	240	649	427	649	343	NFN–4	G5, T11
38	...	43	550	240	649	NP	649	343	NFN–4	T11
39	...	43	550	240	NP	NP	649	343	NFN–4	G14, T11
40	...	43	550	240	NP	NP	649	343	NFN–4	G5, G14, T11
41	...	43	550	240	NP	427	NP	NP	NFN–4	G5
42	...	43	550	240	NP	NP	649	343	NFN–4	T11

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
2	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
3	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
4	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
5	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
6	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
7	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
8	176	170	164	159	155	150	145	141	137	133	130	128	126	124	123	123	122	122
9	176	176	176	176	176	176	176	176	176	176	176	173	170	167	167	166	166	166
10	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
11	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
12	176	170	164	159	155	150	145	141	137	133	130	128	126	124	123	123	122	122
13	176	176	176	176	176	176	176	176	176	176	176	173	170	167	167	166	166	166
14	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
15	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
16	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
17	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
18	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
19	157	150	143	138	134	131	128	125	123	121	119	117	116	115	114	112	110	...
20	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151	149	...
21	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
22	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
23	157	150	143	138	134	131	128	125	123	121	119	117	116	115	114	112	110	...
24	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151	149	...
25	115	112	109	107	105	103	101	99.1	97.2	95.5	93.9	92.6	91.4	90.1	88.9	87.7	86.3	85.7
26	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
27	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
28	138	135	131	129	126	124	121	119	117	115	113	111	109	108	107	105	104	103
29	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
30	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	...
31	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
32	138	135	131	129	126	124	121	119	117	115	113	111	109	108	107	105	104	103
33	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
34	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
35	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
36	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
37	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
38	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
39	134	129	124	123	122	121	120	119	119	118	117	116	116	115	114	112	110	99.9
40	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	132	106
41	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
42	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	195	195	195	183	*153*	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.6*	*25.2*	*18.9*	*13.8*	*10.2*
2	144	144	144	144	144	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.8*	*25.2*	*18.9*	*13.8*	*10.2*
3	195	195	195	183	*153*	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.6*	*25.2*	*18.9*	*13.8*	*10.2*
4	144	144	144	144	144	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.8*	*25.2*	*18.9*	*13.8*	*10.2*
5	195	195	195	183	*153*	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.6*	*25.2*	*18.9*	*13.8*	*10.2*
6	144	144	144	144	144	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.8*	*25.2*	*18.9*	*13.8*	*10.2*
7	195	195	195	183	*153*	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.6*	*25.2*	*18.9*	*13.8*	*10.2*
8	122	122	122	122	122	*109*	*91.0*	*76.2*	*63.5*	*52.6*	*43.2*	*34.9*	*27.7*	*21.4*	*16.1*	*11.7*	*8.67*
9	166	166	166	156	*130*	*109*	*91.0*	*76.2*	*63.5*	*52.6*	*43.2*	*34.9*	*27.7*	*21.4*	*16.1*	*11.7*	*8.67*
10	144	144	144	144	144	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.8*	*25.2*	*18.9*	*13.8*	*10.2*
11	195	195	195	183	*153*	*128*	*107*	*89.7*	*74.7*	*61.9*	*50.8*	*41.1*	*32.6*	*25.2*	*18.9*	*13.8*	*10.2*
12	122	122	122	122	122	*109*	*91.0*	*76.2*	*63.5*	*52.6*	*43.2*	*34.9*	*27.7*	*21.4*	*16.1*	*11.7*	*8.67*
13	166	166	166	156	*130*	*109*	*91.0*	*76.2*	*63.5*	*52.6*	*43.2*	*34.9*	*27.7*	*21.4*	*16.1*	*11.7*	*8.67*
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	79.7	*59.8*	*40.1*	*26.9*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
26	*87.5*	*59.8*	*40.1*	*26.9*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
27	*86.1*	*58.3*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
28	86.1	*58.3*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
29	*86.1*	*58.3*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	*86.1*	*58.3*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
32	86.1	*58.3*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
33	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
34	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
35	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
36	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
37	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
38	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...
39	*73.4*	*50.1*	*34.1*	*22.7*	*16.5*	*12.7*	*11.7*	...	...	...	...	...	...	...	...	...	...
40	*73.4*	*50.1*	*34.1*	*22.7*	*16.5*	*12.7*	*11.7*	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	*86.5*	*58.7*	*40.0*	*26.8*	*19.0*	*14.8*	*13.8*	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.
2	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.
3	72Ni–15Cr–8Fe	Wld. pipe	SB–517	...	N06600	Cold drawn/ann.
4	72Ni–15Cr–8Fe	Wld. pipe	SB–517	...	N06600	Cold drawn/ann.
5	72Ni–15Cr–8Fe	Bar, rod	SB–166	...	N06600	Hot fin.
6	72Ni–15Cr–8Fe	Bar, rod	SB–166	...	N06600	Hot fin.
7	72Ni–15Cr–8Fe	Plate, sheet, strip	SB–168	...	N06600	Hot rolled
8	72Ni–15Cr–8Fe	Plate, sheet, strip	SB–168	...	N06600	Hot rolled
9	60Ni–23Cr–Fe	Smls. tube	SB–163	...	N06601	Annealed
10	60Ni–23Cr–Fe	Smls. tube	SB–163	...	N06601	Annealed
11	60Ni–23Cr–Fe	Bar	SB–166	...	N06601	Annealed
12	60Ni–23Cr–Fe	Bar	SB–166	...	N06601	Annealed
13	60Ni–23Cr–Fe	Smls. pipe & tube	SB–167	...	N06601	Annealed
14	60Ni–23Cr–Fe	Smls. pipe & tube	SB–167	...	N06601	Annealed
15	60Ni–23Cr–Fe	Plate, sheet, strip	SB–168	...	N06601	Annealed
16	60Ni–23Cr–Fe	Plate, sheet, strip	SB–168	...	N06601	Annealed
17	52Ni–22Cr–13Co–9Mo	Bar, rod	SB–166	...	N06617	Annealed
18	52Ni–22Cr–13Co–9Mo	Bar, rod	SB–166	...	N06617	Annealed
19	52Ni–22Cr–13Co–9Mo	Smls. pipe & tube	SB–167	...	N06617	Annealed
20	52Ni–22Cr–13Co–9Mo	Smls. pipe & tube	SB–167	...	N06617	Annealed
21	52Ni–22Cr–13Co–9Mo	Plate, sheet, strip	SB–168	...	N06617	Annealed
22	52Ni–22Cr–13Co–9Mo	Plate, sheet, strip	SB–168	...	N06617	Annealed
23	52Ni–22Cr–13Co–9Mo	Forgings	SB–564	...	N06617	Annealed
24	52Ni–22Cr–13Co–9Mo	Forgings	SB–564	...	N06617	Annealed
25	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	2	N06625	Solution ann.
26	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	2	N06625	Solution ann.
27	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe & tube	SB–444	2	N06625	Solution ann.
28	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe & tube	SB–444	2	N06625	Solution ann.
29	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	2	N06625	Solution ann.
30	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	2	N06625	Solution ann.
31	60Ni–22Cr–9Mo–3.5Cb	Smls. & wld. fittings	SB–366	...	N06625	Annealed
32	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed
33	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed
34	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed
35	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed
36	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe	SB–444	1	N06625	Annealed
37	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed
38	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed
39	60Ni–22Cr–9Mo–3.5Cb	Wld. tube	SB–704	...	N06625	Annealed
40	60Ni–22Cr–9Mo–3.5Cb	Wld. pipe	SB–705	1	N06625	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	≤125	43	550	240	649	427 (Cl. 3 only)	649	343	NFN–4	T11
2	≤125	43	550	240	649	427	649	343	NFN–4	G5, T11
3	...	43	550	240	NP	NP	649	343	NFN–4	G14, T11
4	...	43	550	240	NP	NP	649	343	NFN–4	G5, G14, T11
5	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN–4	T13
6	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN–4	G5, T12
7	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN–4	G20, T13
8	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN–4	G5, G20, T12
9	≤75 O.D.	43	552	207	899	NP	899	NP	NFN–4	G4, T14
10	≤75 O.D.	43	552	207	899	NP	899	NP	NFN–4	G4, G5, T13
11	...	43	552	207	899	NP	899	NP	NFN–4	G4, T14
12	...	43	552	207	899	NP	899	NP	NFN–4	G4, G5, T13
13	...	43	552	207	899	NP	899	NP	NFN–4	G4, T14
14	...	43	552	207	899	NP	899	NP	NFN–4	G4, G5, T13
15	...	43	552	207	899	NP	899	NP	NFN–4	G4, T14
16	...	43	552	207	899	NP	899	NP	NFN–4	G4, G5, T13
17	...	43	655	240	899	NP	982	NP	NFN–4	G4, G29, T18
18	...	43	655	240	899	NP	982	NP	NFN–4	G4, G5, G29, T17
19	...	43	655	240	899	NP	982	NP	NFN–4	G4, G29, T18
20	...	43	655	240	899	NP	982	NP	NFN–4	G4, G5, G29, T17
21	...	43	655	240	899	NP	982	NP	NFN–4	G4, G29, T18
22	...	43	655	240	899	NP	982	NP	NFN–4	G4, G5, G29, T17
23	...	43	655	240	899	NP	982	NP	NFN–4	G4, G29, T18
24	...	43	655	240	899	NP	982	NP	NFN–4	G4, G5, G29, T17
25	...	43	690	275	593	NP	871	343	NFN–22	G4, G5, G23, T17, W13
26	...	43	690	275	593	NP	871	343	NFN–22	G4, G23, T18, W13
27	...	43	690	275	593	NP	871	343	NFN–22	G4, G5, G23, T17, W13
28	...	43	690	275	593	NP	871	343	NFN–22	G4, G23, T18, W13
29	...	43	690	275	593	NP	871	343	NFN–22	G4, G5, G23, T17, W13
30	...	43	690	275	593	NP	871	343	NFN–22	G4, G23, T18, W13
31	...	43	760	345	593	NP	649	343	NFN–17	G23, T16, W12
32	100 < *t* ≤ 250	43	760	345	593	427	649	343	NFN–17	G23, T16
33	100 < *t* ≤ 250	43	760	345	593	427	649	343	NFN–17	G23, T16
34	...	43	760	380	593	427	649	343	NFN–17	G23, T16
35	...	43	825	415	593	NP	649	343	NFN–17	G22, G23, T16
36	...	43	825	415	593	427	649	343	NFN–17	G23, T16
37	≤100	43	825	415	593	427	649	343	NFN–17	G22, G23, T16
38	≤100	43	825	415	593	427	649	343	NFN–17	G22, G23, T16
39	...	43	825	415	593	427	649	343	NFN–17	G14, G23, T16
40	...	43	825	415	593	NP	649	343	NFN–17	G14, G23, T16

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
2	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
3	134	129	124	123	122	121	120	119	119	118	117	116	116	115	114	112	110	99.9
4	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	132	106
5	161	156	152	150	148	147	147	147	147	147	146	146	145	145	143	141	139	137
6	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
7	161	156	152	150	148	147	147	147	147	147	146	146	145	145	143	141	139	137
8	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
9	138	128	122	118	114	111	108	105	102	100	98.9	97.6	96.6	95.9	95.4	95.1	94.9	94.8
10	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
11	138	128	122	118	114	111	108	105	102	100	98.9	97.6	96.6	95.9	95.4	95.1	94.9	94.8
12	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
13	138	128	122	118	114	111	108	105	102	100	98.9	97.6	96.6	95.9	95.4	95.1	94.9	94.8
14	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
15	138	128	122	118	114	111	108	105	102	100	98.9	97.6	96.6	95.9	95.4	95.1	94.9	94.8
16	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
17	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
18	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
19	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
20	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
21	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
22	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
23	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
24	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
25	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
26	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
27	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
28	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
29	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
30	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
31	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
32	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
33	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
34	217	217	217	217	217	217	217	217	217	207	205	204	202	201	199	197	196	194
35	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
36	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
37	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
38	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
39	201	201	201	201	201	199	197	195	194	192	190	189	188	186	185	183	182	180
40	201	201	201	201	201	199	197	195	194	192	191	189	188	186	185	183	181	180

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
2	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
3	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
4	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
5	134	118	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
6	151	119	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
7	134	118	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
8	151	119	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
9	94.8	94.7	94.5	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
10	128	128	108	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
11	94.8	94.7	94.5	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
12	128	128	108	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
13	94.8	94.7	94.5	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
14	128	128	108	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
15	94.8	94.7	94.5	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
16	128	128	108	85.7	67.5	52.9	41.5	32.5	25.6	20.3	16.2	13.0	10.5	8.6	7.0	5.8	5.0
17	108	107	106	106	106	105	105	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
18	145	144	144	144	143	142	124	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
19	108	107	106	106	106	105	105	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
20	145	144	144	144	143	142	124	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
21	108	107	106	106	106	105	105	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
22	145	144	144	144	143	142	124	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
23	108	107	106	106	106	105	105	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
24	145	144	144	144	143	142	124	101	81.0	64.1	50.4	39.5	31.3	24.6	19.4	15.3	12.3
25	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
26	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
27	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
28	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
29	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
30	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
31	185	184	183	182	178	137	88.8	...	...	...	...	...	...	...	...	...	...
32	192	190	188	185	179	137	88.9	...	...	...	...	...	...	...	...	...	...
33	192	190	188	185	179	137	88.9	...	...	...	...	...	...	...	...	...	...
34	192	190	188	185	179	137	88.9	...	...	...	...	...	...	...	...	...	...
35	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
36	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
37	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
38	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
39	178	176	174	172	164	116	75.5	...	...	...	...	...	...	...	...	...	...
40	178	176	174	172	164	116	75.5	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	Ni–Cr–Mo–W	Forged fittings	SB–462	...	N06686	Solution ann.
2	Ni–Cr–Mo–W	Forged fittings	SB–462	...	N06686	Solution ann.
3	Ni–Cr–Mo–W	Forgings	SB–564	...	N06686	Solution ann.
4	Ni–Cr–Mo–W	Forgings	SB–564	...	N06686	Solution ann.
5	Ni–Cr–Mo–W	Rod	SB–574	...	N06686	Solution ann.
6	Ni–Cr–Mo–W	Rod	SB–574	...	N06686	Solution ann.
7	Ni–Cr–Mo–W	Plate, sheet, strip	SB–575	...	N06686	Solution ann.
8	Ni–Cr–Mo–W	Plate, sheet, strip	SB–575	...	N06686	Solution ann.
9	Ni–Cr–Mo–W	Wld. pipe	SB–619	...	N06686	Solution ann.
10	Ni–Cr–Mo–W	Wld. pipe	SB–619	...	N06686	Solution ann.
11	Ni–Cr–Mo–W	Smls. pipe & tube	SB–622	...	N06686	Solution ann.
12	Ni–Cr–Mo–W	Smls. pipe & tube	SB–622	...	N06686	Solution ann.
13	Ni–Cr–Mo–W	Wld. tube	SB–626	...	N06686	Solution ann.
14	Ni–Cr–Mo–W	Wld. tube	SB–626	...	N06686	Solution ann.
15	58Ni–29Cr–9Fe	Bar, rod	SB–166	...	N06690	Annealed
16	58Ni–29Cr–9Fe	Bar, rod	SB–166	...	N06690	Annealed
17	58Ni–29Cr–9Fe	Plate, sheet, strip	SB–168	...	N06690	Annealed
18	58Ni–29Cr–9Fe	Plate, sheet, strip	SB–168	...	N06690	Annealed
19	58Ni–29Cr–9Fe	Smls. pipe & tube	SB–167	...	N06690	Cold drawn/ann.
20	58Ni–29Cr–9Fe	Smls. pipe & tube	SB–167	...	N06690	Cold drawn/ann.
21	49Ni–25Cr–18Fe–6Mo	Plate, sheet, strip	SB–582	...	N06975	Solution ann.
22	49Ni–25Cr–18Fe–6Mo	Plate, sheet, strip	SB–582	...	N06975	Solution ann.
23	49Ni–25Cr–18Fe–6Mo	Wld. pipe	SB–619	...	N06975	Solution ann.
24	49Ni–25Cr–18Fe–6Mo	Wld. pipe	SB–619	...	N06975	Solution ann.
25	49Ni–25Cr–18Fe–6Mo	Smls. pipe & tube	SB–622	...	N06975	Solution ann.
26	49Ni–25Cr–18Fe–6Mo	Smls. pipe & tube	SB–622	...	N06975	Solution ann.
27	49Ni–25Cr–18Fe–6Mo	Wld. tube	SB–626	...	N06975	Solution ann.
28	49Ni–25Cr–18Fe–6Mo	Wld. tube	SB–626	...	N06975	Solution ann.
29	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
30	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
31	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
32	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
33	47Ni–22Cr–20Fe–7Mo	Smls. & wld. fittings	SB–366	...	N06985	Annealed
34	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
35	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
36	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
37	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
38	47Ni–22Cr–20Fe–7Mo	Wld. pipe	SB–619	...	N06985	Annealed
39	47Ni–22Cr–20Fe–7Mo	Wld. pipe	SB–619	...	N06985	Annealed
40	47Ni–22Cr–20Fe–7Mo	Smls. pipe & tube	SB–622	...	N06985	Annealed
41	47Ni–22Cr–20Fe–7Mo	Smls. pipe & tube	SB–622	...	N06985	Annealed
42	47Ni–22Cr–20Fe–7Mo	Wld. tube	SB–626	...	N06985	Annealed
43	47Ni–22Cr–20Fe–7Mo	Wld. tube	SB–626	...	N06985	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	G5
2	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	...
3	...	43	689	310	NP	NP	427	NP	NFN–10	G5
4	...	43	689	310	NP	NP	427	NP	NFN–10	...
5	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	G5
6	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	...
7	...	43	689	310	NP	NP	427	NP	NFN–10	G5
8	...	43	689	310	NP	NP	427	NP	NFN–10	...
9	≤203.2	43	689	310	NP	NP	427	NP	NFN–10	G5, G14
10	≤203.2	43	689	310	NP	NP	427	NP	NFN–10	G14
11	...	43	689	310	NP	NP	427	NP	NFN–10	G5
12	...	43	689	310	NP	NP	427	NP	NFN–10	...
13	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	G5, G14
14	≤88.9	43	689	310	NP	NP	427	NP	NFN–10	G14
15	...	43	585	240	NP	NP	454	343	NFN–4	...
16	...	43	585	240	NP	NP	454	343	NFN–4	G5
17	...	43	585	240	NP	NP	454	343	NFN–4	...
18	...	43	585	240	NP	NP	454	343	NFN–4	G5
19	...	43	585	240	649	NP	454	343	NFN–4	H3, T12
20	...	43	585	240	649	NP	454	343	NFN–4	G5, H3, T11
21	...	45	585	220	NP	NP	427	343	NFN–11	...
22	...	45	585	220	NP	NP	427	343	NFN–11	G5
23	...	45	585	220	NP	NP	427	343	NFN–11	G14
24	...	45	585	220	NP	NP	427	343	NFN–11	G5, G14
25	...	45	585	220	NP	NP	427	343	NFN–11	...
26	...	45	585	220	NP	NP	427	343	NFN–11	G5
27	...	45	585	220	NP	NP	427	343	NFN–11	G14
28	...	45	585	220	NP	NP	427	343	NFN–11	G5, G14
29	>19	45	585	205	NP	NP	427	343	NFN–19	...
30	>19	45	585	205	NP	NP	427	343	NFN–19	G5
31	>19	45	585	205	NP	NP	427	343	NFN–19	...
32	>19	45	585	205	NP	NP	427	343	NFN–19	G5
33	...	45	620	240	NP	NP	427	343	NFN–18	G5, W12
34	≤19	45	620	240	NP	NP	427	343	NFN–18	...
35	≤19	45	620	240	NP	NP	427	343	NFN–18	G5
36	≤19	45	620	240	NP	NP	427	343	NFN–18	...
37	≤19	45	620	240	NP	NP	427	343	NFN–18	G5
38	...	45	620	240	NP	NP	427	343	NFN–18	G14
39	...	45	620	240	NP	NP	427	343	NFN–18	G5, G14
40	...	45	620	240	NP	NP	427	343	NFN–18	...
41	...	45	620	240	NP	NP	427	343	NFN–18	G5
42	...	45	620	240	NP	NP	427	343	NFN–18	G14
43	...	45	620	240	NP	NP	427	343	NFN–18	G5, G14

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
2	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
3	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
4	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
5	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
6	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
7	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
8	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
9	167	167	167	...	165	...	160	...	156	...	153	151	150	149	148	146	144	...
10	167	154	144	...	137	...	132	...	128	...	123	121	119	118	117	116	116	...
11	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
12	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
13	167	167	167	...	165	...	160	...	156	...	153	151	150	149	148	146	144	...
14	167	154	144	...	137	...	132	...	128	...	123	121	119	118	117	116	116	...
15	161	153	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
16	161	161	161	161	161	161	161	160	160	159	158	158	158	157	156	156	155	155
17	161	153	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
18	161	161	161	161	161	161	161	160	160	159	158	158	158	157	156	156	155	155
19	161	151	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
20	161	161	161	161	161	161	161	160	159	159	158	158	158	157	157	156	155	154
21	147	140	133	130	127	124	121	118	115	112	109	107	105	103	102	101	101	...
22	147	147	147	147	147	147	147	147	147	147	146	145	141	139	138	137	135	...
23	125	119	114	111	108	106	103	100	97.6	95.1	92.9	91.0	89.1	87.4	86.9	86.2	85.6	...
24	125	125	125	125	125	125	125	125	125	125	124	123	120	118	117	116	115	...
25	147	140	133	130	127	124	121	118	115	112	109	107	105	103	102	101	101	...
26	147	147	147	147	147	147	147	147	147	147	146	145	141	139	138	137	135	...
27	125	119	114	111	108	106	103	100	97.6	95.1	92.9	91.0	89.1	87.4	86.9	86.2	85.6	...
28	125	125	125	125	125	125	125	125	125	125	124	123	120	118	117	116	115	...
29	138	130	121	116	111	107	103	100	97.0	94.2	91.7	89.6	87.7	86.0	84.7	82.9	81.0	...
30	138	138	138	138	138	138	138	136	132	127	124	121	119	116	114	112	110	...
31	138	130	121	116	111	107	103	100	97.0	94.2	91.7	89.6	87.7	86.0	84.7	82.9	81.0	...
32	138	138	138	138	138	138	138	136	132	127	124	121	119	116	114	112	110	...
33	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
34	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
35	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
36	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
37	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
38	137	129	121	115	111	107	103	99.3	96.3	93.5	91.0	88.9	87.1	85.2	83.4	82.1	80.9	...
39	137	137	137	137	137	137	137	135	130	126	123	120	117	115	113	111	109	...
40	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
41	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
42	137	129	121	115	111	107	103	99.3	96.3	93.5	91.0	88.9	87.1	85.2	83.4	82.1	80.9	...
43	137	137	137	137	137	137	137	135	130	126	123	120	117	115	113	111	109	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	126	*95.0*	*71.4*	*54.3*	*41.4*	*30.6*	*19.7*	...	...	...	...	...	...	...	...	...	...
20	*127*	*95.0*	*71.4*	*54.3*	*41.4*	*30.6*	*19.7*	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	35Ni–35Fe–20Cr–Cb	Forgings	SB–462	...	N08020	Annealed
2	35Ni–35Fe–20Cr–Cb	Forgings	SB–462	...	N08020	Annealed
3	35Ni–35Fe–20Cr–Cb	Plate	SB–463	...	N08020	Annealed
4	35Ni–35Fe–20Cr–Cb	Plate	SB–463	...	N08020	Annealed
5	35Ni–35Fe–20Cr–Cb	Bar	SB–473	...	N08020	Annealed
6	35Ni–35Fe–20Cr–Cb	Bar	SB–473	...	N08020	Annealed
7	35Ni–35Fe–20Cr–Cb	Smls. pipe & tube	SB–729	...	N08020	Annealed
8	35Ni–35Fe–20Cr–Cb	Smls. pipe & tube	SB–729	...	N08020	Annealed
9	35Ni–35Fe–20Cr–Cb	Wld. pipe	SB–464	...	N08020	Wld. ann.
10	35Ni–35Fe–20Cr–Cb	Wld. pipe	SB–464	...	N08020	Wld. ann.
11	35Ni–35Fe–20Cr–Cb	Wld. pipe	SB–464	...	N08020	Wld. ann.
12	35Ni–35Fe–20Cr–Cb	Wld. tube	SB–468	...	N08020	Wld. ann.
13	35Ni–35Fe–20Cr–Cb	Wld. tube	SB–468	...	N08020	Wld. ann.
14	35Ni–35Fe–20Cr–Cb	Wld. tube	SB–468	...	N08020	Wld. ann.
15	35Ni–35Fe–20Cr–Cb	Smls. & wld. fittings	SB–366	...	N08020	Annealed
16	37Ni–33Fe–23Cr–4Mo–Cu	Plate, sheet, strip	SB–463	...	N08024	Annealed
17	37Ni–33Fe–23Cr–4Mo–Cu	Plate, sheet, strip	SB–463	...	N08024	Annealed
18	37Ni–33Fe–23Cr–4Mo–Cu	Wld. pipe	SB–464	...	N08024	Wld. ann.
19	37Ni–33Fe–23Cr–4Mo–Cu	Wld. pipe	SB–464	...	N08024	Wld. ann.
20	37Ni–33Fe–23Cr–4Mo–Cu	Wld. tube	SB–468	...	N08024	Wld. ann.
21	37Ni–33Fe–23Cr–4Mo–Cu	Wld. tube	SB–468	...	N08024	Wld. ann.
22	35Ni–30Fe–24Cr–6Mo–Cu	Plate, sheet, strip	SB–463	...	N08026	Annealed
23	35Ni–30Fe–24Cr–6Mo–Cu	Plate, sheet, strip	SB–463	...	N08026	Annealed
24	35Ni–30Fe–24Cr–6Mo–Cu	Wld. pipe	SB–464	...	N08026	Wld. ann.
25	35Ni–30Fe–24Cr–6Mo–Cu	Wld. pipe	SB–464	...	N08026	Wld. ann.
26	35Ni–30Fe–24Cr–6Mo–Cu	Wld. tube	SB–468	...	N08026	Wld. ann.
27	35Ni–30Fe–24Cr–6Mo–Cu	Wld. tube	SB–468	...	N08026	Wld. ann.
28	31Ni–31Fe–29Cr–Mo	Smls. tube	SB–668	...	N08028	Annealed
29	31Ni–31Fe–29Cr–Mo	Smls. tube	SB–668	...	N08028	Annealed
30	31Ni–31Fe–29Cr–Mo	Plate, sheet, strip	SB–709	...	N08028	Annealed
31	31Ni–31Fe–29Cr–Mo	Plate, sheet, strip	SB–709	...	N08028	Annealed
32	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. & wld. fittings	SB–366	...	N08031	Solution ann.
33	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forged fittings	SB–462	...	N08031	Solution ann.
34	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forged fittings	SB–462	...	N08031	Solution ann.
35	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forgings	SB–564	...	N08031	Solution ann.
36	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forgings	SB–564	...	N08031	Solution ann.
37	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Rod	SB–581	...	N08031	Solution ann.
38	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Rod	SB–581	...	N08031	Solution ann.
39	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. pipe	SB–619	...	N08031	Solution ann.
40	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. pipe	SB–619	...	N08031	Solution ann.
41	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. pipe & tube	SB–622	...	N08031	Solution ann.
42	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. pipe & tube	SB–622	...	N08031	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	45	550	240	NP	427	427	343	NFN–12	G5
2	...	45	550	240	NP	NP	427	343	NFN–12	...
3	...	45	550	240	NP	NP	427	343	NFN–12	...
4	...	45	550	240	NP	427	427	343	NFN–12	G5
5	...	45	550	240	NP	427	427	343	NFN–12	G5
6	...	45	550	240	NP	NP	427	343	NFN–12	...
7	...	45	550	240	NP	NP	427	343	NFN–12	...
8	...	45	550	240	NP	NP	427	343	NFN–12	G5
9	...	45	550	240	NP	427	NP	NP	NFN–12	G5, W5
10	...	45	550	240	NP	NP	427	343	NFN–12	G14
11	...	45	550	240	NP	NP	427	343	NFN–12	G5, G14
12	...	45	550	240	NP	427	NP	NP	NFN–12	G5, W5
13	...	45	550	240	NP	NP	427	343	NFN–12	G14
14	...	45	550	240	NP	NP	427	343	NFN–12	G5, G14
15	...	45	585	275	NP	NP	427	343	NFN–12	G5, W12
16	...	45	550	240	NP	NP	427	343	NFN–13	...
17	...	45	550	240	NP	NP	427	343	NFN–13	G5
18	...	45	550	240	NP	NP	427	343	NFN–13	G14
19	...	45	550	240	NP	NP	427	343	NFN–13	G5, G14
20	...	45	550	240	NP	NP	427	343	NFN–13	G14
21	...	45	550	240	NP	NP	427	343	NFN–13	G5, G14
22	...	45	550	240	NP	NP	427	343	NFN–13	...
23	...	45	550	240	NP	NP	427	343	NFN–13	G5
24	...	45	550	240	NP	NP	427	343	NFN–13	G14
25	...	45	550	240	NP	NP	427	343	NFN–13	G5, G14
26	...	45	550	240	NP	NP	427	343	NFN–13	G14
27	...	45	550	240	NP	NP	427	343	NFN–13	G5, G14
28	...	45	505	215	NP	316	454	343	NFN–13	...
29	...	45	505	215	NP	316	454	343	NFN–13	G5
30	...	45	505	215	NP	NP	454	343	NFN–13	...
31	...	45	505	215	NP	NP	454	343	NFN–13	G5
32	...	45	650	275	NP	NP	427	NP	NFN–11	G5, W12
33	...	45	650	275	NP	NP	427	NP	NFN–11	...
34	...	45	650	275	NP	NP	427	NP	NFN–11	G5
35	...	45	650	275	NP	NP	427	NP	NFN–11	...
36	...	45	650	275	NP	NP	427	NP	NFN–11	G5
37	...	45	650	275	NP	NP	427	NP	NFN–11	...
38	...	45	650	275	NP	NP	427	NP	NFN–11	G5
39	...	45	650	275	NP	NP	427	NP	NFN–11	G14
40	...	45	650	275	NP	NP	427	NP	NFN–11	G5, G14
41	...	45	650	275	NP	NP	427	NP	NFN–11	...
42	...	45	650	275	NP	NP	427	NP	NFN–11	G5

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
2	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
3	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
4	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
5	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
6	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
7	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
8	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
9	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
10	134	127	120	117	115	113	111	109	108	106	104	103	103	102	101	98.7	96.9	...
11	134	134	134	133	132	131	130	130	130	130	130	129	129	128	128	128	128	...
12	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
13	134	127	120	117	115	113	111	109	108	106	104	103	103	102	101	98.7	96.9	...
14	134	134	134	133	132	131	130	130	130	130	130	129	129	128	128	128	128	...
15	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
16	158	150	141	136	132	129	125	122	119	115	112	109	107	104	102	101	99.5	...
17	158	158	158	157	156	154	151	150	148	146	144	143	142	140	138	135	133	...
18	134	127	119	115	112	109	107	104	101	98.3	95.5	92.8	90.5	88.6	86.8	85.6	84.3	...
19	134	134	134	133	132	131	129	127	126	125	123	122	120	119	117	115	113	...
20	134	127	119	115	112	109	107	104	101	98.3	95.5	92.8	90.5	88.6	86.8	85.6	84.3	...
21	134	134	134	133	132	131	129	127	126	125	123	122	120	119	117	115	113	...
22	158	150	141	136	131	126	121	117	114	110	107	105	102	99.6	97.8	96.0	94.1	...
23	158	158	158	157	155	153	151	149	147	145	143	141	138	135	132	130	127	...
24	134	128	120	115	111	107	103	99.8	96.4	93.4	91.0	88.9	87.1	85.2	83.4	82.1	80.9	...
25	134	134	134	133	132	130	128	126	125	123	122	120	117	115	112	110	109	...
26	134	128	120	115	111	107	103	99.8	96.4	93.4	91.0	88.9	87.1	85.2	83.4	82.1	80.9	...
27	134	134	134	133	132	130	128	126	125	123	122	120	117	115	112	110	109	...
28	143	136	129	125	122	118	114	111	107	104	101	98.3	95.9	93.3	90.2	88.4	86.0	83.4
29	143	143	143	141	138	136	133	131	130	128	126	125	124	122	121	119	116	113
30	143	136	129	125	122	118	114	111	107	104	101	98.3	95.9	93.3	90.2	88.4	86.0	83.4
31	143	143	143	141	138	136	133	131	130	128	126	125	124	122	121	119	116	113
32	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
33	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
34	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
35	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
36	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
37	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
38	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
39	157	142	127	121	115	112	108	105	102	99.7	97.0	95.4	94.0	92.2	90.9	89.1	87.2	...
40	157	157	156	154	151	147	144	141	138	135	132	129	126	125	123	120	118	...
41	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
42	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08031	Solution ann.
2	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08031	Solution ann.
3	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. tube	SB–626	...	N08031	Solution ann.
4	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. tube	SB–626	...	N08031	Solution ann.
5	37Ni–33Fe–25Cr	Condenser tubes	SB–163	...	N08120	Solution ann.
6	37Ni–33Fe–25Cr	Condenser tubes	SB–163	...	N08120	Solution ann.
7	37Ni–33Fe–25Cr	Smls. & wld. fittings	SB–366	...	N08120	Solution ann.
8	37Ni–33Fe–25Cr	Smls. pipe & tube	SB–407	...	N08120	Solution ann.
9	37Ni–33Fe–25Cr	Smls. pipe & tube	SB–407	...	N08120	Solution ann.
10	37Ni–33Fe–25Cr	Bar, rod	SB–408	...	N08120	Solution ann.
11	37Ni–33Fe–25Cr	Bar, rod	SB–408	...	N08120	Solution ann.
12	37Ni–33Fe–25Cr	Plate, sheet, strip	SB–409	...	N08120	Solution ann.
13	37Ni–33Fe–25Cr	Plate, sheet, strip	SB–409	...	N08120	Solution ann.
14	37Ni–33Fe–25Cr	Wld. pipe	SB–514	...	N08120	Solution ann.
15	37Ni–33Fe–25Cr	Wld. pipe	SB–514	...	N08120	Solution ann.
16	37Ni–33Fe–25Cr	Wld. tube	SB–515	...	N08120	Solution ann.
17	37Ni–33Fe–25Cr	Wld. tube	SB–515	...	N08120	Solution ann.
18	37Ni–33Fe–25Cr	Forgings	SB–564	...	N08120	Solution ann.
19	37Ni–33Fe–25Cr	Forgings	SB–564	...	N08120	Solution ann.
20	26Ni–43Fe–22Cr–5Mo	Wld. pipe	SB–619	...	N08320	Solution ann.
21	26Ni–43Fe–22Cr–5Mo	Wld. pipe	SB–619	...	N08320	Solution ann.
22	26Ni–43Fe–22Cr–5Mo	Plate, sheet, strip	SB–620	...	N08320	Solution ann.
23	26Ni–43Fe–22Cr–5Mo	Plate, sheet, strip	SB–620	...	N08320	Solution ann.
24	26Ni–43Fe–22Cr–5Mo	Rod	SB–621	...	N08320	Solution ann.
25	26Ni–43Fe–22Cr–5Mo	Rod	SB–621	...	N08320	Solution ann.
26	26Ni–43Fe–22Cr–5Mo	Smls. pipe & tube	SB–622	...	N08320	Solution ann.
27	26Ni–43Fe–22Cr–5Mo	Smls. pipe & tube	SB–622	...	N08320	Solution ann.
28	26Ni–43Fe–22Cr–5Mo	Wld. tube	SB–626	...	N08320	Solution ann.
29	26Ni–43Fe–22Cr–5Mo	Wld. tube	SB–626	...	N08320	Solution ann.
30	35Ni–19Cr–1 1/4Si	Bar	SB–511	...	N08330	...
31	35Ni–19Cr–1 1/4Si	Bar	SB–511	...	N08330	...
32	35Ni–19Cr–1 1/4Si	Bar	SB–511	...	N08330	...
33	35Ni–19Cr–1 1/4Si	Bar	SB–511	...	N08330	...
34	35Ni–19Cr–1 1/4Si	Pipe	SB–535	...	N08330	...
35	35Ni–19Cr–1 1/4Si	Pipe	SB–535	...	N08330	...
36	35Ni–19Cr–1 1/4Si	Plate	SB–536	...	N08330	...
37	35Ni–19Cr–1 1/4Si	Plate	SB–536	...	N08330	...
38	35Ni–19Cr–1 1/4Si	Smls. & wld. fittings	SB–366	...	N08330	Annealed
39	35Ni–19Cr–1 1/4Si	Smls. & wld. pipe	SB–535	...	N08330	Annealed
40	35Ni–19Cr–1 1/4Si	Smls. & wld. pipe	SB–535	...	N08330	Annealed
41	35Ni–19Cr–1 1/4Si	Plate, sheet, strip	SB–536	...	N08330	Annealed
42	35Ni–19Cr–1 1/4Si	Plate, sheet, strip	SB–536	...	N08330	Annealed
43	35Ni–19Cr–1 1/4Si	Wld. pipe	SB–710	...	N08330	Annealed
44	35Ni–19Cr–1 1/4Si	Wld. pipe	SB–710	...	N08330	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	45	650	275	NP	NP	427	NP	NFN–11	...
2	...	45	650	275	NP	NP	427	NP	NFN–11	G5
3	...	45	650	275	NP	NP	427	NP	NFN–11	G14
4	...	45	650	275	NP	NP	427	NP	NFN–11	G5, G14
5	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G14, T16
6	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, G14, T15
7	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, T15, W12
8	...	45	621	276	NP	NP	899	NP	NFN–9	G4, T16
9	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, T15
10	...	45	621	276	NP	NP	899	NP	NFN–9	G4, T16
11	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, T15
12	...	45	621	276	NP	NP	899	NP	NFN–9	G4, T16
13	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, T15
14	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G14, T16
15	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, G14, T15
16	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G14, T16
17	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, G14, T15
18	...	45	621	276	NP	NP	899	NP	NFN–9	G4, T16
19	...	45	621	276	NP	NP	899	NP	NFN–9	G4, G5, T15
20	...	45	515	195	NP	NP	427	343	NFN–13	G14
21	...	45	515	195	NP	NP	427	343	NFN–13	G5, G14
22	...	45	515	195	NP	NP	427	343	NFN–13	...
23	...	45	515	195	NP	NP	427	343	NFN–13	G5
24	...	45	515	195	NP	NP	427	343	NFN–13	...
25	...	45	515	195	NP	NP	427	343	NFN–13	G5
26	...	45	515	195	NP	NP	427	343	NFN–13	...
27	...	45	515	195	NP	NP	427	343	NFN–13	G5
28	...	45	515	195	NP	NP	427	343	NFN–13	G14
29	...	45	515	195	NP	NP	427	343	NFN–13	G5, G14
30	...	46	690	205	816	NP	NP	NP	NFN–13	G2, H2, T14
31	...	46	485	205	816	NP	NP	NP	NFN–13	G2, G5, H2, T12
32	...	46	485	205	NP	NP	899	343	NFN–13	G4, H1, T14
33	...	46	485	205	NP	NP	899	343	NFN–13	G4, G5, H1, T12
34	...	46	485	205	816	NP	NP	NP	NFN–13	G2, H2, T14
35	...	46	485	205	816	NP	NP	NP	NFN–13	G2, G5, H2, T12
36	...	46	485	205	816	NP	NP	NP	NFN–13	G2, H2, T14
37	...	46	485	205	816	NP	NP	NP	NFN–13	G2, G5, H2, T12
38	...	46	485	205	NP	NP	899	343	NFN–13	G4, G5, T12, W12
39	...	46	485	205	NP	NP	816	343	NFN–13	H1, T14, W12
40	...	46	485	205	NP	NP	816	343	NFN–13	G5, H1, T12, W12
41	...	46	485	205	NP	NP	899	343	NFN–13	G4, H1, T14
42	...	46	485	205	NP	NP	899	343	NFN–13	G4, G5, H1, T12
43	...	46	485	205	NP	NP	899	343	NFN–13	G4, G14, H1, T14
44	...	46	485	205	NP	NP	899	343	NFN–13	G4, G5, G14, H1, T12

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
2	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
3	157	142	127	121	115	112	108	105	102	99.7	97.0	95.4	94.0	92.2	90.9	89.1	87.2	...
4	157	157	156	154	151	147	144	141	138	135	132	129	126	125	123	120	118	...
5	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
6	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
7	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
8	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
9	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
10	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
11	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
12	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
13	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
14	150	146	138	132	127	122	117	114	111	107	105	103	101	99.5	98.6	97.8	96.9	96.1
15	150	150	150	150	147	145	142	141	139	139	138	138	137	134	133	132	131	130
16	150	146	138	132	127	122	117	114	111	107	105	103	101	99.5	98.6	97.8	96.9	96.1
17	150	150	150	150	147	145	142	141	139	139	138	138	137	134	133	132	131	130
18	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
19	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
20	110	105	101	98.0	95.7	93.3	90.8	88.2	85.7	83.6	81.8	79.9	78.2	77.0	75.8	74.5	73.3	...
21	110	110	110	110	110	110	110	110	110	109	109	108	106	104	103	101	98.9	...
22	129	124	118	115	112	109	107	104	101	98.5	96.4	94.4	92.5	90.8	89.6	87.7	85.8	...
23	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...
24	129	124	118	115	112	109	107	104	101	98.5	96.4	94.4	92.5	90.8	89.6	87.7	85.8	...
25	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...
26	129	124	118	115	112	109	107	104	101	98.5	96.4	94.4	92.5	90.8	89.6	87.7	85.8	...
27	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...
28	110	105	101	98.0	95.7	93.3	90.8	88.2	85.7	83.6	81.8	79.9	78.2	77.0	75.8	74.5	73.3	...
29	110	110	110	110	110	110	110	110	110	109	109	108	106	104	103	101	98.9	...
30	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
31	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
32	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
33	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
34	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
35	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
36	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
37	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
38	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
39	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
40	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
41	138	130	121	116	113	110	107	105	102	100	97.8	95.8	94.0	92.1	90.3	89.0	87.2	85.9
42	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
43	117	110	102	98.9	96.4	93.9	91.4	89.2	87.0	84.9	83.0	81.6	80.2	78.4	77.2	75.3	74.0	72.8
44	117	117	117	117	117	116	115	115	114	113	112	110	108	106	104	102	100	98.6

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	113	113	112	112	112	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
6	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
7	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
8	113	113	112	112	112	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
9	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
10	113	113	112	112	112	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
11	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
12	113	113	112	112	112	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
13	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
14	96.1	96.1	95.2	95.2	95.2	*81.8*	*67.4*	*55.8*	*46.2*	*38.3*	*31.6*	*26.0*	*21.3*	*17.4*	*14.0*	*11.1*	*8.33*
15	130	129	129	122	*99.5*	*81.8*	*67.4*	*55.8*	*46.2*	*38.3*	*31.6*	*26.0*	*21.3*	*17.4*	*14.0*	*11.1*	*8.33*
16	96.1	96.1	95.2	95.2	95.2	*81.8*	*67.4*	*55.8*	*46.2*	*38.3*	*31.6*	*26.0*	*21.3*	*17.4*	*14.0*	*11.1*	*8.33*
17	130	129	129	122	*99.5*	*81.8*	*67.4*	*55.8*	*46.2*	*38.3*	*31.6*	*26.0*	*21.3*	*17.4*	*14.0*	*11.1*	*8.33*
18	113	113	112	112	112	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
19	153	152	152	143	*117*	*96.2*	*79.3*	*65.6*	*54.4*	*45.0*	*37.2*	*30.6*	*25.1*	*20.5*	*16.5*	*13.0*	*9.8*
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
31	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
32	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	*5.88*	*4.48*	*3.26*
33	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	*5.88*	*4.48*	*3.26*
34	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
35	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
36	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
37	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
38	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	*5.88*	*4.48*	*3.26*
39	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
40	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	...	...	...
41	84.2	82.6	77.9	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	*5.88*	*4.48*	*3.26*
42	112	*100*	*78.1*	*63.7*	*50.5*	*39.9*	*32.1*	*26.5*	*22.1*	*17.8*	*13.7*	*11.3*	*9.12*	*7.12*	*5.88*	*4.48*	*3.26*
43	71.5	70.2	64.9	*54.4*	*42.7*	*34.0*	*27.3*	*22.3*	*18.6*	*14.9*	*11.3*	*9.58*	*7.91*	*5.95*	*5.03*	*3.82*	*2.78*
44	95.7	*85.3*	*66.4*	*54.4*	*42.7*	*34.0*	*27.3*	*22.3*	*18.6*	*14.9*	*11.3*	*9.58*	*7.91*	*5.95*	*5.03*	*3.82*	*2.78*

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
(13)	1	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. & wld. fittings	SB–366	...	N08367	Solution ann.
	2	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–462	...	N08367	Solution ann.
	3	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–462	...	N08367	Solution ann.
	4	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–564	...	N08367	Solution ann.
	5	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–564	...	N08367	Solution ann.
	6	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
	7	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
	8	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
	9	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
	10	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.
	11	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.
	12	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
	13	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
	14	46Fe–24Ni–21Cr–6Mo–Cu–N	Bar, rod, wire	SB–691	...	N08367	Solution ann.
	15	46Fe–24Ni–21Cr–6Mo–Cu–N	Bar, rod, wire	SB–691	...	N08367	Solution ann.
	16	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
	17	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
	18	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. & wld. fittings	SB–366	...	N08367	Solution ann.
	19	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
	20	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
	21	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
	22	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
	23	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.
	24	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.
	25	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
	26	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
	27	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
	28	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
	29	46Fe–24Ni–21Cr–6Mo–Cu–N	Castings	SA–351	CN3MN	J94651	Solution ann.
	30	25Ni–47Fe–21Cr–5Mo	Plate, sheet, strip	SB–599	...	N08700	Solution ann.
	31	25Ni–47Fe–21Cr–5Mo	Plate, sheet, strip	SB–599	...	N08700	Solution ann.
	32	25Ni–47Fe–21Cr–5Mo	Bar, wire	SB–672	...	N08700	Solution ann.
	33	32Ni–45Fe–20Cr–Cb	Castings	SA–351	CT15C	...	As cast
	34	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Annealed
	35	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Annealed
	36	33Ni–42Fe–21Cr	Smls. & wld. fittings	SB–366	...	N08800	Annealed
	37	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08800	Annealed
	38	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08800	Annealed
	39	33Ni–42Fe–21Cr	Bar	SB–408	...	N08800	Annealed
	40	33Ni–42Fe–21Cr	Bar	SB–408	...	N08800	Annealed
	41	33Ni–42Fe–21Cr	Plate	SB–409	...	N08800	Annealed
	42	33Ni–42Fe–21Cr	Plate	SB–409	...	N08800	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	>5	45	655	310	NP	427	427	NP	NFN–12	G5, W5, W12
2	...	45	655	310	NP	427	427	343	NFN–12	...
3	...	45	655	310	NP	427	427	343	NFN–12	G5
4	...	45	655	310	NP	427	427	343	NFN–12	...
5	...	45	655	310	NP	427	427	343	NFN–12	G5
6	>5	45	655	310	NP	427	427	343	NFN–12	G14
7	>5	45	655	310	NP	427	427	343	NFN–12	G5, G14
8	>5	45	655	310	NP	427	427	343	NFN–12	G14
9	>5	45	655	310	NP	427	427	343	NFN–12	G5, G14
10	>5	45	655	310	NP	427	427	343	NFN–12	...
11	>5	45	655	310	NP	427	427	343	NFN–12	G5
12	>5	45	655	310	NP	427	427	343	NFN–12	...
13	>5	45	655	310	NP	427	427	343	NFN–12	G5
14	...	45	655	310	NP	427	427	343	NFN–12	...
15	...	45	655	310	NP	427	427	343	NFN–12	G5
16	>5	45	655	310	NP	427	427	343	NFN–12	G14
17	>5	45	655	310	NP	427	427	343	NFN–12	G5, G14
18	≤5	45	690	310	NP	NP	427	NP	NFN–12	G5, W12
19	≤5	45	690	310	NP	427	427	343	NFN–12	G14
20	≤5	45	690	310	NP	427	427	343	NFN–12	G5, G14
21	≤5	45	690	310	NP	427	427	343	NFN–12	G14
22	≤5	45	690	310	NP	427	427	343	NFN–12	G5, G14
23	≤5	45	690	310	NP	427	427	343	NFN–12	...
24	≤5	45	690	310	NP	427	427	343	NFN–12	G5
25	≤5	45	690	310	NP	427	427	343	NFN–12	...
26	≤5	45	690	310	NP	427	427	343	NFN–12	G5
27	≤5	45	690	310	NP	427	427	343	NFN–12	G14
28	≤5	45	690	310	NP	427	427	343	NFN–12	G5, G14
29	...	45	550	260	NP	427	427	343	NFN–12	G15
30	...	45	550	240	NP	NP	343	343	NFN–8	...
31	...	45	550	240	NP	NP	343	343	NFN–8	G5
32	...	45	550	240	NP	NP	343	343	NFN–8	...
33	...	45	435	170	NP	NP	871	343	NFN–9	G4, G15
34	...	45	515	205	NP	427	816	NP	NFN–8	G5, T14
35	...	45	515	205	NP	NP	816	NP	NFN–8	T15
36	...	45	515	205	NP	NP	816	NP	NFN–8	G5, T14, W12
37	...	45	515	205	816	427	816	NP	NFN–8	G5, T14
38	...	45	515	205	816	NP	816	NP	NFN–8	T15
39	...	45	515	205	816	427	816	NP	NFN–8	G5, T14
40	...	45	515	205	816	NP	816	NP	NFN–8	T15
41	...	45	515	205	816	427	816	NP	NFN–8	G5, T14
42	...	45	515	205	816	NP	816	NP	NFN–8	T15

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
2	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
3	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
4	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
5	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
6	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
7	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
8	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
9	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
10	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
11	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
12	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
13	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
14	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
15	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
16	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
17	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
18	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
19	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
20	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
21	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
22	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
23	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
24	197	197	197	192	186	181	178	176	173	171	170	168	167	166	165	164	163	...
25	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
26	197	197	197	192	186	181	178	176	173	171	170	168	167	166	165	164	163	...
27	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
28	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
29	158	154	146	138	129	123	117	113	110	106	104	102	101	99.9	99.2	98.0	96.7	...
30	158	152	143	137	131	126	123	120	118	117	116	112	108	...	...	...	...	...
31	158	158	158	157	156	154	152	150	149	148	148	148	148	...	...	...	...	...
32	158	152	143	137	131	126	123	120	118	117	116	112	108	...	...	...	...	...
33	115	111	108	106	105	104	103	102	101	100	98.9	97.2	95.4	94.3	93.0	91.8	90.5	89.3
34	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
35	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
36	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
37	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
38	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
39	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
40	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
41	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
42	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	88.0	84.0	74.8	66.7	59.5	52.7	45.9	39.7	34.0	28.9	24.4	20.4	17.0	14.2	11.8	9.26	...	
34	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
35	103	102	101	98.1	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
36	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
37	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
38	103	102	101	98.1	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
39	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
40	103	102	101	98.1	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
41	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	
42	103	102	101	98.1	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08800	Annealed
2	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08800	Annealed
3	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08800	Annealed
4	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08800	Annealed
5	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08800	Annealed
6	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08800	Annealed
7	32Ni–44Fe–21Cr	Smls. tube	SB–163	...	N08801	Ann./stabilized
8	32Ni–44Fe–21Cr	Smls. tube	SB–163	...	N08801	Ann./stabilized
9	32Ni–44Fe–21Cr	Smls. pipe & tube	SB–407	...	N08801	Ann./stabilized
10	32Ni–44Fe–21Cr	Smls. pipe & tube	SB–407	...	N08801	Ann./stabilized
11	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08810	Annealed
12	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08810	Sol. treat./ann.
13	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08810	Annealed
14	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08810	Hot fin./ann.
15	33Ni–42Fe–21Cr	Bar	SB–408	...	N08810	Annealed
16	33Ni–42Fe–21Cr	Bar	SB–408	...	N08810	Sol. treat./ann.
17	33Ni–42Fe–21Cr	Plate	SB–409	...	N08810	Annealed
18	33Ni–42Fe–21Cr	Plate	SB–409	...	N08810	Sol. treat./ann.
19	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08810	Annealed
20	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08810	Annealed
21	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08810	Annealed
22	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08810	Annealed
23	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08810	Annealed
24	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08810	Sol. treat./ann.
25	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08811	Annealed
26	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08811	Annealed
27	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08811	Annealed
28	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08811	Annealed
29	33Ni–42Fe–21Cr	Bar	SB–408	...	N08811	Annealed
30	33Ni–42Fe–21Cr	Bar	SB–408	...	N08811	Annealed
31	33Ni–42Fe–21Cr	Plate	SB–409	...	N08811	Annealed
32	33Ni–42Fe–21Cr	Plate	SB–409	...	N08811	Annealed
33	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08811	Annealed
34	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08811	Annealed
35	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08811	Annealed
36	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08811	Annealed
37	42Ni–21.5Cr–3Mo–2.3Cu	Smls. tube	SB–163	...	N08825	Annealed
38	42Ni–21.5Cr–3Mo–2.3Cu	Smls. tube	SB–163	...	N08825	Annealed
39	42Ni–21.5Cr–3Mo–2.3Cu	Smls. & wld. fittings	SB–366	...	N08825	Annealed
40	42Ni–21.5Cr–3Mo–2.3Cu	Smls. pipe & tube	SB–423	...	N08825	Cold worked/ann.
41	42Ni–21.5Cr–3Mo–2.3Cu	Smls. pipe & tube	SB–423	...	N08825	Cold worked/ann.
42	42Ni–21.5Cr–3Mo–2.3Cu	Plate	SB–424	...	N08825	Annealed
43	42Ni–21.5Cr–3Mo–2.3Cu	Plate	SB–424	...	N08825	Annealed
44	42Ni–21.5Cr–3Mo–2.3Cu	Bar, rod	SB–425	...	N08825	Annealed
45	42Ni–21.5Cr–3Mo–2.3Cu	Bar, rod	SB–425	...	N08825	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	45	515	205	NP	NP	816	NP	NFN–8	G14, T15
2	...	45	515	205	NP	NP	816	NP	NFN–8	G5, G14, T14
3	...	45	515	205	816	NP	816	NP	NFN–8	G5, G14, T14
4	...	45	515	205	816	NP	816	NP	NFN–8	G14, T15
5	...	45	515	205	816	427	816	NP	NFN–8	G5, T14
6	...	45	515	205	816	NP	816	NP	NFN–8	T15
7	...	45	450	170	566	NP	482	NP	NFN–9	H4
8	...	45	450	170	566	NP	482	NP	NFN–9	G5, H4
9	...	45	450	170	566	NP	482	NP	NFN–9	H4
10	...	45	450	170	566	NP	482	NP	NFN–9	G5, H4
11	...	45	450	170	NP	NP	899	NP	NFN–9	G4, T16
12	...	45	450	170	NP	427	899	NP	NFN–9	G4, G5, T15
13	...	45	450	170	816	NP	982	NP	NFN–9	G4, G30, T16
14	...	45	450	170	816	427	982	NP	NFN–9	G4, G5, G30, T15
15	...	45	450	170	816	NP	899	NP	NFN–9	G4, T16
16	...	45	450	170	816	427	899	NP	NFN–9	G4, G5, T15
17	...	45	450	170	816	NP	899	NP	NFN–9	G4, T16
18	...	45	450	170	816	427	899	NP	NFN–9	G4, G5, T15
19	...	45	450	170	NP	NP	899	NP	NFN–9	G4, G14, T16
20	...	45	450	170	NP	NP	899	NP	NFN–9	G4, G5, G14, T15
21	...	45	450	170	816	NP	899	NP	NFN–9	G4, G14, T16
22	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, G14, T15
23	...	45	450	170	816	NP	899	NP	NFN–9	G4, T16
24	...	45	450	170	816	427	899	NP	NFN–9	G4, G5, T15
25	...	45	450	170	816	NP	899	NP	NFN–9	G4, T17
26	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, T15
27	...	45	450	170	816	NP	899	NP	NFN–9	G4, T17
28	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, T15
29	...	45	450	170	816	NP	899	NP	NFN–9	G4, T17
30	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, T15
31	...	45	450	170	816	NP	899	NP	NFN–9	G4, T17
32	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, T15
33	...	45	450	170	816	NP	899	NP	NFN–9	G4, G14, T17
34	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, G14, T16
35	...	45	450	170	816	NP	899	NP	NFN–9	G4, T17
36	...	45	450	170	816	NP	899	NP	NFN–9	G4, G5, T15
37	...	45	585	240	NP	427 (Cl. 3 only)	538	343	NFN–7	...
38	...	45	585	240	NP	427 (Cl. 3 only)	538	343	NFN–7	G5
39	...	45	585	240	NP	NP	538	343	NFN–7	G5, W12
40	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	...
41	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	G5
42	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	...
43	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	G5
44	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	...
45	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN–7	G5

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	117	112	108	106	104	102	101	99.5	98.3	97.4	96.5	95.4	94.1	92.9	91.7	91.1	89.9	88.5
2	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
3	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
4	117	112	108	106	104	102	101	99.5	98.3	97.4	96.5	95.4	94.1	92.9	91.7	91.1	89.9	88.5
5	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
6	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
7	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
8	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
9	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
10	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
11	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
12	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
13	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
14	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
15	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
16	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
17	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
18	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
19	97.9	94.0	89.6	87.0	84.7	82.6	80.4	78.1	75.9	74.2	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
20	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.8	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
21	97.9	94.0	89.6	87.0	84.7	82.6	80.4	78.1	75.9	74.2	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
22	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.8	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
23	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
24	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
25	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
26	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
27	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
28	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
29	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
30	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
31	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
32	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
33	97.9	94.0	89.6	87.0	84.7	82.6	80.4	78.1	75.9	74.2	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
34	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.8	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
35	115	111	105	102	99.2	96.6	94.2	92.0	89.8	87.6	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
36	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
37	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
38	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
39	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
40	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
41	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
42	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
43	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
44	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
45	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	87.9	86.8	85.8	83.2	*72.6*	*54.5*	*38.0*	*25.7*	*12.8*	*10.2*	*7.63*	*6.16*	*5.46*	*4.27*	...	...	...
2	117	117	112	*91.8*	*72.6*	*54.5*	*38.0*	*25.7*	*12.8*	*10.2*	*7.63*	*6.16*	*5.46*	*4.27*	...	...	...
3	117	117	112	*91.8*	*72.6*	*54.5*	*38.0*	*25.7*	*12.8*	*10.2*	*7.63*	*6.16*	*5.46*	*4.27*	...	...	...
4	87.9	86.8	85.8	83.2	*72.6*	*54.5*	*38.0*	*25.7*	*12.8*	*10.2*	*7.63*	*6.16*	*5.46*	*4.27*	...	...	...
5	138	137	131	*108*	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...
6	103	102	101	98.1	*85.0*	*64.4*	*44.8*	*30.0*	*15.5*	*11.3*	*8.82*	*6.98*	*6.43*	*5.00*	...	...	...
7	72.8	72.0	71.2	69.9	...	...	...	...	...	...	...	...	...	...	...	...	...
8	98.6	97.1	95.9	91.8	...	...	...	...	...	...	...	...	...	...	...	...	...
9	72.8	72.0	71.2	69.9	...	...	...	...	...	...	...	...	...	...	...	...	...
10	98.6	97.1	95.9	91.8	...	...	...	...	...	...	...	...	...	...	...	...	...
11	72.8	72.0	71.2	69.9	68.4	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
12	98.6	97.1	95.9	91.8	*75.7*	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
13	72.8	72.0	71.2	69.9	68.4	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
14	98.6	97.1	95.9	91.8	*75.7*	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
15	72.8	72.0	71.2	69.9	68.4	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
16	98.6	97.1	95.9	91.8	*75.7*	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
17	72.8	72.0	71.2	69.9	68.4	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
18	98.6	97.1	95.9	91.8	*75.7*	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
19	62.3	61.3	60.3	59.6	58.1	*53.2*	*43.0*	*34.9*	*28.6*	*23.3*	*19.4*	*15.6*	*12.5*	*10.1*	*7.75*	*6.28*	*4.98*
20	83.9	82.7	81.4	77.9	*64.6*	*53.2*	*43.0*	*34.9*	*28.6*	*23.3*	*19.4*	*15.6*	*12.5*	*10.1*	*7.75*	*6.28*	*4.98*
21	62.3	61.3	60.3	59.6	58.1	*53.2*	*43.0*	*34.9*	*28.6*	*23.3*	*19.4*	*15.6*	*12.5*	*10.1*	*7.75*	*6.28*	*4.98*
22	83.9	82.7	81.4	77.9	*64.6*	*53.2*	*43.0*	*34.9*	*28.6*	*23.3*	*19.4*	*15.6*	*12.5*	*10.1*	*7.75*	*6.28*	*4.98*
23	72.8	72.0	71.2	69.9	68.4	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
24	98.6	97.1	95.9	91.8	*75.7*	*62.6*	*50.6*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*11.9*	*9.03*	*7.35*	*5.86*
25	72.8	72.0	71.2	69.8	68.6	66.4	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
26	98.7	97.1	96.1	94.1	*85.5*	*69.3*	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
27	72.8	72.0	71.2	69.8	68.6	66.4	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
28	98.7	97.1	96.1	94.1	*85.5*	*69.3*	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
29	72.8	72.0	71.2	69.8	68.6	66.4	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
30	98.7	97.1	96.1	94.1	*85.5*	*69.3*	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
31	72.8	72.0	71.2	69.8	68.6	66.4	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
32	98.7	97.1	96.1	94.1	*85.5*	*69.3*	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
33	62.3	61.3	60.3	59.6	58.3	56.7	*48.6*	*39.8*	*32.8*	*27.1*	*21.9*	*17.5*	*14.7*	*11.7*	*8.26*	*6.68*	*5.24*
34	83.9	82.7	81.4	80.2	76.6	*58.2*	*48.6*	*39.8*	*32.8*	*27.1*	*21.9*	*17.5*	*14.7*	*11.7*	*8.26*	*6.68*	*5.24*
35	72.8	72.0	71.2	69.8	68.6	66.4	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
36	98.7	97.1	96.1	94.1	*85.5*	*69.3*	*56.8*	*46.8*	*38.6*	*31.5*	*25.5*	*20.6*	*17.1*	*13.8*	*10.2*	*7.98*	*6.20*
37	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	42Ni–21.5Cr–3Mo–2.3Cu	Forgings	SB–564	...	N08825	Annealed
2	42Ni–21.5Cr–3Mo–2.3Cu	Forgings	SB–564	...	N08825	Annealed
3	42Ni–21.5Cr–3Mo–2.3Cu	Wld. tube	SB–704	...	N08825	Annealed
4	42Ni–21.5Cr–3Mo–2.3Cu	Wld. tube	SB–704	...	N08825	Annealed
5	42Ni–21.5Cr–3Mo–2.3Cu	Wld. pipe	SB–705	...	N08825	Annealed
6	42Ni–21.5Cr–3Mo–2.3Cu	Wld. pipe	SB–705	...	N08825	Annealed
7	44Fe–25Ni–21Cr–Mo	Fittings	SB–366	...	N08904	Annealed
8	44Fe–25Ni–21Cr–Mo	Plate, sheet, strip	SB–625	...	N08904	Annealed
9	44Fe–25Ni–21Cr–Mo	Bar, wire	SB–649	...	N08904	Annealed
10	44Fe–25Ni–21Cr–Mo	Wld. pipe	SB–673	...	N08904	Annealed
11	44Fe–25Ni–21Cr–Mo	Wld. tube	SB–674	...	N08904	Annealed
12	44Fe–25Ni–21Cr–Mo	Smls. pipe & tube	SB–677	...	N08904	Annealed
13	25Ni–20Cr–6Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08925	Annealed
14	25Ni–20Cr–6Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08925	Annealed
15	25Ni–20Cr–6Mo–Cu–N	Bar, wire	SB–649	...	N08925	Annealed
16	25Ni–20Cr–6Mo–Cu–N	Bar, wire	SB–649	...	N08925	Annealed
17	25Ni–20Cr–6Mo–Cu–N	Wld. pipe	SB–673	...	N08925	Annealed
18	25Ni–20Cr–6Mo–Cu–N	Wld. pipe	SB–673	...	N08925	Annealed
19	25Ni–20Cr–6Mo–Cu–N	Wld. tube	SB–674	...	N08925	Annealed
20	25Ni–20Cr–6Mo–Cu–N	Wld. tube	SB–674	...	N08925	Annealed
21	25Ni–20Cr–6Mo–Cu–N	Smls. pipe & tube	SB–677	...	N08925	Annealed
22	25Ni–20Cr–6Mo–Cu–N	Smls. pipe & tube	SB–677	...	N08925	Annealed
23	62Ni–28Mo–5Fe	Plate	SB–333	...	N10001	Annealed
24	62Ni–28Mo–5Fe	Plate	SB–333	...	N10001	Annealed
25	62Ni–28Mo–5Fe	Smls. & wld. fittings	SB–366	...	N10001	Annealed
26	62Ni–28Mo–5Fe	Wld. pipe	SB–619	...	N10001	Solution ann.
27	62Ni–28Mo–5Fe	Wld. pipe	SB–619	...	N10001	Solution ann.
28	62Ni–28Mo–5Fe	Smls. pipe & tube	SB–622	...	N10001	Solution ann.
29	62Ni–28Mo–5Fe	Smls. pipe & tube	SB–622	...	N10001	Solution ann.
30	62Ni–28Mo–5Fe	Wld. tube	SB–626	...	N10001	Solution ann.
31	62Ni–28Mo–5Fe	Wld. tube	SB–626	...	N10001	Solution ann.
32	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
33	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
34	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
35	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
36	62Ni–28Mo–5Fe	Sheet, strip	SB–333	...	N10001	Annealed
37	62Ni–28Mo–5Fe	Sheet, strip	SB–333	...	N10001	Annealed
38	70Ni–16Mo–7Cr–5Fe	Smls. & wld. fittings	SB–366	...	N10003	Annealed
39	70Ni–16Mo–7Cr–5Fe	Plate, sheet, strip	SB–434	...	N10003	Annealed
40	70Ni–16Mo–7Cr–5Fe	Rod	SB–573	...	N10003	Annealed
41	62Ni–25Mo–8Cr–2Fe	Smls. & wld. fittings	SB–366	...	N10242	Annealed
42	62Ni–25Mo–8Cr–2Fe	Plate, sheet, strip	SB–434	...	N10242	Annealed
43	62Ni–25Mo–8Cr–2Fe	Plate, sheet, strip	SB–434	...	N10242	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	45	585	240	NP	NP	538	NP	NFN–7	...
2	...	45	585	240	NP	NP	538	NP	NFN–7	G5
3	...	45	585	240	NP	427	538	343	NFN–7	G14
4	...	45	585	240	NP	NP	538	343	NFN–7	G5, G14
5	...	45	585	240	NP	NP	538	343	NFN–7	G14
6	...	45	585	240	NP	NP	538	343	NFN–7	G5, G14
7	...	45	490	215	NP	371	371	343	NFN–9	W12
8	...	45	490	215	NP	371	371	343	NFN–9	...
9	...	45	490	215	NP	371	371	343	NFN–9	...
10	...	45	490	215	NP	371	371	343	NFN–9	G14
11	...	45	490	215	NP	371	371	343	NFN–9	G14
12	...	45	490	215	NP	371	371	343	NFN–9	...
13	...	45	600	295	NP	NP	427	343	NFN–12	...
14	...	45	600	295	NP	NP	427	343	NFN–12	G5
15	...	45	600	295	NP	NP	427	343	NFN–12	...
16	...	45	600	295	NP	NP	427	343	NFN–12	G5
17	...	45	600	295	NP	NP	427	343	NFN–12	G14
18	...	45	600	295	NP	NP	427	343	NFN–12	G5, G14
19	...	45	600	295	NP	NP	427	343	NFN–12	G14
20	...	45	600	295	NP	NP	427	343	NFN–12	G5, G14
21	...	45	600	295	NP	NP	427	343	NFN–12	...
22	...	45	600	295	NP	NP	427	343	NFN–12	G5
23	...	44	690	310	NP	427 (Cl. 3 only)	427	343	NFN–5	...
24	...	44	690	310	NP	427 (Cl. 3 only)	427	343	NFN–5	G5
25	...	44	690	310	NP	NP	427	343	NFN–5	G5, W12
26	...	44	690	310	NP	NP	427	343	NFN–5	G14
27	...	44	690	310	NP	NP	427	343	NFN–5	G5, G14
28	...	44	690	310	NP	NP	427	343	NFN–5	...
29	...	44	690	310	NP	NP	427	343	NFN–5	G5
30	...	44	690	310	NP	NP	427	343	NFN–5	G14
31	...	44	690	310	NP	NP	427	343	NFN–5	G5, G14
32	...	44	690	315	NP	427 (Cl. 3 only)	427	343	NFN–5	G13
33	...	44	690	315	NP	427 (Cl. 3 only)	427	343	NFN–5	G5, G13
34	...	44	795	315	NP	427 (Cl. 3 only)	427	343	NFN–5	G13
35	...	44	795	315	NP	427 (Cl. 3 only)	427	343	NFN–5	G5, G13
36	...	44	795	345	NP	427 (Cl. 3 only)	427	343	NFN–5	...
37	...	44	795	345	NP	427 (Cl. 3 only)	427	NP	NFN–5	G5
38	...	44	690	275	NP	NP	704	343	NFN–6	T15, W12
39	...	44	690	275	NP	NP	704	343	NFN–6	T15
40	...	44	690	275	NP	NP	704	343	NFN–6	T15
41	...	44	725	310	NP	NP	538	NP	NFN–6	G5, W12
42	...	44	725	310	NP	NP	538	NP	NFN–6	G5
43	...	44	725	310	NP	NP	538	NP	NFN–6	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	160	151	146	...	139	...	133	...	128	...	123	...	120	119	118	117	116	116
2	160	160	160	...	160	...	160	...	160	...	160	...	160	160	159	158	157	156
3	137	131	125	122	119	117	114	112	110	108	106	104	102	101	101	100	99.4	98.8
4	137	137	137	137	137	137	137	137	137	137	137	137	137	136	136	135	135	134
5	137	131	125	122	119	117	114	112	110	108	106	104	102	101	101	100	99.4	98.8
6	137	137	137	137	137	137	137	137	137	137	137	137	137	136	136	135	135	134
7	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
8	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
9	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
10	119	107	96.3	91.9	88.8	85.5	82.0	78.6	75.6	72.9	70.7	69.1	67.9	66.7	...	...	...	...
11	119	107	96.3	91.9	88.8	85.5	82.0	78.6	75.6	72.9	70.7	69.1	67.9	66.7	...	...	...	...
12	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
13	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
14	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
15	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
16	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
17	145	141	135	129	125	120	117	113	109	106	103	101	99.3	99.3	99.3	99.3	99.3	...
18	145	145	145	143	141	138	135	132	130	129	127	125	123	122	120	117	115	...
19	145	141	135	129	125	120	117	113	109	106	103	101	99.3	99.3	99.3	99.3	99.3	...
20	145	145	145	143	141	138	135	132	130	129	127	125	123	122	120	117	115	...
21	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
22	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
23	197	193	186	181	177	173	170	167	164	162	160	158	157	155	154	152	151	...
24	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
25	197	197	197	197	197	196	194	193	192	192	191	191	190	189	188	188	187	...
26	168	164	158	154	150	147	145	142	140	138	136	134	133	131	130	130	129	...
27	168	168	168	168	168	166	165	164	164	163	162	162	161	161	160	159	159	...
28	197	193	186	181	177	173	170	167	164	162	160	158	157	155	154	152	151	...
29	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
30	168	164	158	154	150	147	145	142	140	138	136	134	133	131	130	130	129	...
31	168	168	168	168	168	166	165	164	164	163	162	162	161	161	160	159	159	...
32	197	195	191	186	181	177	174	171	168	166	164	162	160	158	157	156	155	...
33	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
34	212	201	190	185	181	177	174	171	168	166	164	162	160	158	157	156	155	...
35	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	210	209	...
36	227	217	207	201	197	193	189	186	183	180	178	176	174	172	171	170	168	...
37	227	227	227	227	227	225	223	222	221	220	220	219	218	217	216	216	215	...
38	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
39	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
40	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
41	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
42	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
43	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	115	114	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	156	154	151	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	98.2	97.2	95.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	133	131	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	98.2	97.2	95.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	133	131	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	118	113	107	96.7	*80.4*	*59.2*	*40.7*	*30.9*	*25.2*	*17.9*	...	...	...	...	...	...	...
39	118	113	108	97.8	*80.7*	*60.7*	*40.8*	*33.5*	*25.7*	*17.4*	...	...	...	...	...	...	...
40	118	113	108	97.8	*80.7*	*60.7*	*40.8*	*33.5*	*25.7*	*17.4*	...	...	...	...	...	...	...
41	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	62Ni–25Mo–8Cr–2Fe	Forgings	SB–564	...	N10242	Annealed
2	62Ni–25Mo–8Cr–2Fe	Forgings	SB–564	...	N10242	Annealed
3	62Ni–25Mo–8Cr–2Fe	Rod	SB–573	...	N10242	Annealed
4	62Ni–25Mo–8Cr–2Fe	Rod	SB–573	...	N10242	Annealed
5	62Ni–25Mo–8Cr–2Fe	Wld. pipe	SB–619	...	N10242	Solution ann.
6	62Ni–25Mo–8Cr–2Fe	Wld. pipe	SB–619	...	N10242	Solution ann.
7	62Ni–25Mo–8Cr–2Fe	Smls. pipe & tube	SB–622	...	N10242	Solution ann.
8	62Ni–25Mo–8Cr–2Fe	Smls. pipe & tube	SB–622	...	N10242	Solution ann.
9	62Ni–25Mo–8Cr–2Fe	Wld. tube	SB–626	...	N10242	Solution ann.
10	62Ni–25Mo–8Cr–2Fe	Wld. tube	SB–626	...	N10242	Solution ann.
11	54Ni–16Mo–15Cr	Smls. & wld. fittings	SB–366	...	N10276	Solution ann.
12	54Ni–16Mo–15Cr	Forgings	SB–462	...	N10276	Solution ann.
13	54Ni–16Mo–15Cr	Forgings	SB–462	...	N10276	Solution ann.
14	54Ni–16Mo–15Cr	Forgings	SB–564	...	N10276	Solution ann.
15	54Ni–16Mo–15Cr	Forgings	SB–564	...	N10276	Solution ann.
16	54Ni–16Mo–15Cr	Rod	SB–574	...	N10276	Solution ann.
17	54Ni–16Mo–15Cr	Rod	SB–574	...	N10276	Solution ann.
18	54Ni–16Mo–15Cr	Plate, sheet, strip	SB–575	...	N10276	Solution ann.
19	54Ni–16Mo–15Cr	Plate, sheet, strip	SB–575	...	N10276	Solution ann.
20	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.
21	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.
22	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.
23	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.
24	54Ni–16Mo–15Cr	Smls. pipe & tube	SB–622	...	N10276	Solution ann.
25	54Ni–16Mo–15Cr	Smls. pipe & tube	SB–622	...	N10276	Solution ann.
26	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.
27	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.
28	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.
29	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.
30	Ni–28Mo–3Fe–1.3Cr–0.25Al	Plate, sheet, strip	SB–333	...	N10629	Solution ann.
31	Ni–28Mo–3Fe–1.3Cr–0.25Al	Plate, sheet, strip	SB–333	...	N10629	Solution ann.
32	Ni–28Mo–3Fe–1.3Cr–0.25Al	Rod	SB–335	...	N10629	Solution ann.
33	Ni–28Mo–3Fe–1.3Cr–0.25Al	Rod	SB–335	...	N10629	Solution ann.
34	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. & wld. fittings	SB–366	...	N10629	Solution ann.
35	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forged fittings	SB–462	...	N10629	Solution ann.
36	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forged fittings	SB–462	...	N10629	Solution ann.
37	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forgings	SB–564	...	N10629	Solution ann.
38	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forgings	SB–564	...	N10629	Solution ann.
39	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. pipe	SB–619	...	N10629	Solution ann.
40	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. pipe	SB–619	...	N10629	Solution ann.
41	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. pipe & tube	SB–622	...	N10629	Solution ann.
42	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. pipe & tube	SB–622	...	N10629	Solution ann.
43	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. tube	SB–626	...	N10629	Solution ann.
44	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. tube	SB–626	...	N10629	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	44	725	310	NP	NP	538	NP	NFN–6	G5
2	...	44	725	310	NP	NP	538	NP	NFN–6	...
3	...	44	725	310	NP	NP	538	NP	NFN–6	G5
4	...	44	725	310	NP	NP	538	NP	NFN–6	...
5	...	44	725	310	NP	NP	538	NP	NFN–6	G5, G14
6	...	44	725	310	NP	NP	538	NP	NFN–6	G14
7	...	44	725	310	NP	NP	538	NP	NFN–6	G5
8	...	44	725	310	NP	NP	538	NP	NFN–6	...
9	...	44	725	310	NP	NP	538	NP	NFN–6	G5, G14
10	...	44	725	310	NP	NP	538	NP	NFN–6	G14
11	...	43	690	285	538	NP	677	343	NFN–10	G5, T14, W12
12	...	43	690	285	NP	NP	677	NP	NFN–10	T15
13	...	43	690	285	NP	NP	677	NP	NFN–10	G5, T14
14	...	43	690	285	NP	NP	677	343	NFN–10	T15
15	...	43	690	285	NP	NP	677	343	NFN–10	G5, T14
16	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN–10	T15
17	...	43	690	285	538	427	677	343	NFN–10	G5, T14
18	...	43	690	285	538	427	677	343	NFN–10	G5, T14
19	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN–10	T15
20	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN–10	W5
21	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN–10	G5, W5
22	...	43	690	285	538	427	677	343	NFN–10	G5, G14, T14, W6
23	...	43	690	285	538	NP	677	343	NFN–10	G14, T15
24	...	43	690	285	538	427	677	343	NFN–10	G5, T14
25	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN–10	T15
26	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN–10	W5
27	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN–10	G5, W5
28	...	43	690	285	538	427	677	343	NFN–10	G5, G14, T14, W6
29	...	43	690	285	538	NP	677	343	NFN–10	G14, T15
30	...	44	760	350	NP	NP	427	NP	NFN–16	G5
31	...	44	760	350	NP	NP	427	NP	NFN–16	...
32	...	44	760	350	NP	NP	427	NP	NFN–16	G5
33	...	44	760	350	NP	NP	427	NP	NFN–16	...
34	...	44	760	350	NP	NP	427	NP	NFN–16	G5, W12
35	...	44	760	350	NP	NP	427	NP	NFN–16	G5
36	...	44	760	350	NP	NP	427	NP	NFN–16	...
37	...	44	760	350	NP	NP	427	NP	NFN–16	G5
38	...	44	760	350	NP	NP	427	NP	NFN–16	...
39	...	44	760	350	NP	NP	427	NP	NFN–16	G5, G14
40	...	44	760	350	NP	NP	427	NP	NFN–16	G14
41	...	44	760	350	NP	NP	427	NP	NFN–16	G5
42	...	44	760	350	NP	NP	427	NP	NFN–16	...
43	...	44	760	350	NP	NP	427	NP	NFN–16	G5, G14
44	...	44	760	350	NP	NP	427	NP	NFN–16	G14

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
2	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
3	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
4	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
5	176	176	176	176	176	176	176	176	176	176	175	175	174	174	173	173	173	173
6	176	171	164	158	153	149	145	143	141	139	139	139	138	137	136	134	132	129
7	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
8	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
9	176	176	176	176	176	176	176	176	176	176	175	175	174	174	173	173	173	173
10	176	171	164	158	153	149	145	143	141	139	139	139	138	137	136	134	132	129
11	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
12	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
13	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
14	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
15	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
16	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
17	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
18	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
19	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
20	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	...
21	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	...
22	160	160	160	160	160	160	160	160	158	155	151	147	143	140	138	135	134	133
23	160	152	144	139	135	130	126	121	118	115	111	109	106	104	102	100	98.8	98.1
24	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
25	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
26	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	...
27	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	...
28	160	160	160	160	160	160	160	160	158	155	151	147	143	140	138	135	134	133
29	160	152	144	139	135	130	126	121	118	115	111	109	106	104	102	100	98.8	98.1
30	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
31	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
32	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
33	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
34	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
35	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
36	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
37	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
38	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
39	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
40	184	184	184	179	174	169	165	162	160	157	154	152	151	149	148	147	146	...
41	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
42	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
43	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
44	184	184	184	179	174	169	165	162	160	157	154	152	151	149	148	147	146	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	172	171	171	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	128	127	127	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	172	171	171	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	128	127	127	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
12	115	114	114	112	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
13	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
14	115	114	114	112	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
15	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
16	115	114	114	112	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
17	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
18	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
19	115	114	114	112	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	131	131	124	*100*	*84.6*	*69.5*	*56.7*	*46.2*	*35.7*	...	...	...	...	...	...	...	...
23	97.5	96.7	96.5	95.2	*84.6*	*69.5*	*56.7*	*46.2*	*35.7*	...	...	...	...	...	...	...	...
24	155	154	145	*118*	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
25	115	114	114	112	*99.1*	*81.6*	*67.0*	*54.6*	*42.2*	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	131	131	124	*100*	*84.6*	*69.5*	*56.7*	*46.2*	*35.7*	...	...	...	...	...	...	...	...
29	97.5	96.7	96.5	95.2	*84.6*	*69.5*	*56.7*	*46.2*	*35.7*	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	65Ni–28Mo–2Fe	Smls. & wld. fittings	SB–366	...	N10665	Annealed
2	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Annealed
3	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Annealed
4	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Annealed
5	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Annealed
6	65Ni–28Mo–2Fe	Plate, sheet, strip	SB–333	...	N10665	Solution ann.
7	65Ni–28Mo–2Fe	Plate, sheet, strip	SB–333	...	N10665	Solution ann.
8	65Ni–28Mo–2Fe	Rod	SB–335	...	N10665	Solution ann.
9	65Ni–28Mo–2Fe	Rod	SB–335	...	N10665	Solution ann.
10	65Ni–28Mo–2Fe	Forgings	SB–462	...	N10665	Solution ann.
11	65Ni–28Mo–2Fe	Forgings	SB–462	...	N10665	Solution ann.
12	65Ni–28Mo–2Fe	Forgings	SB–564	...	N10665	Solution ann.
13	65Ni–28Mo–2Fe	Forgings	SB–564	...	N10665	Solution ann.
14	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Solution ann.
15	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Solution ann.
16	65Ni–28Mo–2Fe	Smls. pipe & tube	SB–622	...	N10665	Solution ann.
17	65Ni–28Mo–2Fe	Smls. pipe & tube	SB–622	...	N10665	Solution ann.
18	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Solution ann.
19	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Solution ann.
20	65Ni–29.5Mo–2Fe–2Cr	Plate, sheet, strip	SB–333	...	N10675	Solution ann.
21	65Ni–29.5Mo–2Fe–2Cr	Plate, sheet, strip	SB–333	...	N10675	Solution ann.
22	65Ni–29.5Mo–2Fe–2Cr	Rod	SB–335	...	N10675	Solution ann.
23	65Ni–29.5Mo–2Fe–2Cr	Rod	SB–335	...	N10675	Solution ann.
24	65Ni–29.5Mo–2Fe–2Cr	Smls. & wld. fittings	SB–366	...	N10675	Solution ann.
25	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–462	...	N10675	Solution ann.
26	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–462	...	N10675	Solution ann.
27	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–564	...	N10675	Solution ann.
28	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–564	...	N10675	Solution ann.
29	65Ni–29.5Mo–2Fe–2Cr	Wld. pipe	SB–619	...	N10675	Solution ann.
30	65Ni–29.5Mo–2Fe–2Cr	Wld. pipe	SB–619	...	N10675	Solution ann.
31	65Ni–29.5Mo–2Fe–2Cr	Smls. pipe & tube	SB–622	...	N10675	Solution ann.
32	65Ni–29.5Mo–2Fe–2Cr	Smls. pipe & tube	SB–622	...	N10675	Solution ann.
33	65Ni–29.5Mo–2Fe–2Cr	Wld. tube	SB–626	...	N10675	Solution ann.
34	65Ni–29.5Mo–2Fe–2Cr	Wld. tube	SB–626	...	N10675	Solution ann.
35	37Ni–30Co–28Cr–2.7Si	Smls. & wld. fittings	SB–366	...	N12160	Solution ann.
36	37Ni–30Co–28Cr–2.7Si	Plate, sheet, strip	SB–435	...	N12160	Solution ann.
37	37Ni–30Co–28Cr–2.7Si	Plate, sheet, strip	SB–435	...	N12160	Solution ann.
38	37Ni–30Co–28Cr–2.7Si	Forgings	SB–564	...	N12160	Solution ann.
39	37Ni–30Co–28Cr–2.7Si	Forgings	SB–564	...	N12160	Solution ann.
40	37Ni–30Co–28Cr–2.7Si	Rod	SB–572	...	N12160	Solution ann.
41	37Ni–30Co–28Cr–2.7Si	Rod	SB–572	...	N12160	Solution ann.
42	37Ni–30Co–28Cr–2.7Si	Wld. pipe	SB–619	...	N12160	Solution ann.
43	37Ni–30Co–28Cr–2.7Si	Wld. pipe	SB–619	...	N12160	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	44	760	350	NP	NP	427	343	NFN–16	G5, W12
2	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN–16	G5, W5
3	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN–16	W5
4	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN–16	G5, W5
5	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN–16	W5
6	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN–16	...
7	...	44	760	350	NP	427 (Cl. 3 only)	427	NP	NFN–16	G5
8	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN–16	G13
9	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN–16	G5, G13
10	...	44	760	350	NP	NP	427	NP	NFN–16	...
11	...	44	760	350	NP	NP	427	NP	NFN–16	G5
12	...	44	760	350	NP	NP	427	NP	NFN–16	...
13	...	44	760	350	NP	NP	427	NP	NFN–16	G5
14	...	44	760	350	NP	NP	427	343	NFN–16	G14
15	...	44	760	350	NP	NP	427	343	NFN–16	G5, G14
16	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN–16	...
17	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN–16	G5
18	...	44	760	350	NP	NP	427	343	NFN–16	G5, G14
19	...	44	760	350	NP	NP	427	343	NFN–16	G14
20	...	44	760	350	NP	NP	427	343	NFN–16	G5
21	...	44	760	350	NP	NP	427	343	NFN–16	...
22	...	44	760	350	NP	NP	427	343	NFN–16	G5
23	...	44	760	350	NP	NP	427	343	NFN–16	...
24	...	44	760	350	NP	NP	427	343	NFN–16	G5, W12
25	...	44	760	350	NP	NP	427	NP	NFN–16	G5
26	...	44	760	350	NP	NP	427	NP	NFN–16	...
27	...	44	760	350	NP	NP	427	343	NFN–16	G5
28	...	44	760	350	NP	NP	427	343	NFN–16	...
29	...	44	760	350	NP	NP	427	343	NFN–16	G5, G14
30	...	44	760	350	NP	NP	427	343	NFN–16	G14
31	...	44	760	350	NP	NP	427	343	NFN–16	G5
32	...	44	760	350	NP	NP	427	343	NFN–16	...
33	...	44	760	350	NP	NP	427	343	NFN–16	G5, G14
34	...	44	760	350	NP	NP	427	343	NFN–16	G14
35	...	46	620	240	NP	NP	816	NP	NFN–13	G5, T14, W12
36	...	46	620	240	NP	NP	816	NP	NFN–13	T14
37	...	46	620	240	NP	NP	816	NP	NFN–13	G5, T14
38	...	46	620	240	NP	NP	816	NP	NFN–13	T14
39	...	46	620	240	NP	NP	816	NP	NFN–13	G5, T14
40	...	46	620	240	NP	NP	816	NP	NFN–13	T14
41	...	46	620	240	NP	NP	816	NP	NFN–13	G5, T14
42	...	46	620	240	NP	NP	816	NP	NFN–13	G14, T14
43	...	46	620	240	NP	NP	816	NP	NFN–13	G5, G14, T14

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
2	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
3	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
4	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
5	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
6	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
7	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
8	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
9	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
10	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
11	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
12	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
13	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
14	184	184	184	181	177	173	170	167	164	162	160	159	157	156	154	151	149	...
15	184	184	184	184	184	184	184	184	184	184	183	182	182	181	180	179	179	...
16	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
17	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
18	184	184	184	184	184	184	184	184	184	184	183	182	182	181	180	179	179	...
19	184	184	184	181	177	173	170	167	164	162	160	159	157	156	154	151	149	...
20	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
21	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
22	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
23	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
24	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
25	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
26	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
27	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
28	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
29	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
30	184	184	184	181	178	174	170	166	163	160	156	153	150	149	147	146	144	...
31	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
32	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
33	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
34	184	184	184	181	178	174	170	166	163	160	156	153	150	149	147	146	144	...
35	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
36	161	151	139	132	126	120	115	110	105	101	98.6	96.5	94.7	93.8	93.8	93.1	93.1	93.1
37	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
38	161	151	139	132	126	120	115	110	105	101	98.6	96.5	94.7	93.8	93.8	93.1	93.1	93.1
39	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
40	161	151	139	132	126	120	115	110	105	101	98.6	96.5	94.7	93.8	93.8	93.1	93.1	93.1
41	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
42	137	128	118	113	107	102	97.3	93.1	89.5	86.6	84.1	81.9	80.4	80.0	80.0	79.3	79.3	79.3
43	137	137	137	137	136	135	131	126	121	117	113	111	108	108	108	108	108	108

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	126	122	105	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
36	93.1	93.1	93.0	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
37	126	122	105	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
38	93.1	93.1	93.0	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
39	126	122	105	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
40	93.1	93.1	93.0	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
41	126	122	105	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
42	79.3	79.3	79.3	*76.1*	*61.8*	*51.8*	*43.8*	*37.0*	*30.6*	*26.5*	*22.8*	*19.4*	*16.4*	*13.3*	...	...	...
43	108	104	89.4	*76.1*	*61.8*	*51.8*	*43.8*	*37.0*	*30.6*	*26.5*	*22.8*	*19.4*	*16.4*	*13.3*	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	37Ni–30Co–28Cr–2.7Si	Smls. pipe & tube	SB–622	...	N12160	Solution ann.
2	37Ni–30Co–28Cr–2.7Si	Smls. pipe & tube	SB–622	...	N12160	Solution ann.
3	37Ni–30Co–28Cr–2.7Si	Wld. tube	SB–626	...	N12160	Solution ann.
4	37Ni–30Co–28Cr–2.7Si	Wld. tube	SB–626	...	N12160	Solution ann.
5	59Ni–22Cr–14Mo–4Fe–3W	Castings	SA–494	CX2MW	N26022	Solution ann.
6	53Ni–17Mo–16Cr–6Fe–5W	Castings	SA–494	CW–12MW/C	N30002	Annealed
7	62Ni–28Mo–5Fe	Castings	SA–494	N–12MV/B	N30012	Annealed
8	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. & wld. fittings	SB–366	...	R20033	Solution ann.
9	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Forged fittings	SB–462	...	R20033	Solution ann.
10	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Forgings	SB–564	...	R20033	Solution ann.
11	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. pipe	SB–619	...	R20033	Solution ann.
12	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. pipe & tube	SB–622	...	R20033	Solution ann.
13	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Plate, sheet, strip	SB–625	...	R20033	Solution ann.
14	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. tube	SB–626	...	R20033	Solution ann.
15	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Rod	SB–649	...	R20033	Solution ann.
16	21Ni–30Fe–22Cr–18Co–3Mo–3W	Plate, sheet, strip	SB–435	...	R30556	Annealed
17	21Ni–30Fe–22Cr–18Co–3Mo–3W	Plate, sheet, strip	SB–435	...	R30556	Annealed
18	21Ni–30Fe–22Cr–18Co–3Mo–3W	Rod	SB–572	...	R30556	Annealed
19	21Ni–30Fe–22Cr–18Co–3Mo–3W	Rod	SB–572	...	R30556	Annealed
20	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. pipe	SB–619	...	R30556	Annealed
21	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. pipe	SB–619	...	R30556	Annealed
22	21Ni–30Fe–22Cr–18Co–3Mo–3W	Smls. pipe & tube	SB–622	...	R30556	Annealed
23	21Ni–30Fe–22Cr–18Co–3Mo–3W	Smls. pipe & tube	SB–622	...	R30556	Annealed
24	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. tube	SB–626	...	R30556	Annealed
25	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. tube	SB–626	...	R30556	Annealed
26	Co–26Cr–9Ni–5Mo–3Fe–2W	Rod	SB–815	...	R31233	Solution ann.
27	Co–26Cr–9Ni–5Mo–3Fe–2W	Plate, sheet, strip	SB–818	...	R31233	Solution ann.
28	Ti	Plate, sheet, strip	SB–265	1	R50250	Annealed
29	Ti	Smls. tube	SB–338	1	R50250	Annealed
30	Ti	Wld. tube	SB–338	1	R50250	Annealed
31	Ti	Bar, billet	SB–348	1	R50250	Annealed
32	Ti	Smls. & wld. fittings	SB–363	WPT1	R50250	Annealed
33	Ti	Forgings	SB–381	F–1	R50250	Annealed
34	Ti	Smls. pipe	SB–861	1	R50250	Annealed
35	Ti	Wld. pipe	SB–862	1	R50250	Annealed
36	Ti	Castings	SB–367	C–2	R50400	...
37	Ti	Plate, sheet, strip	SB–265	2	R50400	Annealed
38	Ti	Smls. tube	SB–338	2	R50400	Annealed
39	Ti	Wld. tube	SB–338	2	R50400	Annealed
40	Ti	Bar, billet	SB–348	2	R50400	Annealed
41	Ti	Smls. & wld. fittings	SB–363	WPT2	R50400	Annealed
42	Ti	Forgings	SB–381	F–2	R50400	Annealed
43	Ti	Smls. pipe	SB–861	2	R50400	Annealed
44	Ti	Wld. pipe	SB–862	2	R50400	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	46	620	240	NP	NP	816	NP	NFN–13	T14
2	...	46	620	240	NP	NP	816	NP	NFN–13	G5, T14
3	...	46	620	240	NP	NP	816	NP	NFN–13	G14, T14
4	...	46	620	240	NP	NP	816	NP	NFN–13	G5, G14, T14
5	...	43	550	310	NP	NP	260	260	NFN–10	G15
6	...	...	495	275	NP	NP	538	343	NFN–10	G15, W1
7	...	...	525	275	NP	NP	538	343	NFN–10	G15, W1
8	...	45	750	380	NP	NP	427	NP	NFN–10	W12
9	...	45	750	380	NP	NP	427	NP	NFN–10	...
10	...	45	750	380	NP	NP	427	NP	NFN–10	...
11	...	45	750	380	NP	NP	427	NP	NFN–10	G14
12	...	45	750	380	NP	NP	427	NP	NFN–10	...
13	...	45	750	380	NP	NP	427	NP	NFN–10	...
14	...	45	750	380	NP	NP	427	NP	NFN–10	G14
15	...	45	750	380	NP	NP	427	NP	NFN–10	...
16	...	45	690	310	NP	NP	899	343	NFN–15	G4, T17
17	...	45	690	310	NP	NP	899	343	NFN–15	G4, G5, T16
18	...	45	690	310	NP	NP	899	343	NFN–15	G4, T17
19	...	45	690	310	NP	NP	899	343	NFN–15	G4, G5, T16
20	...	45	690	310	NP	NP	899	343	NFN–15	G4, G14, T16
21	...	45	690	310	NP	NP	899	343	NFN–15	G4, G5, G14, T15
22	...	45	690	310	NP	NP	899	343	NFN–15	G4, T17
23	...	45	690	310	NP	NP	899	343	NFN–15	G4, G5, T16
24	...	45	690	310	NP	NP	899	343	NFN–15	G4, G14, T16
25	...	45	690	310	NP	NP	899	343	NFN–15	G4, G5, G14, T15
26	...	49	896	379	NP	NP	427	NP	NFN–15	G8
27	...	49	896	379	NP	NP	427	NP	NFN–15	G8
28	...	51	240	138	316	316	316	NP	NFT–3	...
29	...	51	240	138	316	316	316	NP	NFT–3	...
30	...	51	240	138	316	316	316	NP	NFT–3	G14, W6
31	...	51	240	138	316	316	316	NP	NFT–3	...
32	...	51	240	138	NP	316	316	NP	NFT–3	W5, W12
33	...	51	240	138	NP	316	316	NP	NFT–3	...
34	...	51	240	138	316	316	316	NP	NFT–3	...
35	...	51	240	138	316	316	316	NP	NFT–3	G14, W6
36	...	51	345	275	NP	NP	260	260	NFT–2	G15, W1
37	...	51	345	275	316	316	316	316	NFT–2	...
38	...	51	345	275	316	316	316	316	NFT–2	...
39	...	51	345	275	316	316	316	316	NFT–2	G14, W6
40	...	51	345	275	316	316	316	316	NFT–2	...
41	...	51	345	275	NP	316	316	316	NFT–2	W5, W12
42	...	51	345	275	NP	316	316	316	NFT–2	...
43	...	51	345	275	316	316	316	316	NFT–2	...
44	...	51	345	275	316	316	316	316	NFT–2	G14, W6

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	161	151	139	132	126	120	115	110	105	101	98.6	96.5	94.7	93.8	93.8	93.1	93.1	93.1
2	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
3	137	128	118	113	107	102	97.3	93.1	89.5	86.6	84.1	81.9	80.4	80.0	80.0	79.3	79.3	79.3
4	137	137	137	137	136	135	131	126	121	117	113	111	108	108	108	108	108	108
5	158	156	152	150	149	148	148	148	148	148	...	...	...	...	...	...	...	...
6	142	138	133	130	128	128	128	127	126	122	118	117	117	117	117	117	117	115
7	150	143	140	140	140	140	140	140	140	138	132	127	126	124	122	119	118	115
8	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
9	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
10	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
11	182	182	180	173	164	158	154	150	147	143	140	138	137	135	134	133	131	...
12	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
13	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
14	182	182	180	173	164	158	154	150	147	143	140	138	137	135	134	133	131	...
15	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
16	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
17	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
18	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
19	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
20	168	159	148	141	135	130	125	122	119	116	114	112	111	109	108	107	106	105
21	168	168	167	166	164	161	159	157	156	155	153	151	149	147	145	144	143	142
22	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
23	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
24	168	159	148	141	135	130	125	122	119	116	114	112	111	109	108	107	106	105
25	168	168	167	166	164	161	159	157	156	155	153	151	149	147	145	144	143	142
26	236	235	218	...	196	...	177	...	163	...	154	151	148	146	144	142	139	...
27	236	235	218	...	196	...	177	...	163	...	154	151	148	146	144	142	139	...
28	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
29	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
30	58.6	54.6	47.0	42.8	38.4	35.3	32.9	28.6	25.8	23.3	21.4	19.2	...	...	...	...	...	...
31	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
32	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
33	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
34	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
35	58.6	54.6	47.0	42.8	38.4	35.3	32.9	28.6	25.8	23.3	21.4	19.2	...	...	...	...	...	...
36	98.6	90.5	79.4	72.8	66.6	61.7	56.7	52.2	48.3	44.7	...	...	...	...	...	...	...	...
37	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
38	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
39	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
40	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
41	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
42	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
43	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
44	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	93.1	93.1	93.0	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
2	126	122	105	*89.2*	*72.4*	*61.2*	*51.3*	*43.2*	*36.2*	*31.0*	*26.5*	*22.5*	*19.1*	*16.1*	...	...	...
3	79.3	79.3	79.3	*76.1*	*61.8*	*51.8*	*43.8*	*37.0*	*30.6*	*26.5*	*22.8*	*19.4*	*16.4*	*13.3*	...	...	...
4	108	104	89.4	*76.1*	*61.8*	*51.8*	*43.8*	*37.0*	*30.6*	*26.5*	*22.8*	*19.4*	*16.4*	*13.3*	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	112	110	108	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	113	110	107	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	122	121	120	119	118	115	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
17	165	163	162	158	140	*115*	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
18	122	121	120	119	118	115	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
19	165	163	162	158	140	*115*	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
20	104	103	102	101	99.8	*98.1*	*79.3*	*65.0*	*53.6*	*43.9*	*35.9*	*29.1*	*24.0*	*19.5*	*14.8*	*12.0*	*9.54*
21	140	138	138	134	*119*	*98.1*	*79.3*	*65.0*	*53.6*	*43.9*	*35.9*	*29.1*	*24.0*	*19.5*	*14.8*	*12.0*	*9.54*
22	122	121	120	119	118	115	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
23	165	163	162	158	140	*115*	*93.0*	*76.1*	*62.9*	*51.3*	*41.8*	*34.3*	*28.3*	*22.6*	*17.4*	*14.0*	*10.9*
24	104	103	102	101	99.8	*98.1*	*79.3*	*65.0*	*53.6*	*43.9*	*35.9*	*29.1*	*24.0*	*19.5*	*14.8*	*12.0*	*9.54*
25	140	138	138	134	*119*	*98.1*	*79.3*	*65.0*	*53.6*	*43.9*	*35.9*	*29.1*	*24.0*	*19.5*	*14.8*	*12.0*	*9.54*
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
(13)	1	Ti	Plate, sheet, strip	SB–265	2H	R50400	Annealed
(13)	2	Ti	Smls. tube	SB–338	2H	R50400	Annealed
(13)	3	Ti	Wld. tube	SB–338	2H	R50400	Annealed
(13)	4	Ti	Bar, billet	SB–348	2H	R50400	Annealed
(13)	5	Ti	Smls. fittings	SB–363	WPT2H	R50400	Annealed
(13)	6	Ti	Wld. fittings	SB–363	WPT2HW	R50400	Annealed
(13)	7	Ti	Forgings	SB–381	F–2H	R50400	Annealed
(13)	8	Ti	Smls. pipe	SB–861	2H	R50400	Annealed
(13)	9	Ti	Wld. pipe	SB–862	2H	R50400	Annealed
	10	Ti	Castings	SB–367	C–3	R50550	...
	11	Ti	Plate, sheet, strip	SB–265	3	R50550	Annealed
	12	Ti	Smls. tube	SB–338	3	R50550	Annealed
	13	Ti	Wld. tube	SB–338	3	R50550	Annealed
	14	Ti	Bar, billet	SB–348	3	R50550	Annealed
	15	Ti	Smls. & wld. fittings	SB–363	WPT3	R50550	Annealed
	16	Ti	Forgings	SB–381	F–3	R50550	Annealed
	17	Ti	Smls. pipe	SB–861	3	R50550	Annealed
	18	Ti	Wld. pipe	SB–862	3	R50550	Annealed
	19	Ti–Pd	Plate, sheet, strip	SB–265	11	R52250	Annealed
	20	Ti–Pd	Plate, sheet, strip	SB–265	17	R52252	Annealed
	21	Ti–Ru	Plate, sheet, strip	SB–265	27	R52254	Annealed
	22	Ti–Pd	Plate, sheet, strip	SB–265	7	R52400	Annealed
	23	Ti–Pd	Smls. tube	SB–338	7	R52400	Annealed
	24	Ti–Pd	Wld. tube	SB–338	7	R52400	Annealed
	25	Ti–Pd	Bar, billet	SB–348	7	R52400	Annealed
	26	Ti–Pd	Smls. fittings	SB–363	WPT7	R52400	Annealed
	27	Ti–Pd	Wld. fittings	SB–363	WPT7W	R52400	Annealed
	28	Ti–Pd	Castings	SB–367	C–7	R52400	Annealed
	29	Ti–Pd	Forgings	SB–381	F–7	R52400	Annealed
	30	Ti–Pd	Smls. pipe	SB–861	7	R52400	Annealed
	31	Ti–Pd	Wld. pipe	SB–862	7	R52400	Annealed
(13)	32	Ti–0.15Pd	Plate, sheet, strip	SB–265	7H	R52400	Annealed
(13)	33	Ti–0.15Pd	Smls. tube	SB–338	7H	R52400	Annealed
(13)	34	Ti–0.15Pd	Wld. tube	SB–338	7H	R52400	Annealed
(13)	35	Ti–0.15Pd	Bar, billet	SB–348	7H	R52400	Annealed
(13)	36	Ti–0.15Pd	Smls. fittings	SB–363	WPT7H	R52400	Annealed
(13)	37	Ti–0.15Pd	Wld. fittings	SB–363	WPT7HW	R52400	Annealed
(13)	38	Ti–0.15Pd	Forgings	SB–381	F–7H	R52400	Annealed
(13)	39	Ti–0.15Pd	Smls. pipe	SB–861	7H	R52400	Annealed
(13)	40	Ti–0.15Pd	Wld. pipe	SB–862	7H	R52400	Annealed
	41	Ti–Pd	Plate, sheet, strip	SB–265	16	R52402	Annealed
	42	Ti–Pd	Smls. tube	SB–338	16	R52402	Annealed
	43	Ti–Pd	Wld. tube	SB–338	16	R52402	Annealed
	44	Ti–Pd	Bar, billet	SB–348	16	R52402	Annealed
	45	Ti–Pd	Forgings	SB–381	F–16	R52402	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	51	400	275	NP	NP	316	NP	NFT–2	...
2	...	51	400	275	NP	NP	316	NP	NFT–2	...
3	...	51	400	275	NP	NP	316	NP	NFT–2	G14, W6
4	...	51	400	275	NP	NP	316	NP	NFT–2	...
5	...	51	400	275	NP	NP	316	NP	NFT–2	...
6	...	51	400	275	NP	NP	316	NP	NFT–2	W12
7	...	51	400	275	NP	NP	316	NP	NFT–2	...
8	...	51	400	275	NP	NP	316	NP	NFT–2	...
9	...	51	400	275	NP	NP	316	NP	NFT–2	W12
10	...	52	450	380	NP	NP	260	NP	NFT–1	G15, W1
11	...	52	450	380	316	316	316	316	NFT–1	...
12	...	52	450	380	316	316	316	316	NFT–1	...
13	...	52	450	380	316	316	316	316	NFT–1	G14, W6
14	...	52	450	380	316	316	316	316	NFT–1	...
15	...	52	450	380	NP	316	316	316	NFT–1	W5, W12
16	...	52	450	380	NP	316	316	316	NFT–1	...
17	...	52	450	380	316	316	316	316	NFT–1	...
18	...	52	450	380	316	316	316	316	NFT–1	G14, W6
19	...	51	240	138	NP	NP	316	NP	NFT–3	...
20	...	51	240	138	NP	NP	316	NP	NFT–3	...
21	...	51	240	138	NP	NP	316	NP	NFT–3	...
22	...	51	345	275	NP	316	316	316	NFT–2	...
23	...	51	345	275	NP	316	316	316	NFT–2	...
24	...	51	345	275	NP	316	316	316	NFT–2	G14, W6
25	...	51	345	275	NP	316	316	316	NFT–2	...
26	...	51	345	275	NP	NP	316	316	NFT–2	...
27	...	51	345	275	NP	NP	316	316	NFT–2	G14
28	...	51	345	275	NP	NP	260	260	NFT–2	G15, W1
29	...	51	345	275	NP	NP	316	316	NFT–2	...
30	...	51	345	275	NP	316	316	316	NFT–2	...
31	...	51	345	275	NP	316	316	316	NFT–2	G14, W6
32	...	51	400	275	NP	NP	316	NP	NFT–2	...
33	...	51	400	275	NP	NP	316	NP	NFT–2	...
34	...	51	400	275	NP	NP	316	NP	NFT–2	G14, W6
35	...	51	400	275	NP	NP	316	NP	NFT–2	...
36	...	51	400	275	NP	NP	316	NP	NFT–2	...
37	...	51	400	275	NP	NP	316	NP	NFT–2	W12
38	...	51	400	275	NP	NP	316	NP	NFT–2	...
39	...	51	400	275	NP	NP	316	NP	NFT–2	...
40	...	51	400	275	NP	NP	316	NP	NFT–2	W12
41	...	51	345	275	NP	NP	316	316	NFT–2	...
42	...	51	345	275	NP	NP	316	316	NFT–2	...
43	...	51	345	275	NP	NP	316	316	NFT–2	G14, W6
44	...	51	345	275	NP	NP	316	316	NFT–2	...
45	...	51	345	275	NP	NP	316	316	NFT–2	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
2	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
3	96.9	93.5	82.6	75.9	70.1	65.1	60.7	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
4	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
5	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
6	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
7	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
8	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
9	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
10	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	...	...	...	...	...	...	...	...
11	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
12	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
13	109	103	90.1	82.2	74.1	67.3	61.7	56.0	51.2	47.6	44.9	42.5	...	...	...	...	...	...
14	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
15	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
16	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
17	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
18	109	103	90.1	82.2	74.1	67.3	61.7	56.0	51.2	47.6	44.9	42.5	...	...	...	...	...	...
19	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
20	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
21	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
22	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
23	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
24	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
25	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
26	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
27	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
28	98.6	90.5	79.4	72.8	66.6	61.7	56.7	52.2	48.3	44.7	...	...	...	...	...	...	...	...
29	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
30	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
31	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
32	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
33	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
34	96.9	93.5	82.6	75.9	70.1	65.1	60.7	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
35	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
36	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
37	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
38	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
39	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
40	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
41	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
42	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
43	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
44	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
45	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
(13)	1	Ti–0.05Pd	Plate, sheet, strip	SB–265	16H	R52402	Annealed
(13)	2	Ti–0.05Pd	Smls. tube	SB–338	16H	R52402	Annealed
(13)	3	Ti–0.05Pd	Wld. tube	SB–338	16H	R52402	Annealed
(13)	4	Ti–0.05Pd	Bar, billet	SB–348	16H	R52402	Annealed
(13)	5	Ti–0.05Pd	Smls. fittings	SB–363	WPT16H	R52402	Annealed
(13)	6	Ti–0.05Pd	Wld. fittings	SB–363	WPT16HW	R52402	Annealed
(13)	7	Ti–0.05Pd	Forgings	SB–381	F–16H	R52402	Annealed
(13)	8	Ti–0.05Pd	Smls. pipe	SB–861	16H	R52402	Annealed
(13)	9	Ti–0.05Pd	Wld. pipe	SB–862	16H	R52402	Annealed
	10	Ti–Ru	Plate, sheet, strip	SB–265	26	R52404	Annealed
	11	Ti–Ru	Smls. tube	SB–338	26	R52404	Annealed
	12	Ti–Ru	Wld. tube	SB–338	26	R52404	Annealed
	13	Ti–Ru	Bar, billet	SB–348	26	R52404	Annealed
	14	Ti–Ru	Smls. fittings	SB–363	WPT26	R52404	Annealed
	15	Ti–Ru	Wld. fittings	SB–363	WPT26W	R52404	Annealed
	16	Ti–Ru	Forgings	SB–381	F–26	R52404	Annealed
	17	Ti–Ru	Smls. pipe	SB–861	26	R52404	Annealed
	18	Ti–Ru	Wld. pipe	SB–862	26	R52404	Annealed
(13)	19	Ti–0.10Ru	Plate, sheet, strip	SB–265	26H	R52404	Annealed
(13)	20	Ti–0.10Ru	Smls. tube	SB–338	26H	R52404	Annealed
(13)	21	Ti–0.10Ru	Wld. tube	SB–338	26H	R52404	Annealed
(13)	22	Ti–0.10Ru	Bar, billet	SB–348	26H	R52404	Annealed
(13)	23	Ti–0.10Ru	Smls. fittings	SB–363	WPT26H	R52404	Annealed
(13)	24	Ti–0.10Ru	Wld. fittings	SB–363	WPT26HW	R52404	Annealed
(13)	25	Ti–0.10Ru	Forgings	SB–381	F–26H	R52404	Annealed
(13)	26	Ti–0.10Ru	Smls. pipe	SB–861	26H	R52404	Annealed
(13)	27	Ti–0.10Ru	Wld. pipe	SB–862	26H	R52404	Annealed
	28	Ti–0.3Mo–0.8Ni	Plate, sheet, strip	SB–265	12	R53400	Annealed
	29	Ti–0.3Mo–0.8Ni	Smls. tube	SB–338	12	R53400	Annealed
	30	Ti–0.3Mo–0.8Ni	Wld. tube	SB–338	12	R53400	Annealed
	31	Ti–0.3Mo–0.8Ni	Bar, billet	SB–348	12	R53400	Annealed
	32	Ti–0.3Mo–0.8Ni	Smls. fittings	SB–363	WPT12	R53400	Annealed
	33	Ti–0.3Mo–0.8Ni	Wld. fittings	SB–363	WPT12W	R53400	Annealed
	34	Ti–0.3Mo–0.8Ni	Forgings	SB–381	F–12	R53400	Annealed
	35	Ti–0.3Mo–0.8Ni	Smls. pipe	SB–861	12	R53400	Annealed
	36	Ti–0.3Mo–0.8Ni	Wld. pipe	SB–862	12	R53400	Annealed
	37	Ti–3Al–2.5V	Plate, sheet, strip	SB–265	9	R56320	Annealed
	38	Ti–3Al–2.5V	Smls. tube	SB–338	9	R56320	Annealed
	39	Ti–3Al–2.5V	Wld. tube	SB–338	9	R56320	Annealed
	40	Ti–3Al–2.5V	Bar, billet	SB–348	9	R56320	Annealed
	41	Ti–3Al–2.5V	Smls. fittings	SB–363	WPT9	R56320	Annealed
	42	Ti–3Al–2.5V	Wld. fittings	SB–363	WPT9W	R56320	Annealed
	43	Ti–3Al–2.5V	Forgings	SB–381	F–9	R56320	Annealed
	44	Ti–3Al–2.5V	Smls. pipe	SB–861	9	R56320	Annealed
	45	Ti–3Al–2.5V	Wld. pipe	SB–862	9	R56320	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	51	400	275	NP	NP	316	NP	NFT–2	...
2	...	51	400	275	NP	NP	316	NP	NFT–2	...
3	...	51	400	275	NP	NP	316	NP	NFT–2	G14, W6
4	...	51	400	275	NP	NP	316	NP	NFT–2	...
5	...	51	400	275	NP	NP	316	NP	NFT–2	...
6	...	51	400	275	NP	NP	316	NP	NFT–2	W12
7	...	51	400	275	NP	NP	316	NP	NFT–2	...
8	...	51	400	275	NP	NP	316	NP	NFT–2	...
9	...	51	400	275	NP	NP	316	NP	NFT–2	W12
10	...	51	345	275	NP	NP	316	316	NFT–2	...
11	...	51	345	275	NP	NP	316	316	NFT–2	...
12	...	51	345	275	NP	NP	316	316	NFT–2	G14, W6
13	...	51	345	275	NP	NP	316	316	NFT–2	...
14	...	51	345	275	NP	NP	316	316	NFT–2	...
15	...	51	345	275	NP	NP	316	316	NFT–2	G14
16	...	51	345	275	NP	NP	316	316	NFT–2	...
17	...	51	345	275	NP	NP	316	316	NFT–2	...
18	...	51	345	275	NP	NP	316	316	NFT–2	G14, W6
19	...	51	400	275	NP	NP	316	NP	NFT–2	...
20	...	51	400	275	NP	NP	316	NP	NFT–2	...
21	...	51	400	275	NP	NP	316	NP	NFT–2	G14, W6
22	...	51	400	275	NP	NP	316	NP	NFT–2	...
23	...	51	400	275	NP	NP	316	NP	NFT–2	...
24	...	51	400	275	NP	NP	316	NP	NFT–2	W12
25	...	51	400	275	NP	NP	316	NP	NFT–2	...
26	...	51	400	275	NP	NP	316	NP	NFT–2	...
27	...	51	400	275	NP	NP	316	NP	NFT–2	W12
28	...	52	485	345	NP	NP	316	316	NFT–1	...
29	...	52	485	345	NP	NP	316	316	NFT–1	...
30	...	52	485	345	NP	NP	316	316	NFT–1	G14, W6
31	...	52	485	345	NP	NP	316	316	NFT–1	...
32	...	52	485	345	NP	NP	316	316	NFT–1	...
33	...	52	485	345	NP	NP	316	316	NFT–1	G14
34	...	52	485	345	NP	NP	316	316	NFT–1	...
35	...	52	485	345	NP	NP	316	316	NFT–1	...
36	...	52	485	345	NP	NP	316	316	NFT–1	G14, W6
37	...	53	620	485	NP	316	316	316	NFT–4	...
38	...	53	620	485	NP	316	316	316	NFT–4	...
39	...	53	620	485	NP	316	316	316	NFT–4	G14, W6
40	...	53	620	485	NP	316	NP	NP	NFT–4	...
41	...	53	620	485	NP	316	NP	NP	NFT–4	...
42	...	53	620	485	NP	316	NP	NP	NFT–4	G14, W6
43	...	53	620	485	NP	316	NP	NP	NFT–4	...
44	...	53	620	485	NP	316	316	316	NFT–4	...
45	...	53	620	485	NP	316	316	316	NFT–4	G14, W6

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
2	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
3	97.1	93.4	82.6	75.9	70.1	65.1	60.8	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
4	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
5	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
6	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
7	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
8	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
9	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
10	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
11	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
12	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
13	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
14	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
15	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
16	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
17	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
18	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
19	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
20	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
21	97.1	93.4	82.6	75.9	70.1	65.1	60.8	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
22	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
23	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
24	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
25	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
26	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
27	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
28	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
29	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
30	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
31	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
32	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
33	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
34	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
35	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
36	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
37	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
38	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
39	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
40	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
41	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
42	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
43	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
44	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
45	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
1	Ti–3Al–2.5V–0.1Ru	Plate, sheet, strip	SB–265	28	R56323	Annealed
2	Ti–3Al–2.5V–0.1Ru	Smls. tube	SB–338	28	R56323	Annealed
3	Ti–3Al–2.5V–0.1Ru	Wld. tube	SB–338	28	R56323	Annealed
4	Ti–3Al–2.5V–0.1Ru	Bar, billet	SB–348	28	R56323	Annealed
5	Ti–3Al–2.5V–0.1Ru	Smls. fittings	SB–363	WPT28	R56323	Annealed
6	Ti–3Al–2.5V–0.1Ru	Wld. fittings	SB–363	WPT28W	R56323	Annealed
7	Ti–3Al–2.5V–0.1Ru	Forgings	SB–381	F–28	R56323	Annealed
8	Ti–3Al–2.5V–0.1Ru	Smls. pipe	SB–861	28	R56323	Annealed
9	Ti–3Al–2.5V–0.1Ru	Wld. pipe	SB–862	28	R56323	Annealed
10	99.2Zr	Forgings	SB–493	...	R60702	Annealed
11	99.2Zr	Smls. tube	SB–523	...	R60702	Annealed
12	99.2Zr	Wld. tube	SB–523	...	R60702	Annealed
13	99.2Zr	Bar, wire	SB–550	...	R60702	Annealed
14	99.2Zr	Plate, sheet, strip	SB–551	...	R60702	Annealed
15	99.2Zr	Smls. fittings	SB–653	PZ–2	R60702	Annealed
16	99.2Zr	Wld. fittings	SB–653	PZ–2W	R60702	Annealed
17	99.2Zr	Smls. & wld. pipe	SB–658	...	R60702	Annealed
18	95.2Zr + Nb	Forgings	SB–493	...	R60705	Annealed
19	95.2Zr + Nb	Smls. tube	SB–523	...	R60705	Annealed
20	95.2Zr + Nb	Wld. tube	SB–523	...	R60705	Annealed
21	95.2Zr + Nb	Bar, wire	SB–550	...	R60705	Annealed
22	95.2Zr + Nb	Plate, sheet, strip	SB–551	...	R60705	Annealed
23	95.2Zr + Nb	Smls. & wld. pipe	SB–658	...	R60705	Annealed

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only) I	III	VIII-1	XII	External Pressure Chart No.	Notes
1	...	53	620	485	NP	NP	316	NP	NFT–4	...
2	...	53	620	485	NP	NP	316	NP	NFT–4	...
3	...	53	620	485	NP	NP	316	NP	NFT–4	G14, W6
4	...	53	620	485	NP	NP	316	NP	NFT–4	...
5	...	53	620	485	NP	NP	316	NP	NFT–4	...
6	...	53	620	485	NP	NP	316	NP	NFT–4	G14, W6
7	...	53	620	485	NP	NP	316	NP	NFT–4	...
8	...	53	620	485	NP	NP	316	NP	NFT–4	...
9	...	53	620	485	NP	NP	316	NP	NFT–4	G14, W6
10	...	61	380	205	NP	204	371	NP	NFZ–1	...
11	...	61	380	205	NP	204	371	NP	NFZ–1	...
12	...	61	380	205	NP	204	371	NP	NFZ–1	G14, W6
13	...	61	380	205	NP	204	371	NP	NFZ–1	...
14	...	61	380	205	NP	204	371	NP	NFZ–1	...
15	...	61	380	205	NP	204	371	NP	NFZ–1	...
16	...	61	380	205	NP	204	371	NP	NFZ–1	G14, W6
17	...	61	380	205	NP	204	371	NP	NFZ–1	W12
18	...	62	485	380	NP	NP	371	NP	NFZ–2	W2
19	...	62	550	380	NP	NP	371	NP	NFZ–2	W2
20	...	62	550	380	NP	NP	371	NP	NFZ–2	G14, W2, W6
21	...	62	550	380	NP	NP	371	NP	NFZ–2	W2
22	...	62	550	380	NP	NP	371	NP	NFZ–2	W2
23	...	62	550	380	NP	NP	371	NP	NFZ–2	W2, W12

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
2	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
3	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
4	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
5	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
6	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
7	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
8	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
9	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
10	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
11	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
12	92.4	88.4	78.0	71.4	65.2	59.7	54.0	49.4	45.2	40.7	37.0	34.1	32.0	30.9	...	...	...	...
13	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
14	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
15	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
16	92.4	88.4	78.0	71.4	65.2	59.7	54.0	49.4	45.2	40.7	37.0	34.1	32.0	30.9	...	...	...	...
17	108	104	92.1	84.3	76.9	70.1	63.7	58.7	53.3	47.9	43.5	40.3	38.0	35.5	...	...	...	...
18	138	126	112	104	97.6	91.9	87.0	82.8	79.2	76.0	73.2	71.0	69.4	68.0	...	...	...	...
19	158	144	128	119	111	105	99.5	94.7	90.5	86.8	83.7	81.2	79.4	77.6	...	...	...	...
20	134	122	109	101	94.9	89.5	84.9	80.8	77.2	73.9	71.1	68.9	67.4	66.0	...	...	...	...
21	158	144	128	119	111	105	99.5	94.7	90.5	86.8	83.7	81.2	79.4	77.6	...	...	...	...
22	158	144	128	119	111	105	99.5	94.7	90.5	86.8	83.7	81.2	79.4	77.6	...	...	...	...
23	158	144	128	119	111	105	99.5	94.7	90.5	86.8	83.7	81.2	79.4	77.6	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Classes 2 and 3;* Section VIII, Division 1; and Section XII
Maximum Allowable Stress Values *S* for Nonferrous Materials
(*See Maximum Temperature Limits for Restrictions on Class)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 1B

GENERAL NOTES

(a) The following abbreviations are used: ann., annealed; cond., condenser; exch., exchanger; extr., extruded; fin., finished; fr., from; rel., relieved; rld., rolled; Smls., Seamless; Sol., Solution; treat., treated; and Wld., Welded.

(b) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(c) For Section VIII and XII applications, stress values in restricted shear, such as dowel bolts, rivets, or similar construction in which the shearing is so restricted that the section under consideration would fail without reduction of areas, shall be 0.80 times the values in this Table.

(d) For Section VIII and XII applications, stress values in bearing shall be 1.60 times the values in this Table.

(**13**) (e) An alternative typeface is used for stress values obtained from time–dependent properties (see Notes T1 through T19).

(f) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SB–407/SB–407M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SB–407 Grade N08800 shall be used when SB–407M Grade N08800 is used in construction.

(g) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (h) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 For steam at 1700 kPa (208°C), the values given for 200°C may be used.

G2 At temperatures over 550°C, these stress values apply only when the carbon is 0.04% or higher.

G3 In the absence of evidence that the casting is of high quality throughout, values not in excess of 80% of those given in the Table shall be used. This is not intended to apply to valves and fittings made to recognized standards.

G4 Creep–fatigue, thermal ratcheting, and environmental effects are increasingly significant failure modes at temperatures in excess of 825°C and shall be considered in the design.

G5 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}\%$ but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. For Section III applications, Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G6 Maximum temperature for external pressure not to exceed 175°C.

G7 Use 175°C curve for all temperature values below 175°C.

G8 The stresses for this material are based on 828 MPa minimum tensile strength because of weld metal strength limitations.

(**13**) G9 Use Fig. NFC–6 up to and including 150°C. Use the 315°C curve of Fig. NFC–3 above 150°C up to and including 200°C. Maximum temperature for external pressure not to exceed 200°C.

G10 Maximum temperature for external pressure not to exceed 225°C.

G11 Referenced external pressure chart is applicable up to 375°C.

G12 Referenced external pressure chart is applicable up to 425°C.

G13 For Section VIII and XII applications, use of external pressure charts for material in the form of bar stock is permitted for stiffener rings only.

G14 For Section VIII applications, a factor of 0.85 has been applied in arriving at the maximum allowable stress values in tension for this material. Divide tabulated values by 0.85 for maximum allowable longitudinal tensile stress.

G15 To these stress values a quality factor as specified in ND–3115 of Section III; UG–24 of Section VIII, Division 1; or TM–190 of Section XII shall be applied for castings. This is not intended to apply to valves and fittings made to recognized standards.

G16 Allowable stress values shown are 90% of those for the corresponding core material.

G17 Copper–silicon alloys are not always suitable when exposed to certain media and high temperatures, particularly steam above 100°C. The user should ensure that the alloy selected is satisfactory for the service for which it is to be used.

G18 Because of the occasionally contingent danger from the failure of pressure vessels by stress corrosion cracking, the following is pertinent. These materials are suitable for engineering use under a wide variety of ordinary corrosive conditions with no particular hazard in respect to stress corrosion.

G19 Few alloys are completely immune to stress corrosion cracking in all combinations of stress and corrosive environments, and the supplier of the material should be consulted. Reference may also be made to the following sources: (1) Stress Corrosion Cracking Control Measures, B. F. Brown, U.S. National Bureau of Standards (1977), available from NACE, Texas; (2) The Stress Corrosion of Metals, H. L. Logan, John Wiley & Sons, New York, 1966.

G20 For plate only.

G21 The maximum operating temperature is arbitrarily set at 250°C because harder temper adversely affects design stress in the creep rupture temperature range.

G22 The minimum tensile strength of reduced tension specimens in accordance with QW–462.1 of Section IX shall not be less than 760 MPa.

G23 This alloy is subject to severe loss of impact strength at room temperatures after exposure in the range of 550°C to 750°C.

G24 For stress relieved tempers (T351, T3510, T3511, T451, T4510, T4511, T651, T6510, T6511), stress values for materials in the basic temper shall be used.

NOTES TO TABLE 1B (CONT'D)

NOTES – GENERAL REQUIREMENTS (CONT'D)

G25 The tension test specimen from plate 13 mm and thicker is machined from the core and does not include the cladding alloy; therefore, the allowable stress values for thickness less than 13 mm shall be used.

G26 The tension test specimen from plate 13 mm and thicker is machined from the core and does not include the cladding alloy; therefore, the allowable stress values shown are 90% of those for the core material of the same thickness.

G27 Alloy N06022 in the solution annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 550°C to 675°C.

G28 For external pressure design, the maximum design temperature is limited to 550°C.

G29 The maximum allowable stress values for greater than 900°C are 9.7 MPa (927°C), 7.6 MPa (954°C), and 5.0 MPa (982°C).

G30 The maximum allowable stress values for greater than 900°C are 5.0 MPa (925°C), 4.0 MPa (950°C), 3.2 MPa (975°C), and 2.6 MPa (1000°C). The maximum use temperature is 982°C; the value listed at 1000°C is provided for interpolation purposes only.

G31 The maximum allowable stress values for greater than 900°C are 7.8 MPa (925°C), 5.2 MPa (950°C), 3.5 MPa (975°C), and 2.4 MPa (1000°C). The maximum use temperature is 982°C; the value listed at 1000°C is provided for interpolation purposes only.

G32 The maximum allowable stress values for greater than 900°C are 6.6 MPa (925°C), 4.4 MPa (950°C), 2.9 MPa (975°C), and 2.0 MPa (1000°C). The maximum use temperature is 982°C; the value listed at 1000°C is provided for interpolation purposes only.

(**13**) G33 External pressure chart NFN–2 may be used for temperatures between 205°C and 315°C.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 For temperatures above 550°C, these stress values may be used only if the material is annealed at a minimum temperature of 1040°C and has a carbon content of 0.04% or higher.

H2 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating it to a minimum temperature of 1040°C and quenching in water or rapidly cooling by other means.

H3 For Section I applications, cold drawn pipe and tube shall be annealed at 1038°C minimum.

H4 The material shall be given a 940°C to 995°C stabilizing heat treatment.

NOTES – TIME–DEPENDENT PROPERTIES [See General Note (e)]

T1 Allowable stresses for temperatures of 125°C and above are values obtained from time–dependent properties.

T2 Allowable stresses for temperatures of 150°C and above are values obtained from time–dependent properties.

T3 Allowable stresses for temperatures of 175°C and above are values obtained from time–dependent properties.

T4 Allowable stresses for temperatures of 205°C and above are values obtained from time–dependent properties.

T5 Allowable stresses for temperatures of 260°C and above are values obtained from time–dependent properties.

T6 Allowable stresses for temperatures of 290°C and above are values obtained from time–dependent properties.

T7 Allowable stresses for temperatures of 315°C and above are values obtained from time–dependent properties.

T8 Allowable stresses for temperatures of 400°C and above are values obtained from time–dependent properties.

T9 Allowable stresses for temperatures of 425°C and above are values obtained from time–dependent properties.

T10 Allowable stresses for temperatures of 455°C and above are values obtained from time–dependent properties.

T11 Allowable stresses for temperatures of 480°C and above are values obtained from time–dependent properties.

T12 Allowable stresses for temperatures of 510°C and above are values obtained from time–dependent properties.

T13 Allowable stresses for temperatures of 540°C and above are values obtained from time–dependent properties.

T14 Allowable stresses for temperatures of 565°C and above are values obtained from time–dependent properties.

T15 Allowable stresses for temperatures of 595°C and above are values obtained from time–dependent properties.

T16 Allowable stresses for temperatures of 620°C and above are values obtained from time–dependent properties.

T17 Allowable stresses for temperatures of 650°C and above are values obtained from time–dependent properties.

T18 Allowable stresses for temperatures of 675°C and above are values obtained from time–dependent properties.

(**13**) T19 Allowable stresses for temperatures of 450°C and above are values obtained from time–dependent properties.

NOTES – WELDING REQUIREMENTS

W1 No welding or brazing permitted.

W2 For Section VIII applications, UNF–56(d) shall apply for welded constructions.

W3 For welded and brazed constructions, stress values for O (annealed) temper material shall be used.

W4 The stress values given for this material are not applicable when either welding or thermal cutting is employed.

W5 These *S* values do not include a longitudinal weld efficiency factor. For Section III applications, for materials welded without filler metal, ultrasonic examination, radiographic examination, or eddy current examination, in accordance with NC–2550, shall provide a longitudinal weld efficiency factor of 1.00. Materials welded with filler metal meeting the requirements of NC–2560 shall receive a longitudinal weld efficiency factor of 1.00. Other longitudinal weld efficiency factors shall be in accordance with the following:

(a) for single butt weld, with filler metal, 0.80;

(b) for single or double butt weld, without filler metal, 0.85;

(c) for double butt weld, with filler metal, 0.90;

(d) for single or double butt weld, with radiography or ultrasonic, 1.00.

W6 Filler metal shall not be used in the manufacture of welded pipe or tubing.

W7 Strength of reduced–section tensile specimen required to qualify welding procedures. See QW–150, Section IX.

W8 After welding, heat treat at 625°C to 650°C, hold 1½ h at temperature for the first 25 mm of cross–section thickness and ½ h for each additional 25 mm, and air cool. For castings used in pumps, valves, and fittings DN 50 and less, PWHT is not required for socket welds and attachment welds when the castings have been temper annealed at 625°C to 650°C prior to welding.

NOTES TO TABLE 1B (CONT'D)

NOTES – WELDING REQUIREMENTS (CONT'D)

W9 If welded or brazed, the allowable stress values for the annealed condition shall be used and the minimum tensile strength of the reduced tension specimen in accordance with QW–462.1 of Section IX shall not be less than 205 MPa.

W10 When nonferrous materials conforming to specifications in Section II, Part B are used in welded or brazed construction, the maximum allowable working stresses shall not exceed the values given herein for annealed material at the metal temperature shown.

W11 These maximum allowable stress values are to be used in welded or brazed constructions.

W12 These *S* values do not include a weld factor. For Section VIII, Division 1 and Section XII applications using welds made without filler metal, the tabulated tensile stress values shall be multiplied by 0.85. For welds made with filler metal, consult UW–12 of Section VIII, Division 1, or TW–130.4 of Section XII, as applicable.

W13 For service at 650°C or higher, the deposited weld metal shall be of the same nominal chemistry as the base metal.

W14 No welding permitted.

W15 For Section VIII and XII applications, no welding is permitted.

W16 Use NFA–12 when welded with 5356 or 5556 filler metal, all thicknesses, or 4043 or 5554 filler metal, thickness ≤ 10 mm. Use NFA–13 when welded with 4043 or 5554 filler metal, thickness > 10 mm.

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Table 2A
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Plate	SA–285	A	K01700	...	...	1	1
2	Carbon steel	Wld. pipe	SA–672	A45	K01700	...	...	1	1
3	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...	...	1	1
4	Carbon steel	Smls. pipe	SA–53	S/A	K02504	...	...	1	1
5	Carbon steel	Smls. pipe	SA–106	A	K02501	...	...	1	1
6	Carbon steel	Bar, shapes	SA–675	50	...	...	...	1	1
7	Carbon steel	Plate	SA–285	B	K02200	...	≤50	1	1
8	Carbon steel	Wld. pipe	SA–672	A50	K02200	...	...	1	1
9	Carbon steel	Bar, shapes	SA–675	55	...	...	...	1	1
10	Carbon steel	Plate	SA–285	C	K02801	...	≤50	1	1
11	Carbon steel	Smls. & wld. pipe	SA–333	1	K03008	...	...	1	1
12	Carbon steel	Smls. & wld. tube	SA–334	1	K03008	...	...	1	1
13	Carbon steel	Plate	SA–516	55	K01800	...	...	1	1
14	Carbon steel	Wld. pipe	SA–671	CA55	K02801	...	...	1	1
15	Carbon steel	Wld. pipe	SA–671	CE55	K02202	...	...	1	1
16	Carbon steel	Wld. pipe	SA–672	A55	K02801	...	...	1	1
17	Carbon steel	Wld. pipe	SA–672	B55	K02001	...	...	1	1
18	Carbon steel	Wld. pipe	SA–672	C55	K01800	...	...	1	1
19	Carbon steel	Wld. pipe	SA–672	E55	K02202	...	...	1	1
20	Carbon steel	Plate, bar, shapes	SA–36	...	K02600	...	...	1	1
21	Carbon steel	Forgings	SA–181	...	K03502	60	...	1	1
22	Carbon steel	Castings	SA–216	WCA	J02502	...	...	1	1
23	Carbon steel	Forgings	SA–266	1	K03506	...	...	1	1
24	Carbon steel	Forgings	SA–350	LF1	K03009	1	...	1	1
25	Carbon steel	Castings	SA–352	LCA	J02504	...	...	1	1
26	Carbon steel	Cast pipe	SA–660	WCA	J02504	...	...	1	1
27	Carbon steel	Bar, shapes	SA–675	60	...	...	...	1	1
28	Carbon steel	Plate	SA–515	60	K02401	...	...	1	1
29	Carbon steel	Plate	SA–516	60	K02100	...	...	1	1
30	Carbon steel	Wld. pipe	SA–671	CB60	K02401	...	...	1	1
31	Carbon steel	Wld. pipe	SA–671	CC60	K02100	...	...	1	1
32	Carbon steel	Wld. pipe	SA–671	CE60	K02402	...	...	1	1
33	Carbon steel	Wld. pipe	SA–672	B60	K02401	...	...	1	1
34	Carbon steel	Wld. pipe	SA–672	C60	K02100	...	...	1	1
35	Carbon steel	Wld. pipe	SA–672	E60	K02402	...	...	1	1
36	Carbon steel	Wld. pipe	SA–53	E/B	K03005	...	...	1	1
37	Carbon steel	Smls. pipe	SA–53	S/B	K03005	...	...	1	1
38	Carbon steel	Smls. pipe	SA–106	B	K03006	...	...	1	1
39	Carbon steel	Fittings	SA–234	WPB	K03006	...	...	1	1
40	Carbon steel	Wld. fittings	SA–234	WPB	K03006	W	...	1	1
41	Carbon steel	Smls. & wld. pipe	SA–333	6	K03006	...	...	1	1
42	Carbon steel	Smls. & wld. tube	SA–334	6	K03006	...	...	1	1
43	Carbon steel	Fittings	SA–420	WPL6	...	...	...	1	1
44	Carbon steel	Wld. fittings	SA–420	WPL6	...	WP–W	...	1	1

Table 2A
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	310	165	371	CS–1	...
2	310	165	371	CS–1	G1, G4
3	330	205	371 (SPT)	CS–2	E2
4	330	205	371 (SPT)	CS–2	E2
5	330	205	371	CS–2	E2
6	345	170	371 (SPT)	CS–1	...
7	345	185	371	CS–1	E2
8	345	185	371	CS–1	E2, G1, G4
9	380	190	371 (SPT)	CS–1	...
10	380	205	371	CS–2	...
11	380	205	371	CS–2	...
12	380	205	371	CS–2	...
13	380	205	371	CS–2	...
14	380	205	371	CS–2	G1, G4
15	380	205	371	CS–2	G1, G4
16	380	205	371	CS–2	G1, G4
17	380	205	371	CS–2	G1, G4
18	380	205	371	CS–2	G1, G4
19	380	205	371	CS–2	G1, G4
20	400	250	371 (SPT)	CS–2	E2
21	415	205	371	CS–2	...
22	415	205	371	CS–2	...
23	415	205	371	CS–2	...
24	415	205	371	CS–2	...
25	415	205	371	CS–2	...
26	415	205	371	CS–2	...
27	415	205	371 (SPT)	CS–2	...
28	415	220	371	CS–2	...
29	415	220	371	CS–2	...
30	415	220	371	CS–2	G1, G4
31	415	220	371	CS–2	G1, G4
32	415	220	371	CS–2	G1, G4
33	415	220	371	CS–2	G1, G4
34	415	220	371	CS–2	G1, G4
35	415	220	371	CS–2	G1, G4
36	415	240	371 (SPT)	CS–2	E2
37	415	240	371 (SPT)	CS–2	E2
38	415	240	371	CS–2	E2
39	415	240	371	CS–2	E2
40	415	240	371	CS–2	E2
41	415	240	371	CS–2	E2
42	415	240	371	CS–2	E2
43	415	240	371	CS–2	E2
44	415	240	371	CS–2	E2

Table 2A
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	103	103	101	99.4	97.8	94.8	90.5	86.2	83.9	81.4	78.9	...	...	...	...	...
2	103	103	101	99.4	97.8	94.8	90.5	86.2	83.9	81.4	78.9	...	...	...	...	...
3	110	110	110	110	110	110	110	108	104	100	**99.1**	...	...	...	...	...
4	110	110	110	110	110	110	110	108	104	100	**99.1**	...	...	...	...	...
5	110	110	110	110	110	110	110	108	104	100	**99.1**	...	...	...	...	...
6	115	110	105	103	101	98.2	94.6	89.8	87.4	84.7	81.6	...	...	...	...	...
7	115	115	113	112	110	106	102	97.1	93.9	91.1	**89.4**	...	...	...	...	...
8	115	115	113	112	110	106	102	97.1	93.9	91.1	**89.4**	...	...	...	...	...
9	126	121	115	113	112	109	104	98.9	96.1	92.9	89.8	...	...	...	...	...
10	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
11	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
12	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
13	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
14	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
15	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
16	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
17	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
18	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
19	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
20	133	133	133	133	133	133	133	129	125	122	**119**	...	...	...	...	...
21	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
22	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
23	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
24	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
25	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
26	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
27	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
28	138	138	134	132	130	126	121	115	112	108	105	...	...	...	...	...
29	138	138	134	132	130	126	121	115	112	108	105	...	...	...	...	...
30	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
31	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
32	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
33	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
34	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
35	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
36	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
37	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
38	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
39	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
40	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
41	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
42	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
43	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...
44	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(13)	1	...	...	...	...	...	...	...	...	...
	2	Carbon steel	Bar	SA–696	B	K03200	...	...	1	1
	3	Carbon steel	Forgings	SA–727	...	K02506	...	...	1	1
	4	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	1	1
	5	Carbon steel	Smls. tube	SA–210	A–1	K02707	...	...	1	1
	6	Carbon steel	Castings	SA–352	LCB	J03003	...	...	1	1
	7	Carbon steel	Plate	SA–515	65	K02800	...	...	1	1
	8	Carbon steel	Plate	SA–516	65	K02403	...	...	1	1
	9	Carbon steel	Wld. pipe	SA–671	CB65	K02800	...	...	1	1
	10	Carbon steel	Wld. pipe	SA–671	CC65	K02403	...	...	1	1
	11	Carbon steel	Wld. pipe	SA–672	B65	K02800	...	...	1	1
	12	Carbon steel	Wld. pipe	SA–672	C65	K02403	...	...	1	1
	13	Carbon steel	Plate	SA–537	...	K12437	1	64 < t ≤ 100	1	2
	14	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	64 < t ≤ 100	1	2
	15	Carbon steel	Forgings	SA–105	...	K03504	...	...	1	2
	16	Carbon steel	Forgings	SA–181	...	K03502	70	...	1	2
	17	Carbon steel	Castings	SA–216	WCB	J03002	...	...	1	2
	18	Carbon steel	Forgings	SA–266	2	K03506	...	...	1	2
	19	Carbon steel	Forgings	SA–350	LF2	K03011	...	...	1	2
	20	Carbon steel	Forgings	SA–508	1	K13502	...	...	1	2
	21	Carbon steel	Forgings	SA–508	1A	K13502	...	...	1	2
	22	Carbon steel	Forgings	SA–541	1	K03506	...	...	1	2
	23	Carbon steel	Forgings	SA–541	1A	K03020	...	...	1	2
	24	Carbon steel	Cast pipe	SA–660	WCB	J03003	...	...	1	2
	25	Carbon steel	Plate	SA–515	70	K03101	...	...	1	2
	26	Carbon steel	Plate	SA–516	70	K02700	...	...	1	2
	27	Carbon steel	Wld. pipe	SA–671	CB70	K03101	...	...	1	2
	28	Carbon steel	Wld. pipe	SA–671	CC70	K02700	...	...	1	2
	29	Carbon steel	Wld. pipe	SA–672	B70	K03101	...	...	1	2
	30	Carbon steel	Wld. pipe	SA–672	C70	K02700	...	...	1	2
	31	Carbon steel	Smls. pipe	SA–106	C	K03501	...	...	1	2
	32	Carbon steel	Castings	SA–216	WCC	K02503	...	...	1	2
	33	Carbon steel	Fittings	SA–234	WPC	K03501	...	...	1	2
	34	Carbon steel	Wld. fittings	SA–234	WPC	K03501	W	...	1	2
	35	Carbon steel	Castings	SA–352	LCC	J02505	...	...	1	2
	36	Carbon steel	Castings	SA–487	16	...	A	...	1	2
	37	Carbon steel	Cast pipe	SA–660	WCC	J02505	...	...	1	2
(13)	38	...	...	...	...	...	...	...	...	...
	39	Carbon steel	Bar	SA–696	C	K03200	...	...	1	2
	40	Carbon steel	Plate	SA–537	...	K12437	2	100 < t ≤ 150	1	3
	41	Carbon steel	Plate	SA–537	...	K12437	1	≤64	1	2
	42	Carbon steel	Wld. pipe	SA–671	CD70	K12437	...	≤64	1	2
	43	Carbon steel	Wld. pipe	SA–672	D70	K12437	...	≤64	1	2
	44	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	≤64	1	2

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	...	...	...	...	...
2	415	240	371	CS-2	E2
3	415	250	371 (SPT)	CS-2	E2
4	415	255	371	CS-2	E2
5	415	255	371	CS-2	E2
6	450	240	371	CS-2	...
7	450	240	371	CS-2	...
8	450	240	371	CS-2	...
9	450	240	371	CS-2	G1, G4
10	450	240	371	CS-2	G1, G4
11	450	240	371	CS-2	G1, G4
12	450	240	371	CS-2	G1, G4
13	450	310	371	CS-2	E2
14	450	310	371	CS-2	E2, G1, G2
15	485	250	371	CS-2	...
16	485	250	371	CS-2	...
17	485	250	371	CS-2	...
18	485	250	371	CS-2	...
19	485	250	371	CS-2	...
20	485	250	371	CS-2	...
21	485	250	371	CS-2	...
22	485	250	371	CS-2	...
23	485	250	371	CS-2	...
24	485	250	371	CS-2	...
25	485	260	371	CS-2	...
26	485	260	371	CS-2	...
27	485	260	371	CS-2	G1, G3
28	485	260	371	CS-2	G1, G4
29	485	260	371	CS-2	G1, G3
30	485	260	371	CS-2	G1, G4
31	485	275	371	CS-2	E2
32	485	275	371	CS-2	E2
33	485	275	371	CS-2	E2
34	485	275	371	CS-2	E2
35	485	275	371	CS-2	E2
36	485	275	371	CS-2	E2
37	485	275	371	CS-2	E2
38	...	...	...	...	...
39	485	275	371	CS-2	E2
40	485	315	371	CS-3	E2
41	485	345	371	CS-3	E2
42	485	345	371	CS-3	E2, G1, G4
43	485	345	371	CS-3	E2, G1, G4
44	485	345	371	CS-3	E2, G1, G4

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	138	138	138	138	138	137	132	126	122	118	**115**	...	...	...	...	...	
3	138	138	138	138	138	138	136	129	125	122	**119**	...	...	...	...	...	
4	138	138	138	138	138	138	138	133	129	125	**122**	...	...	...	...	...	
5	138	138	138	138	138	138	138	133	129	125	**122**	...	...	...	...	...	
6	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...	
7	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...	
8	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...	
9	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...	
10	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...	
11	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...	
12	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...	
13	150	150	150	150	150	150	150	150	148	140	**134**	...	...	...	...	...	
14	150	150	150	150	150	150	150	150	148	140	**134**	...	...	...	...	...	
15	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
16	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
17	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
18	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
19	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
20	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
21	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
22	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
23	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
24	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...	
25	161	161	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
26	161	161	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
27	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
28	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
29	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
30	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...	
31	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
32	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
33	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
34	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
35	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
36	161	160	159	155	151	146	142	137	134	131	**128**	...	...	...	...	...	
37	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
39	161	161	161	161	161	158	151	143	139	136	**132**	...	...	...	...	...	
40	161	161	161	161	161	161	161	160	159	153	**141**	...	...	...	...	...	
41	161	161	160	159	157	156	157	156	153	150	**147**	...	...	...	...	...	
42	161	161	160	159	157	156	157	156	153	150	**147**	...	...	...	...	...	
43	161	161	160	159	157	156	157	156	153	150	**147**	...	...	...	...	...	
44	161	161	160	159	157	156	157	156	153	150	**147**	...	...	...	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	Carbon steel	Forgings	SA–266	3	K05001	...	...	1	2
(**13**)	2	Carbon steel	Plate	SA–299	A	K02803	...	>25	1	2
	3	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	>25	1	2
(**13**)	4	Carbon steel	Plate	SA–299	A	K02803	...	≤25	1	2
	5	Carbon steel	Wld. pipe	SA–671	CK75	K02803	...	≤25	1	2
	6	Carbon steel	Wld. pipe	SA–672	N75	K02803	...	≤25	1	2
	7	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	≤25	1	2
	8	Carbon steel	Plate	SA–537	...	K12437	2	64 < t ≤ 100	1	3
	9	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	64 < t ≤ 100	1	3
	10	Carbon steel	Plate	SA–537	...	K12437	2	≤64	1	3
	11	Carbon steel	Wld. pipe	SA–671	CD80	K12437	...	≤64	1	3
	12	Carbon steel	Wld. pipe	SA–672	D80	K12437	...	≤64	1	3
	13	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	≤64	1	3
	14	Carbon steel	Plate	SA–738	B	K12007	...	...	1	3
(**13**)	15	Ductile cast iron	Castings	SA–874	...	...	...	300 < t < 530	...	...
(**13**)	16	Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT	...	...	300 < t < 530	...	...
	17	C–Mn–Si–Cb	Plate	SA–737	B	K12001	...	...	1	2
	18	C–Mn–Si–V	Plate	SA–737	C	K12202	...	...	1	3
	19	C–½Mo	Fittings	SA–234	WP1	K12821	...	...	3	1
	20	C–½Mo	Wld. fittings	SA–234	WP1	K12821	W	...	3	1
	21	C–½Mo	Smls. pipe	SA–335	P1	K11522	...	...	3	1
	22	C–½Mo	Forged pipe	SA–369	FP1	K11522	...	...	3	1
	23	C–½Mo	Castings	SA–217	WC1	J12524	...	...	3	1
	24	C–½Mo	Castings	SA–352	LC1	J12522	...	...	3	1
	25	C–½Mo	Cast pipe	SA–426	CP1	J12521	...	...	3	1
	26	C–½Mo	Plate	SA–204	A	K11820	...	...	3	1
	27	C–½Mo	Wld. pipe	SA–672	L65	K11820	...	...	3	1
	28	C–½Mo	Wld. pipe	SA–691	CM–65	K11820	...	...	3	1
	29	C–½Mo	Forgings	SA–182	F1	K12822	...	...	3	2
	30	C–½Mo	Plate	SA–204	B	K12020	...	...	3	2
	31	C–½Mo	Forgings	SA–336	F1	K12520	...	...	3	2
	32	C–½Mo	Wld. pipe	SA–672	L70	K12020	...	...	3	2
	33	C–½Mo	Wld. pipe	SA–691	CM–70	K12020	...	...	3	2
	34	C–½Mo	Plate	SA–204	C	K12320	...	...	3	2
	35	C–½Mo	Wld. pipe	SA–672	L75	K12320	...	...	3	2
	36	C–½Mo	Wld. pipe	SA–691	CM–75	K12320	...	...	3	2
	37	½Cr–1/5Mo–V	Plate	SA–517	B	K11630	...	≤32	11B	4
	38	½Cr–¼Mo–Si	Forgings	SA–592	A	K11856	...	64 < t ≤ 100	11B	1
	39	½Cr–¼Mo–Si	Plate	SA–517	A	K11856	...	≤32	11B	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	260	371	CS-2	W1
2	515	275	371	CS-2	...
3	515	275	371	CS-2	G1, G4
4	515	290	371	CS-2	E2
5	515	290	371	CS-2	E2, G1
6	515	290	371	CS-2	E2, G1
7	515	290	371	CS-2	E2, G1
8	515	380	371	CS-5	E2
9	515	380	371	CS-5	E2
10	550	415	371	CS-5	E1
11	550	415	371	CS-5	E1, G1, G4
12	550	415	371	CS-5	E1, G1, G4
13	550	415	371	CS-5	E1, G1, G4
14	585	415	350	CS-5	...
15	300	200	343	CD-2	G17, W1
16	300	200	343	CD-2	G17, W1
17	485	345	371	CS-3	E2
18	550	415	371	CS-3	E1
19	380	205	371	CS-2	...
20	380	205	371	CS-2	...
21	380	205	371	CS-2	...
22	380	205	371	CS-2	...
23	450	240	371	CS-2	...
24	450	240	371	CS-2	...
25	450	240	371	CS-2	...
26	450	255	371	CS-2	...
27	450	255	371	CS-2	G1, G2
28	450	255	371	CS-2	G1, G2
29	485	275	371	CS-2	...
30	485	275	371	CS-2	...
31	485	275	371	CS-2	...
32	485	275	371	CS-2	G1, G2
33	485	275	371	CS-2	G1, G2
34	515	295	371	CS-2	...
35	515	295	371	CS-2	G1, G2
36	515	295	371	CS-2	G1, G2
37	795	690	371 (SPT)	HT-1	...
38	725	620	371 (SPT)	CS-5	...
39	795	690	371 (SPT)	HT-1	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	172	162	157	155	152	148	142	135	131	127	123	...	...	...	...	...	
2	172	172	167	164	163	158	151	143	139	135	131	...	...	...	...	...	(**13**)
3	172	170	168	165	163	158	151	143	139	135	131	...	...	...	...	...	
4	172	172	172	172	171	165	159	151	147	142	**139**	...	...	...	...	...	(**13**)
5	172	172	172	172	171	165	159	151	147	142	**139**	...	...	...	...	...	
6	172	172	172	172	171	165	159	151	147	142	**139**	...	...	...	...	...	
7	172	172	172	172	171	165	159	151	147	142	**139**	...	...	...	...	...	
8	172	172	172	172	172	172	172	172	170	168	**167**	...	...	...	...	...	
9	172	172	172	172	172	172	172	172	170	168	**167**	...	...	...	...	...	
10	184	184	184	184	184	184	184	183	182	**177**	**166**	...	...	...	...	...	
11	184	184	184	184	184	184	184	183	182	**177**	**166**	...	...	...	...	...	
12	184	184	184	184	184	184	184	183	182	**177**	**166**	...	...	...	...	...	
13	184	184	184	184	184	184	184	183	182	**177**	**166**	...	...	...	...	...	
14	195	195	195	195	195	195	195	195	193	190	...	...	...	...	...	...	
15	75.0	75.0	74.3	...	71.2	68.9	67.6	66.7	65.8	64.2	...	...	...	...	...	...	(**13**)
16	75.0	75.0	74.3	...	71.2	68.9	67.6	66.7	65.8	64.2	...	...	...	...	...	...	(**13**)
17	161	161	161	161	161	161	161	157	155	153	**152**	...	...	...	...	...	
18	184	184	184	184	184	184	184	184	183	**180**	**178**	...	...	...	...	...	
19	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
20	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
21	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
22	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
23	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...	
24	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...	
25	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...	
26	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...	
27	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...	
28	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...	
29	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...	
30	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...	
31	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...	
32	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...	
33	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...	
34	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...	
35	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...	
36	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...	
37	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...	
38	241	241	241	241	241	241	241	240	239	233	228	...	...	...	...	...	
39	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	½Cr–½Mo	Smls. pipe	SA–335	P2	K11547	...	...	3	1
2	½Cr–½Mo	Forged pipe	SA–369	FP2	K11547	...	...	3	1
3	½Cr–½Mo	Plate	SA–387	2	K12143	1	...	3	1
4	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	3	1
5	½Cr–½Mo	Smls. tube	SA–213	T2	K11547	...	...	3	1
6	½Cr–½Mo	Cast pipe	SA–426	CP2	J11547	...	...	3	1
7	1Cr–½Mo	Plate	SA–387	12	K11757	1	...	4	1
8	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	22	...	4	1
9	1Cr–½Mo	Cast pipe	SA–426	CP12	J11562	...	...	4	1
10	1Cr–½Mo	Smls. tube	SA–213	T12	K11562	...	...	4	1
11	1Cr–½Mo	Fittings	SA–234	WP12	K12062	1	...	4	1
12	1Cr–½Mo	Smls. pipe	SA–335	P12	K11562	...	...	4	1
13	1Cr–½Mo	Forged pipe	SA–369	FP12	K11562	...	...	4	1
14	1Cr–½Mo	Plate	SA–387	12	K11757	2	...	4	1
15	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	42	...	4	1
16	1Cr–½Mo	Forgings	SA–182	F12	K11564	2	...	4	1
17	1Cr–½Mo	Forgings	SA–336	F12	K11564	...	...	4	1
18	1¼Cr–½Mo	Castings	SA–217	WC6	J12072	...	...	4	1
19	1¼Cr–½Mo	Cast pipe	SA–426	CP11	J12072	...	...	4	1
20	1¼Cr–½Mo	Bar	SA–739	B11	K11797	...	...	4	1
21	1¼Cr–½Mo–Si	Smls. tube	SA–213	T11	K11597	...	...	4	1
22	1¼Cr–½Mo–Si	Fittings	SA–234	WP11	...	1	...	4	1
23	1¼Cr–½Mo–Si	Wld. fittings	SA–234	WP11	...	1/W	...	4	1
24	1¼Cr–½Mo–Si	Smls. pipe	SA–335	P11	K11597	...	...	4	1
25	1¼Cr–½Mo–Si	Forged pipe	SA–369	FP11	K11597	...	...	4	1
26	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	1	...	4	1
27	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	4	1
28	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11572	2	...	4	1
29	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	2	...	4	1
30	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	4	1
31	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	64 < t ≤ 100	11B	2
(13) 32	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	64 < t ≤ 150	11B	2
(13) 33	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	≤64	11B	2
34	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	1	...	5A	1
35	2¼Cr–1Mo	Smls. tube	SA–213	T22	K21590	...	...	5A	1
36	2¼Cr–1Mo	Fittings	SA–234	WP22	K21590	1	...	5A	1
37	2¼Cr–1Mo	Wld. fittings	SA–234	WP22	K21590	1/W	...	5A	1
38	2¼Cr–1Mo	Smls. pipe	SA–335	P22	K21590	...	...	5A	1
39	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	1	...	5A	1
40	2¼Cr–1Mo	Forged pipe	SA–369	FP22	K21590	...	...	5A	1
41	2¼Cr–1Mo	Plate	SA–387	22	K21590	1	...	5A	1
42	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	5A	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	380	205	371	CS–2	...
2	380	205	371	CS–2	...
3	380	230	371	CS–2	...
4	380	230	371	CS–2	G1, G2
5	415	205	371	CS–2	...
6	415	205	371	CS–2	...
7	380	230	371	CS–2	...
8	380	230	371	CS–2	G15
9	415	205	371	CS–2	...
10	415	220	371	CS–2	...
11	415	220	371	CS–2	...
12	415	220	371	CS–2	...
13	415	220	371	CS–2	...
14	450	275	371	CS–2	...
15	450	275	371	CS–2	G16, H2
16	485	275	371	CS–2	...
17	485	275	371	CS–2	...
18	485	275	371	CS–2	...
19	485	275	371	CS–2	...
20	485	310	371	CS–3	...
21	415	205	371	CS–2	...
22	415	205	371	CS–2	...
23	415	205	371	CS–2	...
24	415	205	371	CS–2	...
25	415	205	371	CS–2	...
26	415	240	371	CS–2	...
27	415	240	371	CS–2	G1, G2
28	485	275	371	CS–2	...
29	515	310	371	CS–3	...
30	515	310	371	CS–3	G1, G2, H2
31	725	620	371 (SPT)	CS–5	S1
32	725	620	371 (Cl. MC & SPT)	CS–5	...
33	795	690	371 (Cl. MC & SPT)	HT–1	...
34	415	205	371	CS–2	...
35	415	205	371	CS–2	W2
36	415	205	371	CS–2	W2
37	415	205	371	CS–2	...
38	415	205	371	CS–2	W2
39	415	205	371	CS–2	W2
40	415	205	371	CS–2	W2
41	415	205	371	CS–2	H1, W2
42	415	205	371	CS–2	G1, G2

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
2	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...	
3	126	126	126	126	126	126	126	125	123	121	119	...	...	...	...	...	
4	126	126	126	126	126	126	126	125	123	121	119	...	...	...	...	...	
5	138	134	129	126	124	120	117	114	112	110	108	...	...	...	...	...	
6	138	134	129	126	124	120	117	114	112	110	108	...	...	...	...	...	
7	126	125	124	122	121	121	119	117	115	113	112	...	...	...	...	...	
8	126	125	124	122	121	121	119	117	115	113	112	...	...	...	...	...	
9	138	131	124	120	117	112	109	106	104	103	102	...	...	...	...	...	
10	138	136	132	128	125	120	116	113	112	110	109	...	...	...	...	...	
11	138	136	132	128	125	120	116	113	112	110	109	...	...	...	...	...	
12	138	136	132	128	125	120	116	113	112	110	109	...	...	...	...	...	
13	138	136	132	128	125	120	116	113	112	110	109	...	...	...	...	...	
14	150	150	146	144	143	143	143	141	139	137	136	...	...	...	...	...	
15	150	148	146	144	143	143	143	141	139	137	136	...	...	...	...	...	
16	161	159	158	156	154	150	145	141	139	137	136	...	...	...	...	...	
17	161	161	157	156	154	150	145	141	139	137	136	...	...	...	...	...	
18	161	161	161	161	161	156	151	146	143	141	138	...	...	...	...	...	
19	161	161	161	161	161	156	151	146	143	141	138	...	...	...	...	...	
20	161	161	161	161	161	161	161	161	160	159	155	...	...	...	...	...	
21	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...	
22	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...	
23	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...	
24	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...	
25	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...	
26	138	138	138	138	138	135	131	127	126	123	121	...	...	...	...	...	
27	138	138	138	138	138	135	131	127	126	123	121	...	...	...	...	...	
28	161	161	161	161	161	156	151	146	143	141	138	...	...	...	...	...	
29	172	172	172	172	172	172	169	164	161	158	155	...	...	...	...	...	
30	172	172	172	172	172	172	169	164	161	158	155	...	...	...	...	...	
31	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	
32	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	(**13**)
33	264	264	264	264	264	264	264	264	264	264	263	...	...	...	...	...	(**13**)
34	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...	
35	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...	
36	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...	
37	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...	
38	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...	
39	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...	
40	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...	
41	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...	
42	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...	...	5A	1
2	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...	...	5A	1
3	2¼Cr–1Mo	Cast pipe	SA–426	CP22	J21890	...	...	5A	1
4	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	3	...	5A	1
5	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	3	...	5A	1
6	2¼Cr–1Mo	Plate	SA–387	22	K21590	2	...	5A	1
7	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	5A	1
8	2¼Cr–1Mo	Bar	SA–739	B22	K21390	...	...	5A	1
9	2¼Cr–1Mo	Castings	SA–487	8	J22091	A	...	5C	1
10	2¼Cr–1Mo	Forgings	SA–508	22	K21590	3	...	5C	1
11	2¼Cr–1Mo	Forgings	SA–541	22	K21390	4	≥6	5C	4
12	3Cr–1Mo	Smls. tube	SA–213	T21	K31545	...	...	5A	1
13	3Cr–1Mo	Smls. pipe	SA–335	P21	K31545	...	...	5A	1
14	3Cr–1Mo	Forgings	SA–336	F21	K31545	1	...	5A	1
15	3Cr–1Mo	Forged pipe	SA–369	FP21	K31545	...	...	5A	1
16	3Cr–1Mo	Plate	SA–387	21	K31545	1	...	5A	1
17	3Cr–1Mo	Cast pipe	SA–426	CP21	J31545	...	...	5A	1
18	3Cr–1Mo	Forgings	SA–182	F21	K31545	...	...	5A	1
19	3Cr–1Mo	Forgings	SA–336	F21	K31545	3	...	5A	1
20	3Cr–1Mo	Plate	SA–387	21	K31545	2	...	5A	1
21	5Cr–½Mo	Smls. tube	SA–213	T5	K41545	...	...	5B	1
22	5Cr–½Mo	Fittings	SA–234	WP5	K41545	...	...	5B	1
23	5Cr–½Mo	Wld. fittings	SA–234	WP5	K41545	W	...	5B	1
24	5Cr–½Mo	Smls. pipe	SA–335	P5	K41545	...	...	5B	1
25	5Cr–½Mo	Forged pipe	SA–369	FP5	K41545	...	...	5B	1
26	5Cr–½Mo	Plate	SA–387	5	K41545	1	...	5B	1
27	5Cr–½Mo	Wld. pipe	SA–691	5CR	K41545	...	...	5B	1
28	5Cr–½Mo	Forgings	SA–182	F5	K41545	...	...	5B	1
29	5Cr–½Mo	Plate	SA–387	5	K41545	2	...	5B	1
30	5Cr–½Mo	Castings	SA–217	C5	J42045	...	...	5B	1
31	5Cr–½Mo	Cast pipe	SA–426	CP5	J42045	...	...	5B	1
32	9Cr–1Mo	Smls. tube	SA–213	T9	K90941	...	...	5B	1
33	9Cr–1Mo	Smls. pipe	SA–335	P9	K90941	...	...	5B	1
34	9Cr–1Mo	Forged pipe	SA–369	FP9	K90941	...	...	5B	1
35	9Cr–1Mo	Castings	SA–217	C12	J82090	...	...	5B	1
36	9Cr–1Mo	Cast pipe	SA–426	CP9	J82090	...	...	5B	1
37	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...	...	15E	1
38	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...	...	15E	1
39	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...	...	15E	1
40	9Cr–1Mo–V	Plate	SA–387	91	K90901	2	...	15E	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	485	275	371	CS-2	W2
2	485	275	371 (SPT)	CS-2	...
3	485	275	371	CS-2	...
4	515	310	371	CS-3	W2
5	515	310	371	CS-3	W2
6	515	310	371	CS-3	W2
7	515	310	371	CS-3	G1, G2, H2
8	515	310	371	CS-3	W2
9	585	380	371	CS-3	...
10	585	380	371	CS-2	...
11	725	585	371	CS-3	S3, W1
12	415	205	371	CS-2	...
13	415	205	371	CS-2	...
14	415	205	371	CS-2	...
15	415	205	371	CS-2	...
16	415	205	371	CS-2	...
17	415	205	371	CS-2	...
18	515	310	371	CS-3	...
19	515	310	371	CS-3	...
20	515	310	371	CS-3	...
21	415	205	371	CS-2	...
22	415	205	371	CS-2	...
23	415	205	371	CS-2	...
24	415	205	371	CS-2	...
25	415	205	371	CS-2	...
26	415	205	371	CS-2	...
27	415	205	371	CS-2	G1, G2
28	485	275	371	CS-2	...
29	515	310	371	CS-3	...
30	620	415	371	CS-3	H2
31	620	415	371	CS-3	...
32	415	205	371	CS-2	...
33	415	205	371	CS-2	...
34	415	205	371	CS-2	...
35	620	415	371 (SPT)	CS-3	H2
36	620	415	371	CS-3	...
37	585	415	371	CS-3	...
38	585	415	371	CS-3	...
39	585	415	371	CS-3	...
40	585	415	371	CS-3	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	161	161	161	160	159	156	155	155	154	153	151	...	...	...	...	...
2	161	161	161	160	159	156	155	155	154	153	151	...	...	...	...	...
3	161	161	161	160	159	156	155	155	154	153	151	...	...	...	...	...
4	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
5	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
6	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
7	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
8	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
9	195	195	195	193	191	189	189	188	187	186	184	...	...	...	...	...
10	195	195	195	193	191	189	189	188	187	186	184	...	...	...	...	...
11	241	241	241	241	241	241	240	238	236	234	231	...	...	...	...	...
12	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
13	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
14	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...
15	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
16	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
17	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
18	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
19	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
20	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
21	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
22	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
23	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
24	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
25	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
26	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
27	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
28	161	161	160	158	156	154	154	153	151	149	146	...	...	...	...	...
29	172	172	171	169	167	165	165	164	162	159	156	...	...	...	...	...
30	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
31	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
32	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
33	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
34	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
35	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
36	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
37	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
38	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
39	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
40	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	12Cr	Bar	SA–479	403	S40300	A	...	6	1
2	12Cr	Bar	SA–479	403	S40300	1	...	6	1
3	12Cr–Al	Bar	SA/JIS G4303	SUS405	...	...	...	7	1
4	12Cr–Al	Plate	SA–240	405	S40500	...	...	7	1
5	12Cr–Al	Bar	SA–479	405	S40500	...	...	7	1
6	12½Cr–2Ni	Bar	SA–479	414	S41400	...	...	6	4
7	13Cr	Plate	SA–240	410S	S41008	...	...	7	1
8	13Cr	Forgings	SA–182	F6a	S41000	1	...	6	1
9	13Cr	Bar	SA–479	410	S41000	A	...	6	1
10	13Cr	Bar	SA–479	410	S41000	1	...	6	1
11	13Cr	Forgings	SA–182	F6a	S41000	2	...	6	3
12	13Cr	Castings	SA–217	CA15	J91150	...	...	6	3
13	13Cr	Cast pipe	SA–426	CPCA15	J91150	...	...	6	3
14	13Cr–4Ni	Castings	SA–487	CA6NM	J91540	A	...	6	4
15	13Cr–4Ni	Forgings	SA–182	F6NM	S41500	...	...	6	4
(13) 16	13Cr–4Ni	Bar	SA–479	...	S41500	...	...	6	4
17	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	...	...	...	...
18	17Cr–4Ni–4Cu	Forgings, bar	SA–564	630	S17400	H1150	...	...	...
19	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1150	...	...	...
20	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150	...	...	...
21	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1100	...	...	...
22	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1100	...	...	...
23	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1100	...	...	...
24	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1075	...	...	...
25	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1075	...	...	...
26	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1075	...	...	...
27	27Cr–1Mo	Plate	SA–240	XM–27	S44627	...	...	10I	1
28	27Cr–1Mo	Smls. & wld. tube	SA–268	TPXM–27	S44627	...	...	10I	1
29	27Cr–1Mo	Bar	SA–479	XM–27	S44627	...	...	10I	1
30	Mn–¼Mo–V	Castings	SA–487	2	J13005	A	...	3	3
31	Mn–½Mo	Plate	SA–302	A	K12021	...	...	3	2
32	Mn–½Mo	Wld. pipe	SA–672	H75	K12021	...	...	3	2
33	Mn–½Mo	Plate	SA–302	B	K12022	...	...	3	3
34	Mn–½Mo	Plate	SA–533	A	K12521	1	...	3	3
35	Mn–½Mo	Wld. pipe	SA–672	H80	K12022	...	...	3	3
36	Mn–½Mo	Plate	SA–533	A	K12521	2	...	3	3
37	Mn–½Mo	Plate	SA–533	A	K12521	3	...	11A	4
38	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	1	...	3	3
39	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	2	...	3	3
40	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	3	...	11A	4

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	485	275	371	...	...
2	485	275	371	...	...
3	410	174	371	CS–1	G13
4	415	170	371	CS–1	G13
5	415	170	371	CS–1	G13
6	795	620	371	CS–3	...
7	415	205	371	CS–2	...
8	485	275	371	CS–2	...
9	485	275	371	CS–2	...
10	485	275	371	CS–2	...
11	585	380	371	CS–3	...
12	620	450	371	CS–5	...
13	620	450	371	CS–5	...
14	760	550	371	CS–5	...
15	795	620	371	CS–3	...
16	795	620	371	CS–3	...
17	1035	930	316	HA–7	W1
18	930	725	343	HT–1	G8, W1
19	930	725	343	HT–1	G8, W1
20	930	725	343	HT–1	G8, W1
21	965	795	343	HT–1	G8, W1
22	965	795	343	HT–1	G8, W1
23	965	795	343	HT–1	G8, W1
24	1000	860	343	HT–1	G8, W1
25	1000	860	343	HT–1	G8, W1
26	1000	860	343	HT–1	G8, W1
27	450	275	343	HA–2	G13
28	450	275	343	HA–2	G13
29	450	275	343	HA–2	G13
30	585	365	371 (SPT)	CS–3	...
31	515	310	371	CS–3	...
32	515	310	371	CS–3	G1, G2
33	550	345	371	CS–3	...
34	550	345	371	CS–5	...
35	550	345	371	CS–3	G1, G2
36	620	485	371	CS–5	...
37	690	570	371	CS–5	...
38	550	345	371	CS–5	...
39	620	485	371	CS–5	...
40	690	570	371	CS–5	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
2	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
3	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...	...
4	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...	...
5	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...	...
6	264	264	264	262	260	254	249	244	241	237	232	...	...	...	...	...
7	138	132	126	124	123	120	119	117	115	114	111	...	...	...	...	...
8	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
9	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
10	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
11	195	195	195	194	192	188	186	182	180	176	172	...	...	...	...	...
12	207	207	207	205	203	199	197	193	190	186	182	...	...	...	...	...
13	207	207	207	205	203	199	197	193	190	186	182	...	...	...	...	...
14	253	253	253	250	248	242	238	233	231	227	224	...	...	...	...	...
15	264	264	264	264	264	262	254	244	240	235	229	...	...	...	...	...
16	264	264	264	264	264	262	254	244	240	235	229	...	...	...	...	... (13)
17	345	345	345	345	345	341	331	319	313	...	...	...	...	...	...	...
18	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
19	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
20	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
21	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
22	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
23	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
24	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
25	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
26	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
27	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
28	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
29	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
30	195	195	195	195	195	194	194	190	187	185	182	...	...	...	...	...
31	172	172	172	172	172	172	172	172	172	171	168	...	...	...	...	...
32	172	172	172	172	172	172	172	172	172	171	168	...	...	...	...	...
33	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
34	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
35	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
36	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
37	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
38	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
39	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
40	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Mn–½Mo–½Ni	Plate	SA–302	C	K12039	...	...	3	3
2	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	1	...	3	3
3	Mn–½Mo–½Ni	Wld. pipe	SA–672	J80	K12539	...	...	3	3
4	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	2	...	3	3
5	Mn–½Mo–½Ni	Wld. pipe	SA–672	J90	K12539	...	...	3	3
6	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	3	...	11A	4
7	Mn–½Mo–½Ni	Wld. pipe	SA–672	J100	K12539	...	...	11A	4
8	Mn–½Mo–¾Ni	Plate	SA–302	D	K12054	...	...	3	3
9	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	1	...	3	3
10	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	2	...	3	3
11	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	3	...	11A	4
12	Mn–V	Castings	SA–487	1	J13002	A	...	10A	1
13	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	A	...	3	3
14	½Ni–½Mo–V	Forgings	SA–541	3	K12045	1	...	3	3
15	½Ni–½Mo–V	Forgings	SA–541	3	K12045	2	...	3	3
16	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	64 < t ≤ 100	11B	3
17	¾Ni–½Cr–½Mo–V	Plate	SA–517	F	K11576	...	≤64	11B	3
18	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	1	...	3	3
19	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	1	...	3	3
20	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	2	...	3	3
21	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	2	...	3	3
22	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	1	...	3	3
23	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	2	...	3	3
24	¾Ni–1Mo–¾Cr	Castings	SA–217	WC5	J22000	...	...	4	1
25	1Ni–½Cr–½Mo	Castings	SA–217	WC4	J12082	...	...	4	1
26	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	64 < t ≤ 100	11B	8
27	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	≤64	11B	8
28	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	1	...	...	...
29	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2	...	...	...
30	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	3	...	...	...
31	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	4	...	...	...
32	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	5	...	...	...
33	2½Ni	Castings	SA–352	LC2	J22500	...	...	9A	1
34	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	1	...	...	...
35	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2	...	...	...
36	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	3	...	...	...
37	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	4	...	...	...
38	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	5	...	...	...
39	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	1	...	11A	5
40	3½Ni	Forgings	SA–350	LF3	K32025	...	...	9B	1
41	3½Ni	Plate	SA–203	E	K32018	...	...	9B	1
42	3½Ni	Plate	SA–203	E	K32018	...	...	9B	1
43	3½Ni	Castings	SA–352	LC3	J31550	...	...	9B	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	550	345	371	CS–3	...
2	550	345	371	CS–5	...
3	550	345	371	CS–5	G1, G2
4	620	485	371	CS–5	...
5	620	485	371	CS–5	G1, G2
6	690	570	371	CS–5	...
7	690	570	371	CS–5	G1, G2
8	550	345	371	CS–3	...
9	550	345	371	CS–5	...
10	620	485	371	CS–5	...
11	690	570	371	CS–5	...
12	585	380	371 (SPT)	CS–3	H2
13	620	415	371	CS–3	H2
14	550	345	371	CS–5	...
15	620	450	371	CS–5	...
16	725	620	371 (SPT)	CS–5	S1
17	795	690	371 (SPT)	HT–1	...
18	550	345	371	CS–5	...
19	550	345	371	CS–5	...
20	620	450	371	CS–5	...
21	620	450	371	CS–5	...
22	550	345	371	CS–5	...
23	620	450	371	CS–5	...
24	485	275	371	CS–2	...
25	485	275	371 (SPT)	CS–2	...
26	725	620	371 (SPT)	CS–5	...
27	795	690	371 (SPT)	HT–1	...
28	795	690	371 (SPT)	HT–1	G14, W1
29	930	825	371 (SPT)	HT–1	G6, W1
30	1070	965	371 (SPT)	HT–1	W1
31	1205	1105	371 (SPT)	HT–1	W1
32	1310	1240	371 (SPT)	HT–1	W1
33	485	275	38	CS–2	...
34	795	690	371 (SPT)	HT–1	G14, W1
35	930	825	371 (SPT)	HT–1	G6, W1
36	1070	965	371 (SPT)	HT–1	W1
37	1205	1105	371 (SPT)	HT–1	W1
38	1310	1240	371 (SPT)	HT–1	W1
39	725	585	343	CS–5	G5, H3, S4, W3
40	485	260	371	CS–2	...
41	485	275	149 (SPT)	CS–2	...
42	485	275	260	CS–2	...
43	485	275	38	CS–2	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
2	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
3	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
4	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
5	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
6	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
7	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
8	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
9	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
10	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
11	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
12	196	190	184	181	180	180	180	178	175	172	168	...	...	...	...	...
13	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
14	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
15	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
16	241	241	241	241	241	241	241	241	241	240	236	...	...	...	...	...
17	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
18	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
19	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
20	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
21	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
22	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
23	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
24	161	161	161	161	161	161	159	156	154	152	149	...	...	...	...	...
25	161	161	161	161	161	161	159	156	154	152	149	...	...	...	...	...
26	241	241	241	241	241	241	241	241	241	240	236	...	...	...	...	...
27	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
28	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...
29	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...
30	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...
31	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...
32	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...
33	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...
35	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...
36	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...
37	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...
38	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...
39	241	241	241	241	241	239	237	236	233	230	...	...	...	...	...	...
40	161	160	157	155	152	148	142	133	128	122	116	...	...	...	...	...
41	161	161	161	161	161	...	...	...	...	...	...	...	...	...	...	...
42	161	161	161	161	161	158	151	...	...	...	...	...	...	...	...	...
43	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	3	...	3	3
	2	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	1	...	11A	5
	3	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	1	...	...	...
	4	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2	...	...	...
	5	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	3	...	...	...
	6	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	4	...	...	...
	7	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	5	...	...	...
	8	25Ni–15Cr–2Ti	Forgings, bar	SA–638	660	S66286	...	...	...	...
	9	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	>125	8	1
	10	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...	...	8	1
	11	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316L	...	...	...	8	1
	12	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	≤125	8	1
	13	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...	...	8	1
	14	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...	...	8	1
	15	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	8	1
	16	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316L	S31603	...	...	8	1
(**13**)	17	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	1	...	8	1
(**13**)	18	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	3	...	8	1
(**13**)	19	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	4	...	8	1
	20	16Cr–12Ni–2Mo	Fittings	SA–403	316L	S31603	...	...	8	1
	21	16Cr–12Ni–2Mo	Wld. fittings	SA–403	316L	S31603	WP–W	...	8	1
	22	16Cr–12Ni–2Mo	Bar	SA–479	316L	S31603	...	...	8	1
	23	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...	...	8	1
	24	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316L	S31603	...	...	8	1
	25	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316L	S31603	...	...	8	1
	26	16Cr–12Ni–2Mo	Castings	SA–351	CF3M	J92800	...	...	8	1
	27	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF3M	J92800	...	...	8	1
	28	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...	...	8	1
	29	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF8M	J92900	...	...	8	1
	30	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	>125	8	1
	31	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...	...	8	1
	32	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	>125	8	1
	33	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...	...	8	1
	34	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	≤125	8	1
	35	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...	...	8	1
	36	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...	...	8	1
	37	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
	38	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316	S31600	...	...	8	1
	39	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	1	...	8	1
(**13**)	40	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	3	...	8	1
(**13**)	41	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	4	...	8	1
	42	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	620	485	343	CS-5	...
2	725	585	343	CS-5	H3, S4, W3
3	795	690	371 (SPT)	HT-1	G14, W1
4	930	825	371 (SPT)	HT-1	G6, W1
5	1070	965	371 (SPT)	HT-1	W1
6	1205	1105	371 (SPT)	HT-1	W1
7	1310	1240	371 (SPT)	HT-1	W1
8	895	585	371	HA-5	W1
9	450	170	427	HA-4	G7
10	450	170	427	HA-4	G7
11	480	175	427	HA-4	G7
12	485	170	427	HA-4	G7
13	485	170	427	HA-4	G7
14	485	170	427	HA-4	G7
15	485	170	427	HA-4	G7
16	485	170	427	HA-4	G7
17	485	170	427	HA-4	G7
18	485	170	427	HA-4	G7
19	485	170	427	HA-4	G7
20	485	170	427	HA-4	G7
21	485	170	427	HA-4	G7
22	485	170	427	HA-4	G7
23	485	170	427	HA-4	G7
24	485	170	427	HA-4	G7
25	485	170	427	HA-4	G7
26	485	205	427	HA-4	G7, G13
27	485	205	427	HA-4	G7, G13
28	485	205	427	HA-2	G7, G9, G10, G13
29	485	205	427	HA-2	G7, G13
30	485	205	427	HA-2	G7
31	485	205	427	HA-2	G7, G9, G10
32	485	205	427	HA-2	G7
33	485	205	427	HA-2	G7
34	515	205	427	HA-2	G7, G9
35	515	205	427	HA-2	G7, G9
36	515	205	427	HA-2	G7, G9, G10
37	515	205	427	HA-2	G7
38	515	205	427	HA-2	G7, G9, G10
39	515	205	427	HA-2	G7
40	515	205	427	HA-2	G7
41	515	205	427	HA-2	G7
42	515	205	427	HA-2	G7, G9, G10

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...	...	
2	241	241	241	241	241	239	237	236	233	230	...	...	...	...	...	...	
3	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...	
4	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...	
5	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...	
6	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...	
7	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...	
8	299	299	299	299	299	299	294	289	287	284	282	...	...	...	...	...	
9	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
10	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
11	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
12	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
13	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
14	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
15	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
16	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
17	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	(**13**)
18	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	(**13**)
19	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	(**13**)
20	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
21	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
22	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
23	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
24	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
25	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...	
26	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...	
27	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...	
28	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...	
29	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...	
30	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
31	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
32	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
33	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
34	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
35	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
36	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
37	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
38	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
39	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
40	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	(**13**)
41	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	(**13**)
42	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo	Fittings	SA–403	316	S31600	...	...	8	1
2	16Cr–12Ni–2Mo	Wld. fittings	SA–403	316	S31600	WP–W	...	8	1
3	16Cr–12Ni–2Mo	Bar	SA–479	316	S31600	...	...	8	1
4	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	8	1
5	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316	S31600	...	...	8	1
6	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316	S31600	...	...	8	1
7	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	≤125	8	1
8	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...	...	8	1
9	16Cr–12Ni–2Mo	Plate	SA–240	316H	S31609	...	...	8	1
10	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
11	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316H	S31609	...	...	8	1
12	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	1	...	8	1
(13) 13	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	3	...	8	1
(13) 14	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	4	...	8	1
15	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...	...	8	1
16	16Cr–12Ni–2Mo	Fittings	SA–403	316H	S31609	...	...	8	1
17	16Cr–12Ni–2Mo	Wld. fittings	SA–403	316H	S31609	WP–W	...	8	1
18	16Cr–12Ni–2Mo	Bar	SA–479	316H	S31609	...	...	8	1
19	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316H	S31609	...	...	8	1
20	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316H	S31609	...	...	8	1
21	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316	...	...	...	8	1
22	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	>125	8	1
23	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316LN	S31653	...	...	8	1
24	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	≤125	8	1
25	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316LN	S31653	...	...	8	1
26	16Cr–12Ni–2Mo–N	Plate	SA–240	316LN	S31653	...	...	8	1
27	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316LN	S31653	...	...	8	1
28	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316LN	S31653	...	...	8	1
(13) 29	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	1	...	8	1
(13) 30	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	3	...	8	1
(13) 31	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	4	...	8	1
32	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316LN	S31653	...	...	8	1
33	16Cr–12Ni–2Mo–N	Fittings	SA–403	316LN	S31653	...	...	8	1
34	16Cr–12Ni–2Mo–N	Wld. fittings	SA–403	316LN	S31653	WP–W	...	8	1
35	16Cr–12Ni–2Mo–N	Bar	SA–479	316LN	S31653	...	...	8	1
36	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316LN	S31653	...	...	8	1
37	16Cr–12Ni–2Mo–N	Wld. pipe	SA–813	TP316LN	S31653	...	...	8	1
38	16Cr–12Ni–2Mo–N	Wld. pipe	SA–814	TP316LN	S31653	...	...	8	1
39	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316N	S31651	...	≤125	8	1
40	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...	≤125	8	1
41	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...	≤125	8	1
42	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316N	S31651	...	≤125	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	205	427	HA–2	G7
2	515	205	427	HA–2	G7
3	515	205	427	HA–2	G7
4	515	205	427	HA–2	G7
5	515	205	427	HA–2	G7
6	515	205	427	HA–2	G7
7	515	205	427	HA–2	G7
8	515	205	427	HA–2	G7
9	515	205	427	HA–2	G7
10	515	205	427	HA–2	G7
11	515	205	427	HA–2	G7
12	515	205	427	HA–2	G7
13	515	205	427	HA–2	G7
14	515	205	427	HA–2	G7
15	515	205	427	HA–2	G7
16	515	205	427	HA–2	G7
17	515	205	427	HA–2	G7
18	515	205	427	HA–2	G7
19	515	205	427	HA–2	G7
20	515	205	427	HA–2	G7
21	520	205	427	HA–2	G7
22	485	205	427	HA–2	G7
23	485	205	427	HA–2	G7
24	515	205	427	HA–2	G7
25	515	205	427	HA–2	G7
26	515	205	427	HA–2	G7
27	515	205	427	HA–2	G7
28	515	205	427	HA–2	G7
29	515	205	427	HA–2	G7
30	515	205	427	HA–2	G7
31	515	205	427	HA–2	G7
32	515	205	427	HA–2	G7
33	515	205	427	HA–2	G7
34	515	205	427	HA–2	G7
35	515	205	427	HA–2	G7
36	515	205	427	HA–2	G7
37	515	205	427	HA–2	G7
38	515	205	427	HA–2	G7
39	550	240	427	HA–2	G7
40	550	240	427	HA–2	G7
41	550	240	427	HA–2	G7
42	550	240	427	HA–2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
2	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
3	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
4	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
5	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
6	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
7	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
8	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
9	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
10	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
11	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
12	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
13	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	(**13**)
14	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	(**13**)
15	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
16	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
17	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
18	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
19	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
20	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
21	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
22	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
23	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
24	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
25	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
26	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
27	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
28	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
29	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	(**13**)
30	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	(**13**)
31	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	(**13**)
32	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
33	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
34	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
35	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
36	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
37	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
38	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...	
39	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
40	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
41	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
42	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(13)	1	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	1	≤125	8	1
(13)	2	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	3	≤125	8	1
(13)	3	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	4	≤125	8	1
	4	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...	...	8	1
	5	16Cr–12Ni–2Mo–N	Fittings	SA–403	316N	S31651	...	...	8	1
	6	16Cr–12Ni–2Mo–N	Wld. fittings	SA–403	316N	S31651	WP–W	...	8	1
	7	16Cr–12Ni–2Mo–N	Bar	SA–479	316N	S31651	...	...	8	1
	8	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316N	S31651	...	...	8	1
	9	16Cr–12Ni–2Mo–N	Wld. pipe	SA–813	TP316N	S31651	...	...	8	1
	10	16Cr–12Ni–2Mo–N	Wld. pipe	SA–814	TP316N	S31651	...	...	8	1
	11	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...	≤125	8	1
	12	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	>125	8	1
	13	18Cr–8Ni	Bar	SA/JIS G4303	SUS304L	...	...	...	8	1
	14	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	≤125	8	1
	15	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...	...	8	1
	16	18Cr–8Ni	Plate	SA–240	304L	S30403	...	...	8	1
	17	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	8	1
	18	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304L	S30403	...	...	8	1
	19	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	1	...	8	1
(13)	20	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	3	...	8	1
(13)	21	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	4	...	8	1
	22	18Cr–8Ni	Fittings	SA–403	304L	S30403	...	...	8	1
	23	18Cr–8Ni	Wld. fittings	SA–403	304L	S30403	WP–W	...	8	1
	24	18Cr–8Ni	Bar	SA–479	304L	S30403	...	...	8	1
	25	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	8	1
	26	18Cr–8Ni	Wld. pipe	SA–813	TP304L	S30403	...	...	8	1
	27	18Cr–8Ni	Wld. pipe	SA–814	TP304L	S30403	...	...	8	1
	28	18Cr–8Ni	Castings	SA–351	CF3	J92500	...	...	8	1
	29	18Cr–8Ni	Cast pipe	SA–451	CPF3	J92500	...	...	8	1
	30	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	8	1
	31	18Cr–8Ni	Cast pipe	SA–451	CPF8	J92600	...	...	8	1
	32	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	>125	8	1
	33	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
	34	18Cr–8Ni	Forgings	SA–965	F304	S30400	...	...	8	1
	35	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	>125	8	1
	36	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...	...	8	1
	37	18Cr–8Ni	Bar	SA–479	302	S30200	...	...	8	1
	38	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	≤125	8	1
	39	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...	...	8	1
	40	18Cr–8Ni	Plate	SA–240	304	S30400	...	...	8	1
	41	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	550	240	427	HA–2	G7
2	550	240	427	HA–2	G7
3	550	240	427	HA–2	G7
4	550	240	427	HA–2	G7
5	550	240	427	HA–2	G7
6	550	240	427	HA–2	G7
7	550	240	427	HA–2	G7
8	550	240	427	HA–2	G7
9	550	240	427	HA–2	G7
10	550	240	427	HA–2	G7
11	550	240	427	HA–2	G7
12	450	170	427	HA–3	G7
13	480	175	427	HA–3	G7
14	485	170	427	HA–3	G7
15	485	170	427	HA–3	G7
16	485	170	427	HA–3	G7
17	485	170	427	HA–3	G7
18	485	170	427	HA–3	G7
19	485	170	427	HA–3	G7
20	485	170	427	HA–3	G7
21	485	170	427	HA–3	G7
22	485	170	427	HA–3	G7
23	485	170	427	HA–3	G7
24	485	170	427	HA–3	G7
25	485	170	427	HA–3	G7
26	485	170	427	HA–3	G7
27	485	170	427	HA–3	G7
28	485	205	427	HA–3	G7, G13
29	485	205	427	HA–3	G7, G13
30	485	205	427	HA–1	G7, G9, G10, G13
31	485	205	427	HA–1	G7, G13
32	485	205	427	HA–1	G7, G9, G10
33	485	205	427	HA–1	G7, G9, G10, S2
34	485	205	427	HA–1	G7, G9, G10
35	485	205	427	HA–1	G7
36	485	205	427	HA–1	G7
37	515	205	427	HA–1	G7
38	515	205	427	HA–1	G7, G9, G10
39	515	205	427	HA–1	G7, G9
40	515	205	427	HA–1	G7, G9, G10
41	515	205	427	HA–1	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	(13)
2	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	(13)
3	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	(13)
4	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
5	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
6	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
7	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
8	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
9	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
10	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
11	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...	
12	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
13	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
14	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
15	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
16	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
17	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
18	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
19	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
20	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	(13)
21	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	(13)
22	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
23	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
24	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
25	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
26	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
27	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...	
28	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
29	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
30	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
31	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
32	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
33	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
34	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
35	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
36	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
37	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
38	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
39	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
40	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
41	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304	S30400	...	...	8	1
	2	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	1	...	8	1
(13)	3	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	3	...	8	1
(13)	4	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	4	...	8	1
(13)	5	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
	6	18Cr–8Ni	Fittings	SA–403	304	S30400	...	...	8	1
	7	18Cr–8Ni	Wld. fittings	SA–403	304	S30400	WP–W	...	8	1
	8	18Cr–8Ni	Bar	SA–479	304	S30400	...	...	8	1
	9	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	8	1
	10	18Cr–8Ni	Wld. tube	SA–813	TP304	S30400	...	...	8	1
	11	18Cr–8Ni	Wld. tube	SA–814	TP304	S30400	...	...	8	1
	12	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	≤125	8	1
	13	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...	...	8	1
	14	18Cr–8Ni	Plate	SA–240	304H	S30409	...	...	8	1
	15	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
	16	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304H	S30409	...	...	8	1
	17	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	1	...	8	1
(13)	18	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	3	...	8	1
(13)	19	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	4	...	8	1
	20	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...	...	8	1
	21	18Cr–8Ni	Fittings	SA–403	304H	S30409	...	...	8	1
	22	18Cr–8Ni	Wld. fittings	SA–403	304H	S30409	WP–W	...	8	1
	23	18Cr–8Ni	Bar	SA–479	304H	S30409	...	...	8	1
	24	18Cr–8Ni	Wld. tube	SA–813	TP304H	S30409	...	...	8	1
	25	18Cr–8Ni	Wld. tube	SA–814	TP304H	S30409	...	...	8	1
	26	18Cr–8Ni	Bar	SA/JIS G4303	SUS302	...	...	...	8	1
	27	18Cr–8Ni	Bar	SA/JIS G4303	SUS304	...	...	...	8	1
	28	18Cr–8Ni	Castings	SA–351	CF3A	J92500	...	...	8	1
	29	18Cr–8Ni	Cast pipe	SA–451	CPF3A	J92500	...	...	8	1
	30	18Cr–8Ni	Castings	SA–351	CF8A	J92600	...	...	8	1
	31	18Cr–8Ni	Cast pipe	SA–451	CPF8A	J92600	...	...	8	1
	32	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	>125	8	1
	33	18Cr–8Ni–N	Forgings	SA–965	F304LN	S30453	...	...	8	1
	34	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	≤125	8	1
	35	18Cr–8Ni–N	Smls. tube	SA–213	TP304LN	S30453	...	...	8	1
	36	18Cr–8Ni–N	Plate	SA–240	304LN	S30453	...	...	8	1
	37	18Cr–8Ni–N	Wld. tube	SA–249	TP304LN	S30453	...	...	8	1
	38	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304LN	S30453	...	...	8	1
(13)	39	18Cr–8Ni–N	Wld. pipe	SA–358	304LN	S30453	1	...	8	1
(13)	40	18Cr–8Ni–N	Wld. pipe	SA–358	304LN	S30453	3	...	8	1
(13)	41	18Cr–8Ni–N	Wld. pipe	SA–358	304LN	S30453	4	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	205	427	HA–1	G7, G9, G10
2	515	205	427	HA–1	G7
3	515	205	427	HA–1	G7
4	515	205	427	HA–1	G7
5	515	205	427	HA–1	G7, G9, G10, S5
6	515	205	427	HA–1	G7
7	515	205	427	HA–1	G7
8	515	205	427	HA–1	G7
9	515	205	427	HA–1	G7
10	515	205	427	HA–1	G7
11	515	205	427	HA–1	G7
12	515	205	427	HA–1	G7
13	515	205	427	HA–1	G7
14	515	205	427	HA–1	G7
15	515	205	427	HA–1	G7
16	515	205	427	HA–1	G7
17	515	205	427	HA–1	G7
18	515	205	427	HA–1	G7
19	515	205	427	HA–1	G7
20	515	205	427	HA–1	G7
21	515	205	427	HA–1	G7
22	515	205	427	HA–1	G7
23	515	205	427	HA–1	G7
24	515	205	427	HA–1	G7
25	515	205	427	HA–1	G7
26	520	205	427	HA–1	G7
27	520	205	427	HA–1	G7
28	530	240	371	HA–3	G7, G13
29	530	240	371	HA–3	G7, G13
30	530	240	371	HA–1	G7, G13
31	530	240	371	HA–1	G7, G13
32	485	205	427	HA–1	G7
33	485	205	427	HA–1	G7
34	515	205	427	HA–1	G7
35	515	205	427	HA–1	G7
36	515	205	427	HA–1	G7
37	515	205	427	HA–1	G7
38	515	205	427	HA–1	G7
39	515	205	427	HA–1	G7
40	515	205	427	HA–1	G7
41	515	205	427	HA–1	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
2	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
3	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
4	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
5	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
6	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
7	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
8	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
9	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
10	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
11	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
12	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
13	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
14	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
15	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
16	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
17	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
18	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
19	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
20	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
21	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
22	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
23	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
24	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
25	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
26	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
27	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
28	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...	
29	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...	
30	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...	
31	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...	
32	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
33	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
34	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
35	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
36	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
37	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
38	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
39	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
40	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)
41	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	(**13**)

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni–N	Smls. pipe	SA–376	TP304LN	S30453	...	...	8	1
2	18Cr–8Ni–N	Fittings	SA–403	304LN	S30453	...	...	8	1
3	18Cr–8Ni–N	Wld. fittings	SA–403	304LN	S30453	WP–W	...	8	1
4	18Cr–8Ni–N	Bar	SA–479	304LN	S30453	...	...	8	1
5	18Cr–8Ni–N	Wld. tube	SA–688	TP304LN	S30453	...	...	8	1
6	18Cr–8Ni–N	Wld. tube	SA–813	TP304LN	S30453	...	...	8	1
7	18Cr–8Ni–N	Wld. tube	SA–814	TP304LN	S30453	...	...	8	1
8	18Cr–8Ni–N	Forgings	SA–182	F304N	S30451	...	...	8	1
9	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...	...	8	1
10	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...	...	8	1
11	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304N	S30451	...	...	8	1
12	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	1	...	8	1
(13) 13	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	3	...	8	1
(13) 14	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	4	...	8	1
15	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...	...	8	1
16	18Cr–8Ni–N	Fittings	SA–403	304N	S30451	...	...	8	1
17	18Cr–8Ni–N	Wld. fittings	SA–403	304N	S30451	WP–W	...	8	1
18	18Cr–8Ni–N	Bar	SA–479	304N	S30451	...	...	8	1
19	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...	...	8	1
20	18Cr–8Ni–N	Wld. pipe	SA–813	TP304N	S30451	...	...	8	1
21	18Cr–8Ni–N	Wld. pipe	SA–814	TP304N	S30451	...	...	8	1
22	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...	...	8	1
23	18Cr–8Ni–4Si–N	Bar	SA–479	...	S21800	...	...	8	3
24	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	8	1
25	18Cr–10Ni–Cb	Cast pipe	SA–451	CPF8C	J92710	...	...	8	1
26	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	>125	8	1
27	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...	...	8	1
28	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	>125	8	1
29	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...	...	8	1
30	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	≤125	8	1
31	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...	...	8	1
32	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...	...	8	1
33	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
34	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347	S34700	...	...	8	1
35	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	1	...	8	1
(13) 36	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	3	...	8	1
(13) 37	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	4	...	8	1
38	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...	...	8	1
39	18Cr–10Ni–Cb	Fittings	SA–403	347	S34700	...	...	8	1
40	18Cr–10Ni–Cb	Wld. fittings	SA–403	347	S34700	WP–W	...	8	1
41	18Cr–10Ni–Cb	Bar	SA–479	347	S34700	...	...	8	1
42	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347	S34700	...	...	8	1
43	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP347	S34700	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	205	427	HA–1	G7
2	515	205	427	HA–1	G7
3	515	205	427	HA–1	G7
4	515	205	427	HA–1	G7
5	515	205	427	HA–1	G7
6	515	205	427	HA–1	G7
7	515	205	427	HA–1	G7
8	550	240	427	HA–1	G7
9	550	240	427	HA–1	G7
10	550	240	427	HA–1	G7
11	550	240	427	HA–1	G7
12	550	240	427	HA–1	G7
13	550	240	427	HA–1	G7
14	550	240	427	HA–1	G7
15	550	240	427	HA–1	G7
16	550	240	427	HA–1	G7
17	550	240	427	HA–1	G7
18	550	240	427	HA–1	G7
19	550	240	427	HA–1	G7
20	550	240	427	HA–1	G7
21	550	240	427	HA–1	G7
22	550	240	427	HA–1	G7
23	655	345	427	HA–6	...
24	485	205	427	HA–2	G7, G9, G13
25	485	205	427	HA–2	G7, G13
26	485	205	427	HA–2	G7, G9
27	485	205	427	HA–2	G7, G9
28	485	205	427	HA–2	G7
29	485	205	427	HA–2	G7, G9
30	515	205	427	HA–2	G7, G9
31	515	205	427	HA–2	G7, G9
32	515	205	427	HA–2	G7, G9
33	515	205	427	HA–2	G7
34	515	205	427	HA–2	G7, G9
35	515	205	427	HA–2	G7
36	515	205	427	HA–2	G7
37	515	205	427	HA–2	G7
38	515	205	427	HA–2	G7, G9
39	515	205	427	HA–2	G7
40	515	205	427	HA–2	G7
41	515	205	427	HA–2	G7
42	515	205	427	HA–2	G7
43	515	205	427	HA–2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
2	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
3	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
4	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
5	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
6	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
7	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
8	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
9	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
10	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
11	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
12	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
13	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	(**13**)
14	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	(**13**)
15	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
16	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
17	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
18	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
19	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
20	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
21	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
22	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...	
23	219	198	175	162	152	138	128	123	121	119	118	116	116	115	...	...	
24	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
25	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
26	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
27	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
28	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
29	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...	
30	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
31	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
32	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
33	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
34	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
35	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
36	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	(**13**)
37	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	(**13**)
38	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
39	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
40	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
41	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
42	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
43	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	≤125	8	1
2	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...	...	8	1
3	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...	...	8	1
4	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
5	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347H	S34709	...	...	8	1
6	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...	...	8	1
7	18Cr–10Ni–Cb	Fittings	SA–403	347H	S34709	...	...	8	1
8	18Cr–10Ni–Cb	Wld. fittings	SA–403	347H	S34709	WP–W	...	8	1
9	18Cr–10Ni–Cb	Bar	SA–479	347H	S34709	...	...	8	1
10	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347H	S34709	...	...	8	1
11	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP347H	S34709	...	...	8	1
12	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	≤125	8	1
13	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...	...	8	1
14	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...	...	8	1
15	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
16	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348	S34800	...	...	8	1
17	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	1	...	8	1
(13) 18	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	3	...	8	1
(13) 19	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	4	...	8	1
20	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...	...	8	1
21	18Cr–10Ni–Cb	Fittings	SA–403	348	S34800	...	...	8	1
22	18Cr–10Ni–Cb	Wld. fittings	SA–403	348	S34800	WP–W	...	8	1
23	18Cr–10Ni–Cb	Bar	SA–479	348	S34800	...	...	8	1
24	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348	S34800	...	...	8	1
25	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348	S34800	...	...	8	1
26	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	≤125	8	1
27	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...	...	8	1
28	18Cr–10Ni–Cb	Plate	SA–240	348H	S34809	...	...	8	1
29	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
30	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348H	S34809	...	...	8	1
31	18Cr–10Ni–Cb	Fittings	SA–403	348H	S34809	...	...	8	1
32	18Cr–10Ni–Cb	Wld. fittings	SA–403	348H	S34809	WP–W	...	8	1
33	18Cr–10Ni–Cb	Bar	SA–479	348H	S34809	...	...	8	1
34	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348H	S34809	...	...	8	1
35	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348H	S34809	...	...	8	1
36	18Cr–10Ni–Cb	Bar	SA/JIS G4303	SUS347	...	...	...	8	1
37	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	>10	8	1
38	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	>10	8	1
39	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	>125	8	1
40	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...	...	8	1
41	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	>125	8	1
42	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	205	427	HA–2	G7
2	515	205	427	HA–2	G7
3	515	205	427	HA–2	G7
4	515	205	427	HA–2	G7
5	515	205	427	HA–2	G7
6	515	205	427	HA–2	G7
7	515	205	427	HA–2	G7
8	515	205	427	HA–2	G7
9	515	205	427	HA–2	G7
10	515	205	427	HA–2	G7
11	515	205	427	HA–2	G7
12	515	205	427	HA–2	G7, G9
13	515	205	427	HA–2	G7, G9
14	515	205	427	HA–2	G7, G9
15	515	205	427	HA–2	G7
16	515	205	427	HA–2	G7, G9
17	515	205	427	HA–2	G7
18	515	205	427	HA–2	G7
19	515	205	427	HA–2	G7
20	515	205	427	HA–2	G7, G9
21	515	205	427	HA–2	G7
22	515	205	427	HA–2	G7
23	515	205	427	HA–2	G7
24	515	205	427	HA–2	G7
25	515	205	427	HA–2	G7
26	515	205	427	HA–2	G7
27	515	205	427	HA–2	G7
28	515	205	427	HA–2	G7
29	515	205	427	HA–2	G7
30	515	205	427	HA–2	G7
31	515	205	427	HA–2	G7
32	515	205	427	HA–2	G7
33	515	205	427	HA–2	G7
34	515	205	427	HA–2	G7
35	515	205	427	HA–2	G7
36	520	205	427	HA–2	G7
37	485	170	427	HA–2	G7, G9
38	485	170	427	HA–2	G7
39	485	205	427	HA–2	G7, G9
40	485	205	427	HA–2	G7, G9
41	485	205	427	HA–2	G7
42	485	205	427	HA–2	G7, G9

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
2	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
3	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
4	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
5	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
6	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
7	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
8	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
9	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
10	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
11	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
12	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
13	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
14	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
15	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
16	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
17	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
18	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	(**13**)
19	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	(**13**)
20	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
21	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
22	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
23	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
24	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
25	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
26	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
27	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
28	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
29	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
30	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
31	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
32	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
33	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
34	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
35	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
36	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...	
37	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...	
38	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...	
39	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
40	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
41	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
42	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	≤125	8	1
	2	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	8	1
	3	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	8	1
	4	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
	5	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321	S32100	...	≤10	8	1
	6	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	1	...	8	1
(13)	7	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	3	...	8	1
(13)	8	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	4	...	8	1
	9	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	≤10	8	1
	10	18Cr–10Ni–Ti	Fittings	SA–403	321	S32100	...	...	8	1
	11	18Cr–10Ni–Ti	Wld. fittings	SA–403	321	S32100	WP–W	...	8	1
	12	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...	...	8	1
	13	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321	S32100	...	...	8	1
	14	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321	S32100	...	...	8	1
	15	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	≤125	8	1
	16	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...	...	8	1
	17	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...	...	8	1
	18	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1
	19	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321H	S32109	...	≤5	8	1
	20	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	≤10	8	1
	21	18Cr–10Ni–Ti	Fittings	SA–403	321H	S32109	...	...	8	1
	22	18Cr–10Ni–Ti	Wld. fittings	SA–403	321H	S32109	WP–W	...	8	1
	23	18Cr–10Ni–Ti	Bar	SA–479	321H	S32109	...	...	8	1
	24	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321H	S32109	...	...	8	1
	25	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321H	S32109	...	...	8	1
	26	18Cr–10Ni–Ti	Bar	SA/JIS G4303	SUS321	...	...	...	8	1
	27	18Cr–11Ni	Plate	SA–240	305	S30500	...	...	8	1
	28	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	8	1
	29	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317	S31700	...	...	8	1
	30	20Cr–10Ni	Bar	SA–479	ER308	S30880	...	...	8	1
	31	21Cr–6Ni–9Mn	Forgings	SA–182	FXM–11	S21904	...	...	8	3
	32	21Cr–6Ni–9Mn	Smls. & wld. pipe	SA–312	TPXM–11	S21904	...	...	8	3
	33	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...	...	8	3
	34	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...	...	8	3
	35	22Cr–13Ni–5Mn	Forgings	SA–182	FXM–19	S20910	...	...	8	3
	36	22Cr–13Ni–5Mn	Plate	SA–240	XM–19	S20910	...	...	8	3
	37	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...	...	8	3
	38	22Cr–13Ni–5Mn	Smls. & wld. pipe	SA–312	TPXM–19	S20910	...	...	8	3
	39	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	1	...	8	3
(13)	40	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	3	...	8	3
(13)	41	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	4	...	8	3
	42	22Cr–13Ni–5Mn	Fittings	SA–403	XM–19	S20910	...	...	8	3
	43	22Cr–13Ni–5Mn	Wld. fittings	SA–403	XM–19	S20910	WP–W	...	8	3

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	205	427	HA–2	G7, G9
2	515	205	427	HA–2	G7, G9
3	515	205	427	HA–2	G7, G9
4	515	205	427	HA–2	G7
5	515	205	427	HA–2	G7, G9
6	515	205	427	HA–2	G7
7	515	205	427	HA–2	G7
8	515	205	427	HA–2	G7
9	515	205	427	HA–2	G7, G9
10	515	205	427	HA–2	G7
11	515	205	427	HA–2	G7
12	515	205	427	HA–2	G7
13	515	205	427	HA–2	G7
14	515	205	427	HA–2	G7
15	515	205	427	HA–2	G7
16	515	205	427	HA–2	G7
17	515	205	427	HA–2	G7
18	515	205	427	HA–2	G7
19	515	205	427	HA–2	G7
20	515	205	427	HA–2	G7
21	515	205	427	HA–2	G7
22	515	205	427	HA–2	G7
23	515	205	427	HA–2	G7
24	515	205	427	HA–2	G7
25	515	205	427	HA–2	G7
26	520	205	427	HA–2	G7
27	515	205	427	HA–1	G7
28	515	205	427	HA–2	G7
29	515	205	427	HA–2	G7
30	515	205	427	HA–2	G7
31	620	345	316	HA–6	G7
32	620	345	316	HA–6	G7
33	620	345	316	HA–6	G7
34	620	345	316	HA–6	G7
35	690	380	427	HA–6	G7
36	690	380	427	HA–6	G7
37	690	380	427	HA–6	G7
38	690	380	427	HA–6	G7
39	690	380	427	HA–6	G7
40	690	380	427	HA–6	G7
41	690	380	427	HA–6	G7
42	690	380	427	HA–6	G7
43	690	380	427	HA–6	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
2	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
3	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
4	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
5	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
6	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
7	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	(**13**)
8	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	(**13**)
9	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
10	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
11	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
12	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
13	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
14	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
15	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
16	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
17	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
18	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
19	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
20	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
21	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
22	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
23	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
24	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
25	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
26	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...	
27	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
28	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
29	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...	
30	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...	
31	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...	
32	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...	
33	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...	
34	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...	
35	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
36	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
37	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
38	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
39	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
40	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	(**13**)
41	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	(**13**)
42	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
43	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	

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Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	...	...	8	3
	2	22Cr–13Ni–5Mn	Wld. pipe	SA–813	TPXM–19	S20910	...	...	8	3
	3	22Cr–13Ni–5Mn	Wld. pipe	SA–814	TPXM–19	S20910	...	...	8	3
	4	22Cr–13Ni–5Mn	Forgings	SA–965	FXM–19	S20910	...	...	8	3
	5	23Cr–12Ni	Fittings	SA–403	309	S30900	...	...	8	2
	6	23Cr–12Ni	Wld. fittings	SA–403	309	S30900	WP–W	...	8	2
(**13**)	7	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	1	...	8	2
(**13**)	8	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	3	...	8	2
(**13**)	9	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	4	...	8	2
	10	23Cr–12Ni	Bar	SA–479	309S	S30908	...	...	8	2
	11	23Cr–12Ni	Bar	SA/JIS G4303	SUS309S	...	...	...	8	2
	12	25Cr–12Ni	Castings	SA–351	CH8	J93400	...	...	8	2
	13	25Cr–12Ni	Cast pipe	SA–451	CPH8	J93400	...	...	8	2
	14	25Cr–12Ni	Castings	SA–351	CH20	J93402	...	...	8	2
	15	25Cr–12Ni	Cast pipe	SA–451	CPH20	J93402	...	...	8	2
	16	25Cr–20Ni	Castings	SA–351	CK20	J94202	...	...	8	2
	17	25Cr–20Ni	Cast pipe	SA–451	CPK20	J94202	...	...	8	2
	18	25Cr–20Ni	Forgings	SA–965	F310	S31000	...	...	8	2
	19	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	1	...	8	2
(**13**)	20	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	3	...	8	2
(**13**)	21	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	4	...	8	2
	22	25Cr–20Ni	Fittings	SA–403	310S	S31008	...	...	8	2
	23	25Cr–20Ni	Wld. fittings	SA–403	310S	S31008	WP–W	...	8	2

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	690	380	427	HA–6	G7
2	690	380	427	HA–6	G7
3	690	380	427	HA–6	G7
4	690	380	427	HA–6	G7
5	515	205	427	HA–2	G7
6	515	205	427	HA–2	G7
7	515	205	427	HA–2	G7
8	515	205	427	HA–2	G7
9	515	205	427	HA–2	G7
10	515	205	427	HA–2	G7
11	520	205	427	HA–2	G7
12	450	195	427	HA–3	G7, G9, G10, G13
13	450	195	427	HA–3	G7, G13
14	485	205	427	HA–2	G7
15	485	205	427	HA–2	G7
16	450	195	427	HA–3	G7
17	450	195	427	HA–3	G7
18	515	205	427	HA–2	G7, G9, G11, G12
19	515	205	427	HA–2	G7
20	515	205	427	HA–2	G7
21	515	205	427	HA–2	G7
22	515	205	427	HA–2	G7
23	515	205	427	HA–2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1 and MC, and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Ferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
Line No.	−30 to 40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500	
1	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
2	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
3	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
4	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...	
5	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	
6	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	
7	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	(**13**)
8	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	(**13**)
9	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	(**13**)
10	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	
11	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...	
12	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...	
13	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...	
14	138	138	138	138	137	134	131	128	125	123	120	117	114	111	...	...	
15	138	138	138	138	137	134	131	128	125	123	120	117	114	111	...	...	
16	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...	
17	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...	
18	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	
19	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	
20	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	(**13**)
21	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	(**13**)
22	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	
23	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...	

NOTES TO TABLE 2A

GENERAL NOTES

(a) The following abbreviations are used: Smls., Seamless; Temp., Temperature; and Wld., Welded.

(b) An alternative typeface is used for stress values based on successful experience in service (see Notes E1 and E2).

(c) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–516/SA–516M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–516 Grade 70 shall be used when SA–516M Grade 485 is used in construction.

(d) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(e) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (f) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – EXPERIENCE CRITERION

E1 For values at 350°C and above, the design stress intensity values are based on successful experience in service.

E2 For values at 375°C and above, the design stress intensity values are based on successful experience in service.

NOTES – GENERAL REQUIREMENTS

G1 Material that conforms to Class 10, 13, 20, 23, 30, 33, 40, 43, 50, or 53 is not permitted.

G2 Material that conforms to Class 11 or 12 is not permitted.

G3 Material that conforms to Class 11 or 12 is not permitted when the nominal thickness of the material exceeds 19 mm.

G4 Material that conforms to Class 11 or 12 is not permitted when the nominal thickness of the material exceeds 32 mm.

G5 A product analysis is required on this material.

G6 SA–723 shall not be used for minimum permissible temperature below +5°C.

G7 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}$% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G8 This material has reduced toughness at room temperature after exposure at high temperature. The degree of embrittlement depends on composition, heat treatment, time, and temperature. The lowest temperature of concern is about 250°C. See Nonmandatory Appendix A, A–207.

G9 At temperatures over 550°C, these stress intensity values apply only when the carbon is 0.04% or higher. This note is applicable only when stresses above 550°C are published.

G10 For temperatures above 550°C, these stress intensity values may be used only if the material has been heat treated by heating to a minimum temperature of 1040°C and quenching in water or rapidly cooling by other means. This note is applicable only when stresses above 550°C are published.

G11 These stress intensity values at temperatures of 575°C and above should be used only when assurance is provided that the steel has a predominant grain size not finer than ASTM No. 6. This note is applicable only when stresses above 550°C are published.

G12 These stress intensity values shall be considered basic values to be used when no effort is made to control or check the grain size of the steel.

G13 This steel may be expected to develop embrittlement after service at moderately elevated temperature; see Nonmandatory Appendix A, A–207 and A–208.

G14 All forgings shall have a maximum tensile strength not in excess of 175 MPa above the specified minimum.

G15 Fabricated from SA–387 Grade 12 Class 1 plate.

G16 Fabricated from SA–387 Grade 12 Class 2 plate.

(**13**) G17 A factor of 4 was used for tensile strength to obtain the stress intensity value.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 Annealed.

H2 Normalized and tempered.

H3 Pieces that are formed (after quenching and tempering) at a temperature lower than 15°C below the final tempering temperature shall be heat treated after forming when the extreme fiber strain from forming exceeds 3%. Heat treatment shall be 580°C minimum, but not higher than 15°C below the final tempering temperature for a minimum time of 1 h per 25 mm of thickness. Pieces formed at temperatures within 15°C higher than the original tempering temperature shall be requenched and tempered, either before or after welding into the vessel.

NOTES – SIZE REQUIREMENTS

S1 The maximum thickness of forgings shall not exceed 95 mm (100 mm as heat treated).

S2 Both DN 200 and larger, and schedule 140 and heavier.

S3 The minimum thickness of pressure–retaining parts shall be 6 mm.

NOTES TO TABLE 2A (CONT'D)

NOTES – SIZE REQUIREMENTS (CONT'D)

S4 The minimum thickness of shells, heads, and other pressure–retaining parts shall be 6 mm. The maximum thickness shall be limited only by the ability to develop the specified mechanical properties.

(**13**) S5 Either DN 200 and larger and less than schedule 140 wall, or less than DN 200 and all wall thicknesses.

NOTES – WELDING REQUIREMENTS

W1 Not for welded construction.

W2 In welded construction, for temperatures above 450°C, the weld metal shall have a carbon content of greater than 0.05%.

W3 The following, in addition to the variables in Section IX, QW–250, shall be considered as essential variables requiring requalification of the welding procedure.

(a) An increase in the maximum or a decrease in the minimum specified preheat or interpass temperatures. The specified range of preheat temperatures shall not exceed 85°C.

(b) A change in the thickness T of the welding procedure qualification test plate as follows:

(1) For welded joints that are quenched and tempered after welding, any increase in thickness (the minimum thickness qualified in all cases is 6 mm).

(2) For welded joints that are not quenched and tempered after welding, any change as follows:

(a) for T less than 16 mm, any decrease in thickness (the maximum thickness qualified is $2T$)

(b) for T equal to 16 mm and over, any departure from the range of 16 mm to $2T$

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Table 2B
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm	P-No.
1	...	Plate	SB–171	C71500	M20	64 < t ≤ 125	34
2	...	Plate	SB–171	C71500	O25	64 < t ≤ 125	34
3	...	Plate	SB–171	C71500	M20	≤64	34
4	...	Plate	SB–171	C71500	O25	≤64	34
5	...	Smls. tube	SB–111	C71500	O61	...	34
6	...	Smls. tube	SB–111	C71500	HR50	...	34
7	...	Castings	SB–584	C93700	M01 or M07	...	...
8	67Ni–30Cu	Bar, rod	SB–164	N04400	Annealed	...	42
9	67Ni–30Cu	Smls. pipe & tube	SB–165	N04400	Annealed	>125 O.D.	42
10	67Ni–30Cu	Forgings	SB–564	N04400	Annealed	...	42
11	67Ni–30Cu	Plate	SB–127	N04400	Annealed	...	42
12	67Ni–30Cu	Smls. tube	SB–163	N04400	Annealed	...	42
13	67Ni–30Cu	Smls. pipe & tube	SB–165	N04400	Annealed	≤125 O.D.	42
14	67Ni–30Cu	Bar, rod	SB–164	N04400	Hot worked	...	42
15	67Ni–30Cu	Plate	SB–127	N04400	As rolled	...	42
16	67Ni–30Cu	Bar	SB–164	N04400	Hot worked	...	42
17	67Ni–30Cu	Smls. tube	SB–163	N04400	Stress rel.	...	42
18	67Ni–30Cu	Smls. pipe & tube	SB–165	N04400	Stress rel.	...	42
19	67Ni–30Cu–S	Bar, rod	SB–164	N04405	Annealed	...	42
20	67Ni–30Cu–S	Bar, rod	SB–164	N04405	Hot worked	...	42
21	47Ni–22Cr–9Mo–18Fe	Plate	SB–435	N06002	Annealed	5 < t ≤ 64	43
22	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	N06002	Annealed	1.5 < t ≤ 5	43
23	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	N06002	Solution ann.	≥5	43
24	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	N06002	Solution ann.	...	43
25	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	N06002	Solution ann.	...	43
26	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	N06002	Solution ann.	...	43
27	55Ni–21Cr–13.5Mo	Smls. & wld. fittings	SB–366	N06022	Solution ann.	...	43
28	55Ni–21Cr–13.5Mo	Forgings	SB–462	N06022	Solution ann.	...	43
29	55Ni–21Cr–13.5Mo	Forgings	SB–564	N06022	Solution ann.	...	43
30	55Ni–21Cr–13.5Mo	Rod	SB–574	N06022	Solution ann.	...	43
31	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	N06022	Solution ann.	...	43
32	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	N06022	Solution ann.	...	43
33	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	N06022	Solution ann.	...	43
34	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	N06022	Solution ann.	...	43
35	59Ni–23Cr–16Mo	Wld. fittings	SB–366	N06059	Solution ann.	...	43
36	59Ni–23Cr–16Mo	Smls. fittings	SB–366	N06059	Solution ann.	...	43
37	59Ni–23Cr–16Mo	Forgings	SB–564	N06059	Solution ann.	...	43
38	59Ni–23Cr–16Mo	Rod	SB–574	N06059	Solution ann.	...	43
39	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	N06059	Solution ann.	...	43
40	59Ni–23Cr–16Mo	Wld. pipe	SB–619	N06059	Solution ann.	...	43
41	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	N06059	Solution ann.	...	43
42	59Ni–23Cr–16Mo	Wld. tube	SB–626	N06059	Solution ann.	...	43

Table 2B
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	310	125	260	NFC–4	G1, G4
2	310	125	260	NFC–4	G1, G4
3	345	140	260	NFC–4	G1, G4
4	345	140	260	NFC–4	G1, G4
5	360	125	260	NFC–4	G1
6	495	345	260	NFC–4	G1
7	205	83	204 (SPT)	NFC–1	...
8	485	170	427	NFN–3	G1, G2, G4
9	485	170	427	NFN–3	G1, G4
10	485	170	427	NFN–3	G1, G2, G4
11	485	195	427	NFN–3	G1, G4
12	485	195	427	NFN–3	G1, G4
13	485	195	427	NFN–3	G1, G4
14	515	205	427	NFN–3	E1, G1
15	515	275	427	NFN–3	E1, G1, G4
16	515	275	427	NFN–3	E1, G1
17	585	380	260	NFN–3	G1, G4, W1
18	585	380	260	NFN–3	G1
19	485	170	427	NFN–3	G1, G2, G4
20	515	240	427	NFN–3	G1
21	655	240	427	NFN–15	G1, G4
22	655	240	427	NFN–15	G1, G4
23	655	240	427	NFN–15	G1, G2, G4
24	690	275	427	NFN–15	G1
25	690	275	427	NFN–15	G1, G4
26	690	275	427	NFN–15	G1
27	690	310	427	NFN–10	G1
28	690	310	427	NFN–10	G1
29	690	310	427	NFN–10	G1
30	690	310	427	NFN–10	G1
31	690	310	427	NFN–10	G1
32	690	310	427	NFN–10	G1
33	690	310	427	NFN–10	G1
34	690	310	427	NFN–10	G1
35	690	310	427	NFN–14	G1, G4
36	690	310	427	NFN–14	G1, G4
37	690	310	427	NFN–14	G1, G4
38	690	310	427	NFN–14	G1, G4
39	690	310	427	NFN–14	G1, G4
40	690	310	427	NFN–14	G1, G4
41	690	310	427	NFN–14	G1, G4
42	690	310	427	NFN–14	G1, G4

Table 2B
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	...	...	...	...	...	...
2	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	...	...	...	...	...	...
3	91.7	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	...	...	...	...	...	...
4	91.7	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	...	...	...	...	...	...
5	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	...	...	...	...	...	...
6	165	165	165	165	165	162	159	156	153	150	...	...	...	...	...	...
7	55.2	51.1	47.3	46.8	45.5	44.8	44.2	43.6	...	...	...	...	...	...	...	...
8	115	106	99.7	96.1	93.7	91.8	91.1	90.4	90.3	90.3	90.3	90.3	90.2	89.5	88.9	87.7
9	115	106	99.7	96.1	93.7	91.8	91.1	90.4	90.3	90.3	90.3	90.3	90.2	89.5	88.9	87.7
10	115	106	99.7	96.1	93.7	91.8	91.1	90.4	90.3	90.3	90.3	90.3	90.2	89.5	88.9	87.7
11	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
12	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
13	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
14	138	136	133	131	128	126	124	122	122	121	120	119	118	117	116	**106**
15	172	172	172	172	171	168	165	164	162	161	160	159	158	156	144	**140**
16	172	172	172	172	171	168	165	164	162	161	160	159	158	156	144	**140**
17	195	195	195	195	195	195	195	195	195	195	...	...	...	...	...	...
18	195	195	195	195	195	195	195	195	195	195	...	...	...	...	...	...
19	115	106	99.7	96.1	93.7	91.8	91.1	90.4	90.3	90.3	90.3	90.3	90.2	89.5	88.9	87.7
20	161	151	140	136	132	129	128	128	128	128	128	128	128	127	125	122
21	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
22	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
23	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
24	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
25	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
26	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
27	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
28	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
29	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
30	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
31	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
32	176	176	176	...	176	...	176	...	172	...	164	160	157	155	153	151
33	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
34	176	176	176	...	176	...	176	...	172	...	164	160	157	155	153	151
35	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
36	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
37	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
38	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
39	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
40	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
41	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
42	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178

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Table 2B (Cont'd)
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm	P-No.
1	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	N06600	Hot fin.	>125 O.D.	43
2	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	N06600	Annealed	>125 O.D.	43
3	72Ni–15Cr–8Fe	Smls. tube	SB–163	N06600	Annealed	...	43
4	72Ni–15Cr–8Fe	Bar, rod	SB–166	N06600	Annealed	...	43
5	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	N06600	Annealed	≤125 O.D.	43
6	72Ni–15Cr–8Fe	Plate	SB–168	N06600	Annealed	...	43
7	72Ni–15Cr–8Fe	Forgings	SB–564	N06600	Annealed	...	43
8	72Ni–15Cr–8Fe	Smls. tube	SB–163	N06600	Annealed	$6 < t \le 22$	43
9	60Ni–22Cr–9Mo–3.5Cb	Bar, rod	SB–446	N06625	Annealed	$100 < t \le 250$	43
10	60Ni–22Cr–9Mo–3.5Cb	Plate	SB–443	N06625	Annealed	...	43
11	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe & tube	SB–444	N06625	Annealed	...	43
12	60Ni–22Cr–9Mo–3.5Cb	Bar, rod	SB–446	N06625	Annealed	≤100	43
13	58Ni–29Cr–9Fe	Smls. tube	SB–163	N06690	Annealed	...	43
14	58Ni–29Cr–9Fe	Smls. pipe & tube	SB–167	N06690	Annealed	≤125 O.D.	43
15	58Ni–29Cr–9Fe	Plate	SB–168	N06690	Annealed	...	43
16	58Ni–29Cr–9Fe	Forgings	SB–564	N06690	Annealed	...	43
17	58Ni–29Cr–9Fe	Bar, rod	SB–166	N06690	Cold worked/ann.	...	43
18	58Ni–29Cr–9Fe	Bar, rod	SB–166	N06690	Hot worked	...	43
19	58Ni–29Cr–9Fe	Bar, rod	SB–166	N06690	Hot worked/ann.	...	43
20	58Ni–29Cr–9Fe	Smls. tube	SB–163	N06690	Annealed	$6 < t \le 22$	43
21	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08800	Annealed	...	45
22	42Fe–33Ni–21Cr	Smls. pipe & tube	SB–407	N08800	Annealed	...	45
23	42Fe–33Ni–21Cr	Plate	SB–409	N08800	Annealed	...	45
24	42Fe–33Ni–21Cr	Forgings	SB–564	N08800	Annealed	...	45
25	42Fe–33Ni–21Cr	Bar, rod	SB–408	N08800	Hot fin.	...	45
26	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08800	Annealed	$6 < t \le 22$	45
27	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08800	Cold worked	...	45
28	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08810	Annealed	...	45
29	42Fe–33Ni–21Cr	Smls. pipe & tube	SB–407	N08810	Annealed	...	45
30	42Fe–33Ni–21Cr	Bar, rod	SB–408	N08810	Annealed	...	45
31	42Fe–33Ni–21Cr	Plate	SB–409	N08810	Annealed	...	45
32	42Fe–33Ni–21Cr	Forgings	SB–564	N08810	Annealed	...	45
33	42Ni–21.5Cr–5Mo–2.3Cu	Smls. tube	SB–163	N08825	Annealed	...	45
34	42Ni–21.5Cr–5Mo–2.3Cu	Bar, rod	SB–425	N08825	Annealed	...	45
35	Ti–3Al–2.5V	Plate, sheet, strip	SB–265	R56320	Annealed	...	53
36	Ti–3Al–2.5V	Bar, billet	SB–348	R56320	Annealed	...	53
37	Ti–3Al–2.5V	Forgings	SB–381	R56320	Annealed	...	53
38	Ti–3Al–2.5V	Smls. & wld. tube	SB–338	R56320	Smls. ann.	...	53
39	Ti–3Al–2.5V	Wld. fittings	SB–363	R56320	Smls. ann.	...	53
40	Ti–3Al–2.5V	Smls. pipe	SB–861	R56320	Smls. ann.	...	53
41	Ti–3Al–2.5V	Smls. & wld. tube	SB–338	R56320	Wld. ann.	...	53
42	Ti–3Al–2.5V	Wld. fittings	SB–363	R56320	Wld. ann.	...	53
43	Ti–3Al–2.5V	Wld. pipe	SB–862	R56320	Wld. ann.	...	53

Table 2B (Cont'd)
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Max. Temp. Limit (SPT = Supports Only)	External Pressure Chart No.	Notes
1	515	170	427	NFN–4	G1
2	550	205	427	NFN–4	G1, G4
3	550	240	427	NFN–4	G1, G4
4	550	240	427	NFN–4	G1, G2, G4
5	550	240	427	NFN–4	G1, G4
6	550	240	427	NFN–4	G1, G4
7	550	240	427	NFN–4	G1, G2, G4
8	550	275	427	NFN–21	G1, G3, S1
9	760	345	427	NFN–17	...
10	760	380	427	NFN–17	...
11	825	415	427	NFN–17	...
12	825	415	427	NFN–17	...
13	585	240	427	NFN–4	G1
14	585	240	427	NFN–4	G1
15	585	240	427	NFN–4	G1
16	585	240	427	NFN–4	G1
17	585	240	427	NFN–4	G1
18	585	240	427	NFN–4	G1
19	585	240	427	NFN–4	G1
20	585	275	427	NFN–21	G1, G3, S1
21	515	205	427	NFN–8	G1, G4
22	515	205	427	NFN–8	G1, G4
23	515	205	427	NFN–8	G1, G4
24	515	205	427	NFN–8	G1, G2, G4
25	515	205	427	NFN–8	G1, G2, G4
26	515	275	427	NFN–8	G1, G3, S1
27	570	325	343	NFN–23	G1
28	450	170	427	NFN–9	G1, G4
29	450	170	427	NFN–9	G1, G4
30	450	170	427	NFN–9	G1, G2, G4
31	450	170	427	NFN–9	G1, G4
32	450	170	427	NFN–9	G1, G2, G4
33	585	240	427	NFN–7	G1, G4
34	585	240	427	NFN–7	G2, G4
35	620	485	316	NFT–4	...
36	620	485	316	NFT–4	...
37	620	485	316	NFT–4	...
38	620	485	316	NFT–4	...
39	620	485	316	NFT–4	...
40	620	485	316	NFT–4	...
41	620	485	316	NFT–4	G5
42	620	485	316	NFT–4	G5
43	620	485	316	NFT–4	G5

Table 2B (Cont'd)
Section III, Division 1, Class 1 and Section III, Division 3, Classes TC and SC
Design Stress Intensity Values S_m for Nonferrous Materials

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
2	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
3	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
4	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
5	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
6	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
7	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
8	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
9	230	225	221	218	215	212	209	206	204	201	199	197	194	192	191	189
10	253	247	243	239	236	233	230	227	224	221	219	216	214	212	210	208
11	276	270	265	261	258	254	251	248	245	242	239	236	233	231	229	227
12	276	270	265	261	258	254	251	248	245	242	239	236	233	231	229	227
13	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
14	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
15	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
16	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
17	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
18	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
19	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
20	184	184	184	184	184	184	184	184	184	184	184	184	184	183	183	182
21	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
22	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
23	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
24	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
25	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
26	172	172	172	172	172	172	172	172	172	172	172	171	171	171	170	170
27	191	191	191	191	191	191	190	188	186	185	184	183	183	...	...	...
28	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
29	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
30	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
31	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
32	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
33	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
34	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
35	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
36	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
37	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
38	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
39	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
40	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
41	176	176	167	161	154	147	139	132	126	122	119	117	...	...	...	...
42	176	176	167	161	154	147	139	132	126	122	119	117	...	...	...	...
43	176	176	167	161	154	147	139	132	126	122	119	117	...	...	...	...

NOTES TO TABLE 2B

GENERAL NOTES

(a) The following abbreviations are used: ann., annealed; fin., finished; rel., relieved; Smls., Seamless; and Wld., Welded.

(b) An alternative typeface is used for stress values based on successful experience in service (see Note E1).

(c) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SB–407/SB–407M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SB–407 Grade N08800 shall be used when SB–407M Grade N08800 is used in construction.

(d) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(e) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (f) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – EXPERIENCE CRITERION

(**13**) E1 For values at 425°C, the design stress intensity values are based on successful experience in service.

NOTES – GENERAL REQUIREMENTS

G1 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}$% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G2 Use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.

G3 SB–163 Supplementary Requirement S2 shall be met.

G4 Design stress intensity values for 40°C may be used at temperatures down to –200°C without additional specification requirements.

G5 A joint efficiency factor of 0.85 has been applied in arriving at the maximum allowable design stress intensity values for this material.

NOTES – SIZE REQUIREMENTS

S1 Thickness ≤ 2.5 mm.

NOTES – WELDING REQUIREMENTS

W1 Welding except for seal welds is not permitted.

Table 3
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Ferrous Materials						
	1	Carbon steel	Bolting	SA–307	B	...	...	...
	2	Carbon steel	Bolting	SA–449	1	K04200	...	38 < t ≤ 75
	3	Carbon steel	Bolting	SA–325	...	...	...	...
	4	Carbon steel	Bolting	SA–325	1	K02706	...	32 < t ≤ 38
	5	Carbon steel	Bolting	SA–449	1	K04200	...	25 < t ≤ 38
	6	Carbon steel	Bolting	SA–354	BC	K04100	...	64 < t ≤ 100
	7	Carbon steel	Bolting	SA–325	1	K02706	...	13 < t ≤ 25
	8	Carbon steel	Bolting	SA–449	1	K04200	...	≤25
	9	Carbon steel	Bolting	SA–354	BC	K04100	...	6 < t ≤ 64
	10	Carbon steel	Bolting	SA–354	BD	K04100	...	64 < t ≤ 100
	11	Carbon steel	Bolting	SA–354	BD	K04100	...	6 < t ≤ 64
	12	C–¼Mo	Bolting	SA–320	L7A	G40370	...	≤64
	13	C–¼Mo	Bolting	SA–574	4037	G40370	...	≥16
	14	C–¼Mo	Bolting	SA–574	4042	G40420	...	≥16
	15	C–¼Mo	Bolting	SA–574	4037	G40370	...	≤13
	16	C–¼Mo	Bolting	SA–574	4042	G40420	...	≤13
	17	¾Cr	Bolting	SA–574	5137M	...	...	≥16
	18	¾Cr	Bolting	SA–574	51B37M	...	...	≥16
	19	¾Cr	Bolting	SA–574	5137M	...	...	≤13
	20	¾Cr	Bolting	SA–574	51B37M	...	...	≤13
	21	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	5	50 < t ≤ 100
	22	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	5	≤50
	23	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	4	≤100
	24	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	3	≤100
	25	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	2	≤75
	26	1Cr–1Mn–¼Mo	Bolting	SA–540	B22	H41420	1	≤38
(**13**)	27	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	100 < t ≤ 175
(**13**)	28	1Cr–⅕Mo	Bolting	SA–193	B7M	G41400	...	≤64
(**13**)	29	1Cr–⅕Mo	Bolting	SA–320	L7M	G41400	...	≤64
(**13**)	30	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	64 < t ≤ 100
(**13**)	31	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	≤64
	32	1Cr–⅕Mo	Bolting	SA–320	L7	G41400	...	≤64
	33	1Cr–⅕Mo	Bolting	SA–574	4137	G41370	...	≥16
	34	1Cr–⅕Mo	Bolting	SA–574	4140	G41400	...	≥16
	35	1Cr–⅕Mo	Bolting	SA–574	4142	G41420	...	≥16
	36	1Cr–⅕Mo	Bolting	SA–574	4145	G41450	...	≥16

Table 3
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Ferrous Materials
1	415	...	204	232	NP	232	...
2	620	400	371	343	343	343	...
3	725	560	343	343	343	NP	...
4	725	560	NP	343	343	343	...
5	725	560	371	371	371	343	...
6	795	685	343	343	343	343	...
7	825	635	NP	343	343	343	...
8	825	635	371	343	343	343	...
9	860	750	343	343	343	343	...
10	965	795	343	343	343	343	...
11	1035	895	343	343	343	343	...
12	860	725	NP	343	343	343	W3
13	1170	930	288	288	NP	288	G7, G11, W1
14	1170	930	288	288	NP	288	G7, G11, W1
15	1240	965	288	288	NP	288	G7, G11, W1
16	1240	965	288	288	NP	288	G7, G11, W1
17	1170	930	288	288	NP	NP	G7, G11, W1
18	1170	930	288	288	NP	NP	G7, G11, W1
19	1240	965	288	288	NP	NP	G7, G11, W1
20	1240	965	288	288	NP	NP	G7, G11, W1
21	795	690	371	NP	NP	NP	...
22	825	725	371	NP	NP	NP	...
23	930	825	371	NP	NP	NP	...
24	1000	895	371	371	NP	343	...
25	1070	965	371	NP	NP	NP	...
26	1140	1035	371	NP	NP	NP	...
27	690	515	427	538	427	343	T5
28	690	550	NP	538	427	343	T5
29	690	550	NP	538	427	343	T5
30	795	655	427	538	427	343	T5
31	860	725	427	538	427	343	T5
32	860	725	371	427	427	343	...
33	1170	930	288	NP	NP	NP	G7, G11, W1
34	1170	930	288	288	NP	288	G7, G11, W1
35	1170	930	288	NP	NP	NP	G7, G11, W1
36	1170	930	288	NP	NP	NP	G7, G11, W1

Table 3
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials																	
1	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	...	...	...	...	...	...	...	...	...
2	100	100	100	100	100	100	100	100	100	100	100	100	100	100	...	...	...	...
3	139	139	139	139	139	139	139	139	139	139	139	139	139	...	...	...	...	...
4	139	139	139	139	139	139	139	139	139	139	139	139	139	...	...	...	...	...
5	139	139	139	139	139	139	139	139	139	139	139	139	139	139	...	...	...	...
6	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...	...
7	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...	...
8	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
9	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...	...
10	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
11	207	207	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
12	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...	...
13	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
14	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
15	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
16	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
17	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
18	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
19	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
20	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
21	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
22	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
23	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
24	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
25	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
26	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
27	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	125	*115*	*93.7*
28	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	128	*115*	*93.6*
29	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	128	*115*	*93.6*
30	159	159	159	159	159	159	159	159	159	159	159	159	159	158	153	139	*117*	*93.0*
31	172	172	172	172	172	172	172	172	172	172	172	172	172	172	162	146	*118*	*92.7*
32	172	172	172	172	172	172	172	172	172	172	172	172	172	172	162	146	118	...
33	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
34	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
35	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
36	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...

Table 3
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																	Ferrous Materials	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	*68.4*	*43.8*	*18.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	*68.4*	*43.7*	*18.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
29	*68.4*	*43.7*	*18.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
30	*68.6*	*43.7*	*18.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
31	*68.8*	*43.6*	*18.9*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Ferrous Materials (Cont'd)						
	1	1Cr–1/5Mo	Bolting	SA–574	4137	G41370	...	≤13
	2	1Cr–1/5Mo	Bolting	SA–574	4140	G41400	...	≤13
	3	1Cr–1/5Mo	Bolting	SA–574	4142	G41420	...	≤13
	4	1Cr–1/5Mo	Bolting	SA–574	4145	G41450	...	≤13
(13)	5	1Cr–1/2Mo–V	Bolting	SA–193	B16	K14072	...	100 < *t* ≤ 175
(13)	6	1Cr–1/2Mo–V	Bolting	SA–193	B16	K14072	...	64 < *t* ≤ 100
	7	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	5	50 < *t* ≤ 200
	8	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	5	≤50
(13)	9	1Cr–1/2Mo–V	Bolting	SA–193	B16	K14072	...	≤64
	10	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	4	≤150
	11	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	3	≤150
	12	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	2	≤100
	13	1Cr–1/2Mo–V	Bolting	SA–540	B21	K14073	1	≤100
(13)	14	5Cr–1/2Mo	Bolting	SA–193	B5	K50100	...	≤100
	15	12Cr–1Mo–V–W	Bolting	SA–437	B4C	K91352	...	...
	16	12Cr–1Mo–V–W	Bolting	SA–437	B4B	K91352	...	...
(13)	17	13Cr	Bolting	SA–193	B6	S41000	...	≤100
	18	17Cr–4Ni–4Cu	Bolting	SA–564	630	S17400	H1150	≤200
	19	17Cr–4Ni–4Cu	Bolting	SA–564	630	S17400	H1100	≤200
	20	17Cr–4Ni–4Cu	Bolting	SA–705	630	S17400	H1100	≤200
	21	1/2Ni–1/2Cr–1/4Mo	Bolting	SA–574	8740	G87400	...	≥16
	22	1/2Ni–1/2Cr–1/4Mo	Bolting	SA–574	8740	G87400	...	≤13
	23	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–320	L43	G43400	...	≤100
	24	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–574	4340	G43400	...	≥16
	25	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–574	4340	G43400	...	≤13
(13)	26	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	5	≤150
(13)	27	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	5	150 < *t* ≤ 240
	28	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	4	...
	29	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	3	...
	30	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	2	...
	31	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	1	...
(13)	32	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	5	≤150
(13)	33	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	5	150 < *t* ≤ 240
	34	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	4	...
	35	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	3	...
	36	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	2	...
	37	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	1	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Ferrous Materials (Cont'd)
1	1240	965	288	NP	NP	NP	G7, G11, W1
2	1240	965	288	NP	NP	NP	G7, G11, W1
3	1240	965	288	NP	NP	NP	G7, G11, W1
4	1240	965	288	NP	NP	NP	G7, G11, W1
5	690	585	427	593	427	343	T8
6	760	655	427	593	427	343	T8
7	795	690	371	371	371	NP	...
8	825	725	371	371	371	NP	...
9	860	725	427	593	427	343	T8
10	930	825	371	371	371	343	...
11	1000	895	371	371	371	343	...
12	1070	965	371	371	371	343	...
13	1140	1035	371	371	371	343	...
14	690	550	427	649	427	343	T5
15	795	585	371	371	371	343	...
16	1000	725	371	371	371	343	...
17	760	585	427	482	427	343	T5
18	930	725	NP	343	343	NP	G4
19	965	795	343	343	343	343	G4
20	965	795	343	343	343	343	G4
21	1170	930	288	NP	NP	NP	G7, G11, W1
22	1240	965	288	NP	NP	NP	G7, G11, W1
23	860	725	204	204	371	204	...
24	1170	930	288	288	NP	NP	G7, G11, W1
25	1240	965	288	288	NP	NP	G7, G11, W1
26	795	690	371	371	371	343	...
27	825	725	371	371	371	343	...
28	930	825	371	371	371	343	...
29	1000	895	371	371	371	343	...
30	1070	965	371	371	371	343	...
31	1140	1035	371	371	371	343	...
32	795	690	371	371	371	343	...
33	825	725	371	371	371	343	...
34	930	825	371	371	371	343	...
35	1000	895	371	371	371	343	...
36	1070	965	371	371	371	343	...
37	1140	1035	371	371	371	343	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
2	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
3	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
4	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
5	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	132	119
6	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	147	133
7	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
8	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
9	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	164	148
10	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
11	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
12	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
13	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
14	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	129	*105*	*78.3*
15	147	147	147	147	147	147	147	147	147	147	147	147	147	147	...	...	...	...
16	181	181	181	181	181	181	181	181	181	181	181	181	181	181	...	...	...	...
17	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	*125*	*92.4*
18	181	181	181	181	181	181	181	181	181	181	181	181	181	...	...	...	...	...
19	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
20	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
21	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
22	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
23	172	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...
24	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
25	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
26	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
27	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
28	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
29	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
30	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
31	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
32	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
33	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
34	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
35	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
36	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
37	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																	Ferrous Materials (Cont'd)	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	105	87.7	*61.7*	*34.3*	*13.8*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
6	114	90.4	*61.1*	*34.5*	*13.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	122	91.8	*60.8*	*34.6*	*13.7*	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	*58.5*	*44.4*	*33.9*	*26.3*	*19.5*	*13.0*	*8.79*	...	...	...	...	...	...	...	...	...	...	(**13**)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	*68.4*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Ferrous Materials (Cont'd)						
	1	2Ni–$^{3}/_{4}$Cr–$^{1}/_{3}$Mo–V	Bolting	SA–540	B24V	K24070	3	≤275
	2	3$^{1}/_{2}$Ni–1$^{3}/_{4}$Cr–$^{1}/_{2}$Mo–V	Forgings	SA–508	5	K42365	2	...
	3	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	A	...
	4	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	B	...
(**13**)	5	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	1	...
	6	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	1	...
	7	16Cr–12Ni–2Mo	Bolting	SA–320	B8MA	S31600	1A	...
	8	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	64 < *t* ≤ 75
	9	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	32 < *t* ≤ 38
	10	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	32 < *t* ≤ 38
	11	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	50 < *t* ≤ 64
	12	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	25 < *t* ≤ 32
	13	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	25 < *t* ≤ 32
	14	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	≤50
	15	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	19 < *t* ≤ 25
	16	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	19 < *t* ≤ 25
	17	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	≤19
	18	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	≤19
	19	16Cr–12Ni–2Mo–N	Bolting	SA–193	B8MNA	S31651	1A	...
(**13**)	20	18Cr–8Ni	Bolting	SA–193	B8	S30400	1	...
	21	18Cr–8Ni	Bolting	SA–320	B8	S30400	1	...
	22	18Cr–8Ni	Bolting	SA–320	B8A	S30400	1A	...
	23	18Cr–8Ni	Bolting	SA–193	B8	S30400	2	32 < *t* ≤ 38
	24	18Cr–8Ni	Bolting	SA–320	B8	S30400	2	32 < *t* ≤ 38
	25	18Cr–8Ni	Bolting	SA–193	B8	S30400	2	25 < *t* ≤ 32
	26	18Cr–8Ni	Bolting	SA–320	B8	S30400	2	25 < *t* ≤ 32
	27	18Cr–8Ni	Bolting	SA–193	B8	S30400	2	19 < *t* ≤ 25
	28	18Cr–8Ni	Bolting	SA–320	B8	S30400	2	19 < *t* ≤ 25
	29	18Cr–8Ni	Bolting	SA–193	B8	S30400	2	≤19
	30	18Cr–8Ni	Bolting	SA–320	B8	S30400	2	≤19
	31	18Cr–8Ni–N	Bolting	SA–193	B8NA	S30451	1A	...
	32	18Cr–8Ni–S	Bolting	SA–320	B8F	S30323	1	...
	33	18Cr–8Ni–S	Bolting	SA–320	B8FA	S30323	1A	...
	34	18Cr–8Ni–4Si–N	Bolting	SA–193	B8S	S21800	...	...
	35	18Cr–8Ni–4Si–N	Bolting	SA–193	B8SA	S21800	...	...
(**13**)	36	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	1	...
	37	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	1	...
	38	18Cr–10Ni–Cb	Bolting	SA–320	B8CA	S34700	1A	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Ferrous Materials (Cont'd)
1	1000	895	371	371	371	343	...
2	795	690	NP	38	38	38	...
3	895	585	427	538	427	343	...
4	895	585	427	538	427	343	...
5	515	205	427	816	427	343	G5, G6, T11
6	515	205	204	38	38	38	...
7	515	205	NP	38	38	38	...
8	550	380	NP	538	427	343	G9
9	620	345	427	427	NP	343	G8
10	620	345	NP	38	38	38	G8, G9
11	620	450	NP	538	427	343	G9
12	655	450	427	427	NP	343	G8
13	655	450	NP	38	38	38	G8
14	655	515	NP	538	427	343	G9
15	690	550	427	427	NP	343	G8
16	690	550	NP	38	38	38	G8
17	760	655	427	427	NP	343	G8
18	760	655	NP	38	38	38	G8
19	515	205	427	538	427	343	G5
20	515	205	427	816	427	343	G5, G6, T10
21	515	205	204	38	38	38	...
22	515	205	NP	38	38	38	...
23	690	345	NP	538	427	343	G8, G9
24	690	345	NP	538	427	38	G8
25	725	450	NP	538	427	343	G8, G9
26	725	450	NP	538	427	38	G8
27	795	550	NP	538	427	343	G8, G9
28	795	550	NP	538	427	38	G8
29	860	690	NP	538	427	343	G8, G9
30	860	690	NP	538	427	38	G8
31	515	205	427	538	427	343	G5
32	515	205	204	38	38	38	...
33	515	205	NP	38	38	38	...
34	655	345	NP	510	427	343	...
35	655	345	NP	510	427	343	...
36	515	205	427	816	427	343	G5, G6, T9
37	515	205	204	38	38	38	...
38	515	205	NP	38	38	38	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
2	159	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147
4	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147
5	130	127	121	114	107	103	99.2	95.9	92.8	90.2	88.1	86.1	84.4	83.2	82.0	80.7	80.1	79.5
6	130	127	121	114	107	103	99.2	95.9	...	...	...	...	...	...	...	...	...	...
7	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	130	127	121	114	107	102	99.1	96.7	95.4	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
9	130	127	121	114	107	103	99.2	96.0	92.9	90.1	87.8	86.5	86.2	86.2	86.2	86.2	86.2	...
10	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	130	127	121	115	112	112	112	112	112	112	112	112	112	112	112	112	112	112
12	130	127	121	115	112	112	112	112	112	112	112	112	112	112	112	112	112	...
13	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
15	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	...
16	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	...
18	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	130	127	122	117	112	108	105	102	99.1	96.2	93.7	91.7	89.8	87.9	86.1	84.9	83.0	81.7
20	130	122	114	108	103	99.1	95.7	92.8	90.1	87.2	84.5	83.1	82.5	81.1	79.2	77.3	76.0	74.8
21	130	122	114	108	103	99.1	95.7	92.8	...	...	...	...	...	...	...	...	...	...
22	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	130	122	114	108	103	99.2	95.7	92.6	89.9	87.8	86.5	86.2	86.2	86.2	86.2	86.2	86.2	86.2
24	130	122	114	108	103	99.2	95.7	92.6	89.9	87.8	86.5	86.2	86.2	86.2	86.2	86.2	86.2	86.2
25	130	121	115	114	112	112	112	112	112	112	112	112	112	112	112	112	112	112
26	130	121	115	114	112	112	112	112	112	112	112	112	112	112	112	112	112	112
27	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
28	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
29	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
30	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
31	130	122	112	105	99.0	93.8	89.6	86.3	83.7	81.4	79.6	78.1	76.9	75.6	74.4	73.2	71.9	70.8
32	130	115	101	96.6	93.6	90.6	87.4	84.3	...	...	...	...	...	...	...	...	...	...
33	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	164	163	160	156	150	143	137	132	129	126	123	121	119	118	116	115	115	115
35	164	163	160	156	150	143	137	132	129	126	123	121	119	118	116	115	115	115
36	130	127	122	118	113	109	107	106	104	102	99.7	98.1	96.7	95.0	94.4	93.8	93.1	93.1
37	130	127	122	118	113	109	107	106	...	...	...	...	...	...	...	...	...	...
38	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																	Ferrous Materials (Cont'd)	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	147	147	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	147	147	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	78.8	78.2	77.6	77.1	74.7	*65.5*	*50.4*	*38.6*	*29.6*	*23.0*	*17.7*	*13.4*	*10.4*	*8.05*	...	...	...	(**13**)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	95.1	95.1	95.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	130	130	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	80.5	79.2	78.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	73.6	72.4	70.8	68.9	*65.4*	*51.0*	*41.0*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	(**13**)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	69.0	67.4	66.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	115	115	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	115	115	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
36	92.6	92.4	90.3	*77.2*	*57.3*	*39.9*	*30.0*	*23.2*	*16.3*	*11.2*	*8.93*	*7.08*	*5.77*	*5.32*	...	...	...	(**13**)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Ferrous Materials (Cont'd)						
	1	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2	32 < *t* ≤ 38
	2	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2	32 < *t* ≤ 38
	3	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2	25 < *t* ≤ 32
	4	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2	25 < *t* ≤ 32
	5	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2	19 < *t* ≤ 25
	6	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2	19 < *t* ≤ 25
	7	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2	≤19
	8	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2	≤19
(**13**)	9	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	1	...
	10	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	1	...
	11	18Cr–10Ni–Ti	Bolting	SA–320	B8TA	S32100	1A	...
	12	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2	32 < *t* ≤ 38
	13	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2	32 < *t* ≤ 38
	14	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2	25 < *t* ≤ 32
	15	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2	25 < *t* ≤ 32
	16	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2	19 < *t* ≤ 25
	17	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2	19 < *t* ≤ 25
	18	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2	≤19
	19	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2	≤19
(**13**)	20	18Cr–11Ni	Bolting	SA–193	B8P	S30500	1	...
	21	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2	32 < *t* ≤ 38
	22	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2	25 < *t* ≤ 32
	23	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2	19 < *t* ≤ 25
	24	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2	≤19
	25	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B	>75
	26	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B	>75
	27	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B	≤75
	28	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B	≤75
	29	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A	>75
	30	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A	>75
	31	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A	≤75
	32	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A	≤75
(**13**)	33	22Cr–13Ni–5Mn	Bolting	SA–479	XM–19	S20910	Annealed	...
(**13**)	34	22Cr–13Ni–5Mn	Bolting	SA–479	XM–19	S20910	Hot rolled	75 < *t* ≤ 200
(**13**)	35	22Cr–13Ni–5Mn	Bolting	SA–479	XM–19	S20910	Hot rolled	50 < *t* ≤ 75
(**13**)	36	22Cr–13Ni–5Mn	Bolting	SA–479	XM–19	S20910	Hot rolled	≤50

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Ferrous Materials (Cont'd)
1	690	345	NP	38	38	38	G8
2	690	345	NP	38	38	38	G8
3	725	450	NP	38	38	38	G8
4	725	450	NP	38	38	38	G8
5	795	550	NP	38	38	38	G8
6	795	550	NP	38	38	38	G8
7	860	690	NP	38	38	38	G8
8	860	690	NP	38	38	38	G8
9	515	205	427	816	427	343	G5, G6, T9
10	515	205	204	38	38	38	...
11	515	205	NP	38	38	38	...
12	690	345	NP	538	427	343	G8
13	690	345	NP	38	38	38	G8
14	725	450	NP	538	427	343	G8
15	725	450	NP	38	38	38	G8
16	795	550	NP	538	427	343	G8
17	795	550	NP	38	38	38	G8
18	860	690	NP	538	427	343	G8
19	860	690	NP	38	38	38	G8
20	515	205	NP	816	427	343	T10
21	690	345	NP	538	427	343	G8
22	725	450	NP	538	427	343	G8
23	795	550	NP	538	427	343	G8
24	860	690	NP	538	427	343	G8
25	655	345	427	NP	NP	NP	...
26	655	345	NP	538	427	343	...
27	655	415	427	NP	NP	NP	...
28	655	415	NP	538	427	343	...
29	690	415	427	NP	NP	NP	...
30	690	415	NP	538	427	343	...
31	690	485	427	NP	NP	NP	...
32	690	485	NP	538	427	343	...
33	690	380	NP	621	427	343	T9
34	690	415	NP	621	427	343	T9
35	795	515	NP	621	427	343	T9
36	930	725	NP	621	427	343	T9

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	130	126	122	118	114	110	106	103	99.8	96.8	94.2	92.7	91.1	88.7	87.5	86.3	85.6	85.1
10	130	126	122	118	114	110	106	103	...	...	...	...	...	...	...	...	...	...
11	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	130	126	122	118	114	110	106	103	99.8	96.8	94.2	92.7	91.1	88.7	87.5	86.2	86.2	86.2
13	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	130	127	122	117	114	113	112	112	112	112	112	112	112	112	112	112	112	112
15	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
17	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
19	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	130	122	114	108	103	99.1	95.7	92.8	90.1	87.2	84.5	83.1	82.5	81.1	79.2	77.3	76.0	74.8
21	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	129	127	125
22	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
23	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
24	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
25	86.2	82.3	77.8	75.2	73.0	71.0	69.2	67.6	66.1	64.5	63.0	61.6	60.4	59.1	57.9	57.3	56.7	...
26	86.2	82.7	78.6	76.0	73.7	71.4	69.3	67.6	66.1	64.6	63.0	61.5	60.5	59.8	58.5	57.3	56.7	55.5
27	103	98.9	93.5	90.2	87.4	85.1	83.1	81.4	79.9	78.3	76.4	74.4	72.7	71.4	69.6	68.3	67.1	...
28	103	99.3	94.2	91.0	88.1	85.8	83.8	81.9	80.0	78.2	76.4	74.4	72.7	71.5	70.3	69.0	67.8	66.5
29	103	98.9	93.5	90.2	87.4	85.1	83.1	81.4	79.9	78.3	76.4	74.4	72.7	71.4	69.6	68.3	67.1	...
30	103	99.3	94.2	91.0	88.1	85.8	83.8	81.9	80.1	78.1	76.1	74.7	73.3	71.5	70.3	69.0	67.8	66.5
31	121	115	109	105	102	99.1	96.9	95.0	93.2	91.1	88.9	86.8	85.0	83.1	81.3	80.1	78.8	...
32	121	116	110	106	103	99.9	97.6	95.4	93.3	91.1	88.9	86.8	85.1	83.9	82.0	80.1	78.8	77.6
33	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
34	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
35	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
36	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																		Ferrous Materials (Cont'd)
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	83.8	83.0	77.6	*59.2*	*44.0*	*33.0*	*24.5*	*17.6*	*12.5*	*8.45*	*6.16*	*4.38*	*2.77*	*1.62*	...	...	...	(**13**)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	172	172	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	73.6	72.4	70.8	68.9	*65.4*	*51.0*	*41.0*	*32.9*	*26.5*	*21.3*	*17.2*	*13.9*	*11.1*	*8.73*	...	...	...	(**13**)
21	123	121	118	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	130	130	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	54.7	53.8	52.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	65.3	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	65.3	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	76.4	74.8	72.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	141	139	134	*121*	*80.1*	*53.1*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	141	139	134	*121*	*80.1*	*53.1*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
35	141	139	134	*121*	*80.1*	*53.1*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
36	181	181	165	*114*	*81.8*	*52.7*	...	...	...	...	...	...	...	...	...	...	...	(**13**)

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Nonferrous Materials						
(13)	1	...	Bolting	SB–211	2014	A92014	T6	3–200
(13)	2	...	Bolting	SB–211	2014	A92014	T651	3–200
(13)	3	...	Bolting	SB–211	2024	A92024	T4	3.18–12.69
(13)	4	...	Bolting	SB–211	2024	A92024	T4	12.70–114.30
(13)	5	...	Bolting	SB–211	2024	A92024	T4	114.31–165.10
(13)	6	...	Bolting	SB–211	2024	A92024	T4	165.11–203.2
(13)	7	...	Bolting	SB–211	6061	A96061	T6	3–200
(13)	8	...	Bolting	SB–211	6061	A96061	T651	3–200
(13)	9	...	Rod	SB–187	...	C10200	O60	...
(13)	10	...	Rod	SB–187	...	C11000	O60	...
	11	...	Bar, rod	SB–150	...	C61400	HR50	50 < *t* ≤ 75
	12	...	Bar, rod	SB–150	...	C61400	HR50	25 < *t* ≤ 50
	13	...	Bar, rod	SB–150	...	C61400	HR50	13 < *t* ≤ 25
	14	...	Bar, rod	SB–150	...	C61400	HR50	≤13
(13)	15	...	Bar, rod	SB–150	...	C62300	HR50	>75
(13)	16	...	Bar, rod	SB–150	...	C62300	M20	>75
(13)	17	...	Bar, rod	SB–150	...	C62300	M30	>75
(13)	18	...	Bar, rod	SB–150	...	C62300	O20	>75
(13)	19	...	Bar, rod	SB–150	...	C62300	O25	>75
(13)	20	...	Bar, rod	SB–150	...	C62300	O30	>75
(13)	21	...	Bar, rod	SB–150	...	C62300	HR50	50 < *t* ≤ 75
(13)	22	...	Bar, rod	SB–150	...	C62300	HR50	25 < *t* ≤ 50
(13)	23	...	Bar, rod	SB–150	...	C62300	HR50	13 < *t* ≤ 25
(13)	24	...	Bar, rod	SB–150	...	C62300	HR50	≤13
(13)	25	...	Rod	SB–150	...	C63000	HR50	50 < *t* ≤ 75
(13)	26	...	Bar	SB–150	...	C63000	M20	50 < *t* ≤ 100
(13)	27	...	Bar, rod	SB–150	...	C63000	HR50	25 < *t* ≤ 50
(13)	28	...	Bar, rod	SB–150	...	C63000	HR50	13 < *t* ≤ 25
(13)	29	...	Bar, rod	SB–150	...	C64200	M20	>100
(13)	30	...	Bar, rod	SB–150	...	C64200	M30	>100
(13)	31	...	Bar, rod	SB–150	...	C64200	M10	75 < *t* ≤ 100
(13)	32	...	Bar, rod	SB–150	...	C64200	HR50	50 < *t* ≤ 75
(13)	33	...	Bar, rod	SB–150	...	C64200	HR50	25 < *t* ≤ 50
(13)	34	...	Bar, rod	SB–150	...	C64200	HR50	13 < *t* ≤ 25
(13)	35	...	Bar, rod	SB–150	...	C64200	HR50	≤13

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Nonferrous Materials
1	450	380	204 (Cl. 3 only)	204	204	204	T1, W4
2	450	380	NP	204	204	204	G10, T1, W4
3	425	310	204 (Cl. 3 only)	204	204	204	T1, W4
4	425	290	204 (Cl. 3 only)	204	204	204	T1, W4
5	425	275	204 (Cl. 3 only)	204	204	204	T2, W4
6	400	260	204 (Cl. 3 only)	204	204	204	T2, W4
7	290	240	204 (Cl. 3 only)	204	204	204	T2, W4
8	290	240	NP	204	204	204	G10, T2, W4
9	195	55	NP	204	204	204	T2
10	195	55	NP	204	204	204	T2
11	485	205	260 (Cl. 3 only)	260	260	260	...
12	485	220	260 (Cl. 3 only)	260	260	260	...
13	515	240	260 (Cl. 3 only)	260	260	260	...
14	550	275	260 (Cl. 3 only)	260	260	260	...
15	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
16	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
17	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
18	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
19	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
20	515	205	204 (Cl. 3 only)	316	204	316	T3, W1
21	525	255	204 (Cl. 3 only)	316	204	316	T3, W1
22	580	275	204 (Cl. 3 only)	316	204	316	T3, W1
23	605	305	204 (Cl. 3 only)	316	204	316	T3, W1
24	620	345	204 (Cl. 3 only)	316	204	316	T3, W1
25	585	295	371 (Cl. 3 only)	371	260	343	T4, W4
26	585	295	371 (Cl. 3 only)	371	260	343	T4, W4
27	620	310	371 (Cl. 3 only)	371	260	343	T4, W4
28	690	345	371 (Cl. 3 only)	371	260	343	T4, W4
29	485	170	177 (Cl. 3 only)	316	177	316	T3, W1
30	485	170	177 (Cl. 3 only)	316	177	316	T3, W1
31	485	205	177 (Cl. 3 only)	316	177	316	T3, W4
32	515	240	177 (Cl. 3 only)	316	177	316	T3, W1
33	550	290	177 (Cl. 3 only)	316	177	316	T3, W1
34	585	310	177 (Cl. 3 only)	316	177	316	T3, W1
35	620	310	177 (Cl. 3 only)	316	177	316	T3, W1

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Nonferrous Materials																	
1	89.6	89.6	89.6	89.3	*77.6*	*48.6*	*29.6*	*12.4*	...	...	...	...	...	...	...	...	...	...
2	89.6	89.6	89.6	89.3	*77.6*	*48.6*	*29.6*	*12.4*	...	...	...	...	...	...	...	...	...	...
3	77.9	77.9	77.9	77.2	*71.1*	*46.1*	*33.2*	*20.8*	...	...	...	...	...	...	...	...	...	...
4	72.4	72.4	72.4	72.3	*71.3*	*46.4*	*32.6*	*21.2*	...	...	...	...	...	...	...	...	...	...
5	68.9	68.9	68.9	68.9	68.6	*46.3*	*32.7*	*21.2*	...	...	...	...	...	...	...	...	...	...
6	65.5	65.5	65.5	65.5	65.2	*43.5*	*30.5*	*19.6*	...	...	...	...	...	...	...	...	...	...
7	57.9	57.9	57.9	57.9	57.7	*44.5*	*32.2*	*20.8*	...	...	...	...	...	...	...	...	...	...
8	57.9	57.9	57.9	57.9	57.7	*44.5*	*32.2*	*20.8*	...	...	...	...	...	...	...	...	...	...
9	36.8	31.1	29.7	29.2	28.8	*28.1*	*21.7*	*15.6*	...	...	...	...	...	...	...	...	...	...
10	36.8	31.1	29.7	29.2	28.8	*28.1*	*21.7*	*15.6*	...	...	...	...	...	...	...	...	...	...
11	121	121	121	121	121	121	119	116	112	109	...	...	...	...	...	...	...	...
12	121	121	121	121	121	121	119	116	112	109	...	...	...	...	...	...	...	...
13	121	121	121	121	121	121	119	116	112	109	...	...	...	...	...	...	...	...
14	121	121	121	121	121	121	119	116	112	109	...	...	...	...	...	...	...	...
15	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
16	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
17	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
18	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
19	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
20	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
21	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
22	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
23	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
24	130	130	130	130	129	125	123	115	*94.7*	*77.4*	*70.6*	*66.7*	...	...	...	...	...	...
25	138	138	138	138	138	138	138	138	137	125	*99.9*	*73.5*	*54.1*	*39.0*	...	...	...	...
26	138	138	138	138	138	138	138	138	137	125	*99.9*	*73.5*	*54.1*	*39.0*	...	...	...	...
27	138	138	138	138	138	138	138	138	137	125	*99.9*	*73.5*	*54.1*	*39.0*	...	...	...	...
28	138	138	138	138	138	138	138	138	137	125	*99.9*	*73.5*	*54.1*	*39.0*	...	...	...	...
29	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
30	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
31	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
32	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
33	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
34	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...
35	115	100	95.7	93.0	93.0	89.9	79.2	57.5	*41.5*	*25.1*	*13.6*	*10.2*	...	...	...	...	...	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
															Nonferrous Materials			
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(13)

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Nonferrous Materials (Cont'd)						
	1	...	Rod	SB–98	...	C65100	O60	...
	2	...	Rod	SB–98	...	C65100	H06	25 < *t* ≤ 38
	3	...	Rod	SB–98	...	C65100	H06	13 < *t* ≤ 25
	4	...	Rod	SB–98	...	C65100	H06	≤13
	5	...	Rod	SB–98	...	C65500	O60	...
	6	...	Rod	SB–98	...	C65500	H01	...
	7	...	Rod	SB–98	...	C65500	H02	...
	8	...	Rod	SB–98	...	C66100	O60	...
	9	...	Rod	SB–98	...	C66100	H01	...
	10	...	Rod	SB–98	...	C66100	H02	...
	11	99Ni	Bolting	SB–160	...	N02200	Annealed	...
	12	99Ni	Bolting	SB–160	...	N02200	Hot fin./ann.	...
	13	99Ni	Bolting	SB–160	...	N02200	Cold drawn	...
(13)	14	99Ni–Low C	Bolting	SB–160	...	N02201	Hot fin./ann.	...
(13)	15	67Ni–30Cu	Bolting	SB–164	...	N04400	Annealed	...
(13)	16	67Ni–30Cu	Bolting	SB–164	...	N04400	Hot worked	...
(13)	17	67Ni–30Cu	Bolting	SB–164	...	N04400	Hot worked	...
	18	67Ni–30Cu	Bolting	SB–164	...	N04400	CD–str. rel.	...
	19	67Ni–30Cu	Bolting	SB–164	...	N04400	Cold worked	...
	20	67Ni–30Cu	Bolting	SB–164	...	N04400	CD–str. rel.	...
	21	67Ni–30Cu–S	Bolting	SB–164	...	N04405	Annealed	...
(13)	22	67Ni–30Cu–S	Bolting	SB–164	...	N04405	Annealed	...
	23	67Ni–30Cu–S	Bolting	SB–164	...	N04405	Hot worked	...
(13)	24	67Ni–30Cu–S	Bolting	SB–164	...	N04405	Hot worked	...
	25	67Ni–30Cu–S	Bolting	SB–164	...	N04405	Cold worked	...
	26	67Ni–28Cu–3Al	Bolting	SF–468	...	N05500	Ann./aged	25–38
	27	67Ni–28Cu–3Al	Bolting	SF–468	...	N05500	Ann./aged	6–16
(13)	28	47Ni–22Cr–9Mo–18Fe	Bolting	SB–572	...	N06002	Annealed	...
	29	47Ni–22Cr–19Fe–6Mo	Bolting	SB–581	...	N06007	Solution ann.	>19
	30	47Ni–22Cr–19Fe–6Mo	Bolting	SB–581	...	N06007	Solution ann.	<19
	31	55Ni–21Cr–13.5Mo	Bolting	SB–574	...	N06022	Solution ann.	...
	32	40Ni–29Cr–15Fe–5Mo	Bolting	SB–581	...	N06030	Solution ann.	...
	33	61Ni–16Mo–16Cr	Bolting	SB–574	...	N06455	Solution ann.	...
(13)	34	72Ni–15Cr–8Fe	Bolting	SB–166	...	N06600	Annealed	...
(13)	35	72Ni–15Cr–8Fe	Bolting	SB–166	...	N06600	Hot fin.	...
	36	72Ni–15Cr–8Fe	Bolting	SB–166	...	N06600	Cold drawn	...
	37	72Ni–15Cr–8Fe	Bolting	SB–166	...	N06600	Hot fin.	...
(13)	38	72Ni–15Cr–8Fe	Bolting	SB–166	...	N06600	Hot fin.	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Nonferrous Materials (Cont'd)
1	275	83	177 (Cl. 3 only)	177	177	177	G2
2	515	275	177 (Cl. 3 only)	177	177	177	G2, W2
3	515	310	177 (Cl. 3 only)	177	177	177	G2, W2
4	585	380	177 (Cl. 3 only)	177	177	177	G2, W2
5	360	100	177 (Cl. 3 only)	177	177	177	G2
6	380	165	177 (Cl. 3 only)	NP	177	NP	G2, W2
7	485	260	177 (Cl. 3 only)	NP	177	NP	G2, W2
8	360	100	177 (Cl. 3 only)	177	177	177	G2
9	380	165	177 (Cl. 3 only)	NP	177	NP	G2, W2
10	485	260	177 (Cl. 3 only)	NP	177	NP	G2, W2
11	380	100	316 (Cl. 3 only)	316	316	316	...
12	415	100	316 (Cl. 3 only)	316	316	316	...
13	450	275	316 (Cl. 3 only)	316	316	316	...
14	345	69	316 (Cl. 3 only)	649	427	343	T5
15	485	170	427	482	427	343	T5
16	515	205	427	482	427	343	T5
17	550	275	427	482	427	343	T5
18	580	345	260	260	260	260	G3
19	585	380	260	260	260	260	G3
20	600	415	NP	260	260	260	G3
21	485	170	427	NP	NP	NP	...
22	485	170	NP	482	427	343	T5
23	515	240	427	NP	NP	NP	...
24	515	240	NP	482	427	343	T5
25	585	345	260	260	260	260	G3
26	895	585	NP	260	NP	NP	...
27	895	620	NP	260	NP	NP	...
28	655	240	NP	899	427	343	T11
29	585	205	NP	538	427	343	...
30	620	240	NP	538	427	343	...
31	690	310	NP	427	427	343	...
32	585	240	NP	427	427	343	...
33	690	275	NP	427	427	343	...
34	550	240	427	649	427	343	T6
35	585	240	427	649	427	343	T7
36	620	275	NP	260	260	260	G3, H1
37	620	275	427	NP	NP	NP	...
38	620	275	NP	649	427	343	T7

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Nonferrous Materials (Cont'd)																	
1	55.2	55.2	55.2	55.1	54.4	53.2	51.9	...	...	...	...	...	...	...	...	...	...	...
2	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...
3	77.9	77.9	77.9	77.9	77.9	77.9	77.9	...	...	...	...	...	...	...	...	...	...	...
4	94.5	94.5	94.5	94.5	94.5	94.5	94.5	...	...	...	...	...	...	...	...	...	...	...
5	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
6	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
7	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
8	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
9	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
10	68.9	68.9	68.9	68.9	68.9	67.0	65.1	...	...	...	...	...	...	...	...	...	...	...
11	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
12	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.0	66.4	63.4	59.5	55.8	...	...	...	...	...	...
13	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
14	46.2	45.5	43.9	43.4	43.4	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	41.3	40.7	*40.2*	*35.4*
15	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.3	90.2	88.9	87.9	*78.5*	*60.8*
16	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.3	90.2	88.9	87.9	*78.5*	*60.8*
17	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.3	89.4	89.1	88.4	*64.1*	*35.4*
18	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	...	...	...	...	...	...	...	...
19	115	107	99.5	96.4	95.1	95.1	95.1	95.1	95.1	95.1	...	...	...	...	...	...	...	...
20	115	107	103	103	103	103	103	103	103	103	...	...	...	...	...	...	...	...
21	114	107	99.5	96.0	93.7	92.1	91.1	90.6	90.4	90.3	90.3	90.3	90.3	90.2	88.9	87.6	86.4	...
22	114	107	99.5	96.0	93.7	92.1	91.1	90.6	90.3	90.3	90.3	90.3	90.3	90.3	89.6	87.9	*78.5*	*60.8*
23	129	129	129	129	129	129	129	129	129	129	129	128	127	123	112	101	89.6	...
24	129	129	129	129	129	129	129	129	129	129	129	129	128	123	118	102	*65.1*	*34.9*
25	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	...	...	...	...	...	...	...	...
26	147	147	147	147	147	147	147	147	147	147	...	...	...	...	...	...	...	...
27	155	155	155	155	155	155	155	155	155	155	...	...	...	...	...	...	...	...
28	161	152	142	137	132	128	123	119	115	112	109	107	105	103	103	101	101	100
29	138	137	136	125	114	109	108	106	104	102	100	98.8	97.6	96.4	95.8	95.2	94.6	93.9
30	155	150	143	139	134	130	126	123	121	119	117	115	114	113	112	111	110	110
31	172	172	172	171	169	164	158	152	148	144	141	137	134	132	130	128	127	...
32	147	143	137	131	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
33	172	172	169	164	158	154	150	147	145	143	140	138	136	135	134	132	130	...
34	138	138	138	138	138	138	138	138	138	138	138	138	136	135	134	132	130	118
35	146	146	146	146	146	146	146	146	146	146	146	146	146	145	145	141	140	135
36	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...	...	...	...
37	68.9	67.2	65.2	64.1	63.4	62.9	62.8	62.7	62.7	62.7	62.7	62.6	61.8	61.3	61.4	60.7	60.1	...
38	146	146	146	146	146	146	146	146	146	146	146	146	146	145	145	141	140	135

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																		Nonferrous Materials (Cont'd)
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	*27.9*	*22.7*	*18.7*	*15.6*	*13.0*	*9.96*	*8.20*	...	...	...	...	...	...	...	...	...	...	(**13**)
15	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
16	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
17	*7.84*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	*41.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	*8.07*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	99.5	98.9	98.2	97.9	97.8	*95.9*	*77.1*	*64.8*	*54.9*	*44.8*	*36.1*	*29.2*	*23.7*	*19.0*	*14.8*	*11.2*	*8.14*	(**13**)
29	93.8	93.5	92.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	*86.5*	*58.0*	*40.0*	*26.8*	*18.9*	*15.2*	*15.2*	...	...	...	...	...	...	...	...	...	...	(**13**)
35	134	*119*	*85.4*	*62.9*	*46.2*	*39.4*	*37.9*	...	...	...	...	...	...	...	...	...	...	(**13**)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	134	*119*	*85.4*	*62.9*	*46.2*	*39.4*	*37.9*	...	...	...	...	...	...	...	...	...	...	(**13**)

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Nonferrous Materials (Cont'd)						
(**13**)	1	60Ni–22Cr–9Mo–3.5Cb	Bolting	SB–446	1	N06625	Annealed	...
	2	49Ni–25Cr–18Fe–6Mo	Bolting	SB–581	...	N06975	Solution ann.	...
	3	53Ni–19Cr–19Fe–Cb–Mo	Bolting	SB–637	...	N07718	Solution ann.	≤150
	4	70Ni–16Cr–7Fe–Ti–Al	Bolting	SB–637	2	N07750	Solution ann.	...
	5	26Ni–43Fe–22Cr–5Mo	Bolting	SB–621	...	N08320	Solution ann.	...
	6	46Fe–24Ni–21Cr–6Mo–Cu–N	Bolting	SB–691	...	N08367	Solution ann.	...
(**13**)	7	33Ni–42Fe–21Cr	Bolting	SB–408	...	N08800	Annealed	...
(**13**)	8	33Ni–42Fe–21Cr	Bolting	SB–408	...	N08810	Annealed	...
	9	42Ni–21.5Cr–3Mo–2.3Cu	Bolting	SB–425	...	N08825	Annealed	...
	10	62Ni–28Mo–5Fe	Bolting	SB–335	...	N10001	Annealed	$38 < t \leq 89$
	11	62Ni–28Mo–5Fe	Bolting	SB–335	...	N10001	Annealed	≤38
(**13**)	12	70Ni–16Mo–7Cr–5Fe	Bolting	SB–573	...	N10003	Annealed	...
	13	54Ni–16Mo–15Cr	Bolting	SB–574	...	N10276	Solution ann.	...
	14	65Ni–28Mo–2Fe	Bolting	SB–335	...	N10665	Solution ann.	...
(**13**)	15	21Ni–30Fe–22Cr–18Co–3Mo–3W	Bolting	SB–572	...	R30556	Annealed	...

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-1	VIII-2	XII	Notes
							Nonferrous Materials (Cont'd)
1	825	415	NP	649	427	343	G1, T11
2	585	220	NP	427	427	343	...
3	1275	1035	427	621	427	343	W4, W5
4	1170	795	427	427	427	343	...
5	515	195	NP	427	427	343	...
6	655	310	427	427	NP	NP	...
7	515	205	NP	816	427	343	T10
8	450	170	NP	899	427	343	T11
9	585	240	NP	538	427	343	...
10	690	315	427	427	427	343	...
11	795	315	427	427	427	343	...
12	690	275	NP	704	427	343	T10
13	690	285	NP	677	427	343	T10
14	760	350	NP	427	427	343	...
15	690	310	NP	899	427	343	T12

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
Line No.	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Nonferrous Materials (Cont'd)																	
1	207	207	207	207	207	203	196	190	187	185	183	182	180	179	179	170	168	166
2	147	141	134	130	127	124	122	119	115	112	109	107	105	104	103	101	100	...
3	255	252	247	245	243	241	239	237	236	235	234	233	232	232	231	230	228	227
4	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	...
5	129	124	118	116	113	109	106	104	102	98.9	95.9	93.9	92.7	90.7	88.9	88.3	87.7	...
6	164	164	163	158	155	151	149	147	143	139	136	133	130	128	126	124	122	...
7	129	129	129	126	123	121	119	117	116	114	113	112	111	109	108	107	106	104
8	112	109	105	103	99.8	96.5	93.5	91.4	89.7	87.7	85.5	83.3	81.7	80.4	78.5	76.6	75.4	74.1
9	146	146	146	144	140	137	133	130	127	125	123	122	121	119	119	118	117	116
10	172	172	172	172	172	172	171	169	168	166	165	163	161	158	157	155	153	...
11	79.3	73.2	68.5	67.9	67.5	65.5	63.1	61.8	61.1	59.6	57.8	57.2	57.2	57.2	57.2	57.2	57.2	...
12	172	169	165	162	158	152	146	141	138	138	138	137	134	131	127	124	122	121
13	172	172	171	164	158	152	147	143	139	136	132	128	125	122	120	118	116	115
14	190	190	190	190	190	190	190	190	190	189	189	187	184	183	180	177	174	...
15	172	172	172	166	159	153	148	143	140	137	134	132	130	129	127	126	124	123

Table 3 (Cont'd)
Section III, Classes 2 and 3;* Section VIII, Divisions 1 and 2;† and Section XII
Maximum Allowable Stress Values *S* for Bolting Materials
(*See Maximum Temperature Limits for Restrictions on Class)
(†Use with Part 4.16 of Section VIII, Division 2)

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
																		Nonferrous Materials (Cont'd)
1	165	164	163	163	160	*139*	*88.7*	...	...	...	...	...	...	...	...	...	...	(**13**)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	226	224	222	218	209	202	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	103	102	101	98.1	*85.0*	*64.2*	*44.8*	*29.9*	*16.8*	*11.7*	*8.69*	*7.02*	*6.42*	*5.01*	...	...	...	(**13**)
8	72.9	71.7	70.3	69.4	68.5	*62.6*	*50.5*	*41.2*	*33.6*	*27.7*	*22.6*	*18.3*	*15.0*	*12.1*	*9.78*	*8.04*	*6.70*	(**13**)
9	115	115	114	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	120	119	114	100	*80.1*	*61.3*	*44.9*	*33.7*	*25.5*	*17.5*	...	...	...	...	...	...	...	(**13**)
13	114	114	114	114	*98.5*	*81.5*	*67.1*	*54.6*	*43.1*	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	122	121	119	118	118	115	*92.8*	*76.1*	*62.9*	*51.2*	*41.8*	*34.3*	*28.2*	*22.9*	*18.2*	*14.7*	*12.3*	(**13**)

NOTES TO TABLE 3

GENERAL NOTES

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) For Section VIII applications, stress values in restricted shear, such as in dowel bolts, rivets, or similar construction in which the shearing member is so restricted that the section under consideration would fail without reduction of area, shall be 0.80 times the values in this Table.

(c) For Section VIII applications, stress values in bearing shall be 1.60 times the values in this Table.

(d) These stress values are established from a consideration of strength only and will be satisfactory for average service. For bolted joints where freedom from leakage over a long period of time without retightening is required, lower stress values may be necessary as determined from the relative flexibility of the flange and bolts, and corresponding relaxation properties.

(e) Stress values for –30°C to 40°C are applicable for colder temperatures when toughness requirements of Section III or Section VIII are met.

(f) For bolting with a reported hardness exceeding 350 HB, user is cautioned that under certain conditions of temperature and environment or fatigue conditions, stress corrosion cracking of this high hardness bolting shall be considered.

(g) The following abbreviations are used: ann., annealed; CD, Cold drawn; fin., finished; rel., relieved; str., stress; and wld., welded.

(h) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–193/SA–193M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–193 Grade B6 shall be used when SA–193M Grade B6 is used in construction.

(**13**) (i) An alternative typeface is used for stress values obtained from time–dependent properties (see Notes T1 through T12).

(j) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (k) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 Alloy N06625 in the annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 550°C to 750°C.

G2 Copper–silicon alloys are not always suitable when exposed to certain media and high temperatures, particularly steam above 100°C. The owner, the owner's designated agent, or the user should ensure him/herself that the alloy selected is satisfactory for the service for which it is to be used.

G3 The maximum operating temperature is arbitrarily set at 250°C because harder temper adversely affects design stress in the creep rupture temperature range.

G4 This material has reduced toughness at room temperature after exposure for about 5000 h at 325°C and after shorter exposure above 350°C.

G5 At temperatures above 550°C, these stress values apply only when the carbon is 0.04% or higher on heat analysis.

G6 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating it to a minimum temperature of 1040°C.

G7 The user is cautioned that under certain conditions of temperature and environment or fatigue conditions, stress corrosion of this material shall be considered.

G8 For all design temperatures, the maximum hardness shall be Rockwell C35 immediately under thread roots. The hardness shall be taken on a flat area at least 3 mm across, prepared by removing threads; no more material than necessary shall be removed to prepare the flat area. Hardness determinations shall be made at the same frequency as the tensile tests.

G9 For Section VIII, Division 1 applications, use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.

G10 For stress relieved tempers, stress values for T3 temper can be used for T351, T3510, and T3511; stress values for T4 temper can be used for T451, T4510, and T4511; and stress values for T6 temper can be used for T651, T6510, and T6511.

(**13**) G11 The shipping lot testing method of SA–574, 11.3, is prohibited.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 Design stresses for the cold drawn temper based on hot rolled properties until required data on cold drawn is submitted.

(**13**) **NOTES – TIME–DEPENDENT PROPERTIES [See General Note (i)]**

T1 Allowable stresses for temperatures of 150°C and above are values obtained from time–dependent properties.

T2 Allowable stresses for temperatures of 175°C and above are values obtained from time–dependent properties.

T3 Allowable stresses for temperatures of 230°C and above are values obtained from time–dependent properties.

T4 Allowable stresses for temperatures of 290°C and above are values obtained from time–dependent properties.

T5 Allowable stresses for temperatures of 450°C and above are values obtained from time–dependent properties.

T6 Allowable stresses for temperatures of 480°C and above are values obtained from time–dependent properties.

T7 Allowable stresses for temperatures of 510°C and above are values obtained from time–dependent properties.

T8 Allowable stresses for temperatures of 540°C and above are values obtained from time–dependent properties.

T9 Allowable stresses for temperatures of 565°C and above are values obtained from time–dependent properties.

T10 Allowable stresses for temperatures of 595°C and above are values obtained from time–dependent properties.

T11 Allowable stresses for temperatures of 620°C and above are values obtained from time–dependent properties.

NOTES TO TABLE 3 (CONT'D)
NOTES – TIME–DEPENDENT PROPERTIES [See General Note (i)] (CONT'D)
T12 Allowable stresses for temperatures of 650°C and above are values obtained from time–dependent properties.

NOTES – WELDING REQUIREMENTS
W1 Welding, brazing, and thermal cutting are not permitted.
W2 If welded, the allowable stress values for the annealed condition shall be used.
W3 This material may be welded by the resistance technique.
W4 The stress values given for this material are not applicable when either welding or thermal cutting is employed.
W5 Except for nonstructural tack welds used as a locking device, welding is prohibited for Section VIII, Division 1 use.

Table 4
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Nominal Composition	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
	Ferrous Materials					
1	1Cr–1Mn–¼Mo	SA–540	B22	K41420	5	50 < t ≤ 100
2	1Cr–1Mn–¼Mo	SA–540	B22	K41420	5	≤50
3	1Cr–1Mn–¼Mo	SA–540	B22	K41420	4	≤100
4	1Cr–1Mn–¼Mo	SA–540	B22	K41420	3	≤100
5	1Cr–1Mn–¼Mo	SA–540	B22	K41420	2	≤75
6	1Cr–1Mn–¼Mo	SA–540	B22	K41420	1	≤38
7	1Cr–⅕Mo	SA–193	B7	G41400	...	100 < t ≤ 175
8	1Cr–⅕Mo	SA–193	B7M	G41400	...	≤64
9	1Cr–⅕Mo	SA–193	B7	G41400	...	64 < t ≤ 100
10	1Cr–⅕Mo	SA–193	B7	G41400	...	≤64
11	1Cr–½Mo–V	SA–193	B16	K14072	...	100 < t ≤ 175
12	1Cr–½Mo–V	SA–193	B16	K14072	...	100 < t ≤ 175
13	1Cr–½Mo–V	SA–193	B16	K14072	...	64 < t ≤ 100
14	1Cr–½Mo–V	SA–193	B16	K14072	...	64 < t ≤ 100
15	1Cr–½Mo–V	SA–540	B21	K14073	5	50 < t ≤ 200
16	1Cr–½Mo–V	SA–540	B21	K14073	5	≤50
17	1Cr–½Mo–V	SA–193	B16	K14072	...	≤64
18	1Cr–½Mo–V	SA–193	B16	K14072	...	≤64
19	1Cr–½Mo–V	SA–540	B21	K14073	4	≤150
20	1Cr–½Mo–V	SA–540	B21	K14073	3	≤150
21	1Cr–½Mo–V	SA–540	B21	K14073	2	≤100
22	1Cr–½Mo–V	SA–540	B21	K14073	1	≤100
23	12Cr–1Mo–V–W	SA–437	B4C	K91352	...	...
24	12Cr–1Mo–V–W	SA–437	B4B	K91352	...	...
25	13Cr	SA–193	B6	S41000	...	≤100
26	17Cr–4Ni–4Cu	SA–564	630	S17400	H1100	≤200
27	17Cr–4Ni–4Cu	SA–705	630	S17400	H1100	≤200
28	1¾Ni–¾Cr–¼Mo	SA–320	L43	G43400	...	≤100
29	2Ni–¾Cr–¼Mo	SA–540	B23	H43400	5	150 < t ≤ 238
30	2Ni–¾Cr–¼Mo	SA–540	B23	H43400	5	150 < t ≤ 238
31	2Ni–¾Cr–¼Mo	SA–540	B23	H43400	5	≤150

Table 4
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-2	Notes
					Ferrous Materials
1	795	690	371	371	G4
2	825	725	371	371	G4
3	930	825	371	371	G4
4	1000	895	371	371	G3
5	1070	965	371	371	G3
6	1140	1035	316	316	G1
7	690	515	427	427	G4
8	690	550	NP	427	G4
9	795	655	427	427	G4
10	860	725	427	427	G4
11	690	585	427	NP	...
12	690	585	NP	427	...
13	760	655	427	NP	...
14	760	655	NP	427	...
15	795	690	371	371	G4
16	825	725	371	371	G4
17	860	725	427	NP	...
18	860	725	NP	427	...
19	930	825	371	371	G4
20	1000	895	371	371	G3
21	1070	965	371	371	G3
22	1140	1035	371	371	G1
23	795	585	371	371	...
24	1000	725	371	371	...
25	760	585	371	371	...
26	965	795	343	343	G2
27	965	795	343	343	G2
28	860	725	427	427	G4
29	795	690	371	NP	G4
30	795	690	NP	371	G4
31	825	725	371	371	G4

Table 4
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	−30 to 40	100	150	200	250	300	325	350	375	400	425
	Ferrous Materials										
1	230	218	213	206	200	193	188	183	178	...	...
2	241	229	223	216	210	203	198	192	187	...	...
3	276	262	254	248	241	232	226	220	213	...	...
4	299	284	277	268	261	251	245	238	231	...	...
5	322	306	297	289	281	271	264	257	249	...	...
6	345	328	318	310	301	289	283	...	...	...	...
7	172	160	154	151	146	142	139	136	132	127	122
8	184	171	165	160	156	151	148	145	141	136	130
9	219	202	196	191	185	179	176	171	167	161	154
10	241	223	216	211	205	198	194	190	185	178	170
11	195	188	183	179	175	170	168	166	163	160	156
12	195	189	185	182	178	174	171	168	163	159	155
13	219	210	205	200	195	190	188	185	182	179	175
14	219	211	207	203	199	194	191	187	183	178	173
15	230	221	216	211	206	200	198	195	192	...	...
16	241	232	226	221	216	211	208	205	201	...	...
17	241	232	226	221	216	211	208	205	201	197	193
18	241	234	229	224	220	215	212	207	202	197	191
19	276	266	258	253	247	241	237	234	230	...	...
20	299	288	280	274	268	261	257	253	249	...	...
21	322	310	302	295	288	281	277	273	268	...	...
22	345	332	323	316	308	301	297	292	287	...	...
23	195	187	181	177	173	170	169	167	165	...	...
24	241	230	223	218	214	210	207	206	205	...	...
25	195	185	180	175	170	166	164	162	160	...	...
26	264	242	234	226	220	215	212	210	...	...	...
27	264	242	234	226	220	215	212	210	...	...	...
28	241	226	220	212	205	197	192	187	181	174	167
29	230	218	213	206	200	193	188	183	178	...	...
30	230	218	212	206	201	193	188	183	178	...	...
31	241	229	223	216	210	203	198	192	187	...	...

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Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

	Line No.	Nominal Composition	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
		Ferrous Materials (Cont'd)					
	1	2Ni–¾Cr–¼Mo	SA-540	B23	H43400	4	≤238
	2	2Ni–¾Cr–¼Mo	SA-540	B23	H43400	3	≤238
	3	2Ni–¾Cr–¼Mo	SA-540	B23	H43400	2	≤238
	4	2Ni–¾Cr–¼Mo	SA-540	B23	H43400	1	≤200
	5	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	5	150 < t ≤ 238
	6	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	5	150 < t ≤ 238
	7	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	5	≤150
	8	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	4	≤238
(**13**)	9	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	3	≤238
	10	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	2	≤238
	11	2Ni–¾Cr–⅓Mo	SA-540	B24	K24064	1	≤200
	12	2Ni–¾Cr–⅓Mo–V	SA-540	B24V	K24070	3	≤275
	13	25Ni–15Cr–2Ti	SA-453	660	S66286	A	...
	14	25Ni–15Cr–2Ti	SA-453	660	S66286	B	...
	15	16Cr–12Ni–2Mo	SA-193	B8M	S31600	1/Sol. treat.	...
(**13**)	16	16Cr–12Ni–2Mo	SA-193	B8MA	S31600	1A/Sol. treat.	...
	17	16Cr–12Ni–2Mo–N	SA-193	B8MNA	S31651	1A/Sol. treat.	...
	18	18Cr–8Ni	SA-193	B8	S30400	1/Sol. treat.	...
(**13**)	19	18Cr–8Ni	SA-193	B8A	S30400	1A/Sol. treat.	...
	20	18Cr–8Ni–N	SA-193	B8NA	S30451	1A/Sol. treat.	...
	21	18Cr–8Ni–4Si–N	SA-193	B8S	S21800	Sol. treat.	...
	22	18Cr–8Ni–4Si–N	SA-193	B8SA	S21800	Sol. treat.	...
	23	18Cr–10Ni–Cb	SA-193	B8C	S34700	1/Sol. treat.	...
	24	18Cr–10Ni–Ti	SA-193	B8T	S32100	1/Sol. treat.	...
	25	19Cr–9Ni–Mo–W	SA-453	651	S63198	B	>75
	26	19Cr–9Ni–Mo–W	SA-453	651	S63198	B	≤75
	27	19Cr–9Ni–Mo–W	SA-453	651	S63198	A	>75
	28	19Cr–9Ni–Mo–W	SA-453	651	S63198	A	≤75
	29	22Cr–13Ni–5Mn	SA-193	B8R	S20910	1C/Sol. treat.	...
	30	22Cr–13Ni–5Mn	SA-193	B8RA	S20910	Sol. treat.	...

Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) III	VIII-2	Notes
					Ferrous Materials (Cont'd)
1	930	825	371	371	G4
2	1000	895	371	371	G3
3	1070	965	371	371	G3
4	1140	1035	316	316	G1
5	795	690	371	NP	G4
6	795	690	NP	371	G4
7	825	725	371	371	G4
8	930	825	371	371	G4
9	1000	895	371	371	G3
10	1070	965	371	371	G3
11	1140	1035	316	316	G1
12	1000	895	371	371	G3
13	895	585	427	427	...
14	895	585	427	427	...
15	515	205	427	427	...
16	515	205	427	427	...
17	515	205	427	427	...
18	515	205	427	427	...
19	515	205	427	427	...
20	515	205	427	427	...
21	655	345	427	427	...
22	655	345	427	427	...
23	515	205	427	427	...
24	515	205	427	427	...
25	655	345	427	427	...
26	655	415	427	427	...
27	690	415	427	427	...
28	690	485	427	427	...
29	690	380	427	427	...
30	690	380	427	427	...

Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding											
	−30 to 40	100	150	200	250	300	325	350	375	400	425	
	Ferrous Materials (Cont'd)											
1	276	262	254	248	241	232	226	220	213	...	...	
2	299	284	277	268	261	251	245	238	231	...	...	
3	322	306	297	289	281	271	264	257	249	...	...	
4	345	328	318	310	301	289	283	...	...	...	...	
5	230	218	213	206	200	193	188	183	178	...	...	
6	230	218	212	206	201	193	188	183	178	...	...	
7	241	229	223	216	210	203	198	192	187	...	...	
8	276	262	254	248	241	232	226	220	213	...	...	
9	299	284	277	268	261	251	245	238	231	...	...	(**13**)
10	322	306	297	289	281	271	264	257	249	...	...	
11	345	328	318	310	301	289	283	...	...	...	...	
12	299	284	277	268	261	251	245	238	231	...	...	
13	195	191	188	186	183	180	179	177	176	174	172	
14	195	191	188	186	183	180	179	177	176	174	172	
15	68.9	58.4	53.7	49.9	46.8	44.1	43.0	42.1	41.3	40.6	40.0	
16	68.9	58.4	53.7	49.9	46.8	44.1	43.0	42.1	41.3	40.6	40.0	(**13**)
17	68.9	60.6	55.8	52.7	49.5	47.0	45.7	44.6	44.0	42.7	42.1	
18	68.9	56.3	51.6	47.9	45.3	42.7	41.8	41.2	40.6	39.7	38.7	
19	68.9	56.3	51.6	47.9	45.3	42.7	41.8	41.2	40.6	39.7	38.7	(**13**)
20	68.9	55.4	49.5	44.5	41.8	39.7	39.1	38.2	37.2	37.2	36.6	
21	115	87.3	75.7	68.7	64.2	61.2	60.5	59.6	58.6	58.6	58.0	
22	115	87.3	75.7	68.7	64.2	61.2	60.5	59.6	58.6	58.6	58.0	
23	68.9	62.9	59.2	55.5	52.2	50.2	49.3	48.3	47.5	47.1	46.9	
24	68.9	61.4	57.1	53.4	50.2	47.6	46.5	45.5	44.7	44.1	43.5	
25	115	104	97.8	92.1	88.3	84.0	82.0	80.4	79.1	77.8	76.6	
26	138	125	117	111	105	101	99.2	97.0	94.8	92.9	91.1	
27	138	125	117	111	105	101	99.2	97.0	94.8	92.9	91.1	
28	161	146	136	129	123	118	116	113	111	108	106	
29	126	107	99.8	94.2	89.7	86.2	85.3	84.5	83.2	82.0	81.4	
30	126	107	99.8	94.2	89.7	86.2	85.3	84.5	83.2	82.0	81.4	

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Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Nominal Composition	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/Condition/Temper	Size/Thickness, mm
	Nonferrous Materials					
1	67Ni–30Cu	SB–164	...	N04400	Annealed	...
2	67Ni–30Cu	SB–164	...	N04400	Hot worked	...
3	67Ni–30Cu	SB–164	...	N04400	Hot worked	...
4	67Ni–30Cu	SB–164	...	N04400	CD–str. rel.	...
5	67Ni–30Cu	SB–164	...	N04400	CD–str. rel.	...
6	67Ni–30Cu	SB–164	...	N04400	As drawn	...
7	67Ni–30Cu	SB–164	...	N04400	CD–str. rel.	...
8	67Ni–30Cu	SB–164	...	N04400	As drawn	...
9	67Ni–30Cu–S	SB–164	...	N04405	Annealed	...
10	67Ni–30Cu–S	SB–164	...	N04405	Hot worked	...
11	67Ni–30Cu–S	SB–164	...	N04405	As drawn	...
12	53Ni–19Cr–19Fe–Cb–Mo	SB–637	...	N07718	...	≤150
13	70Ni–16Cr–7Fe–Ti–Al	SB–637	2	N07750	...	<100

Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted)		Notes
			III	VIII-2	
					Nonferrous Materials
1	485	170	427	427	...
2	515	205	427	427	...
3	550	275	427	427	...
4	550	345	260	260	...
5	580	380	260	260	...
6	585	380	260	260	...
7	600	415	260	260	...
8	760	585	260	260	...
9	485	170	427	427	...
10	515	240	427	427	...
11	585	345	260	260	...
12	1275	1035	427	427	...
13	1170	795	427	427	...

Table 4 (Cont'd)
Section III, Classes 1, TC, and SC; and Section VIII, Division 2*
Design Stress Intensity Values S_m for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Design Stress Intensity, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	−30 to 40	100	150	200	250	300	325	350	375	400	425
	Nonferrous Materials										
1	57.2	49.8	47.5	45.5	45.5	45.5	45.5	45.5	45.5	44.7	43.5
2	68.9	60.0	56.5	54.5	54.5	54.5	54.5	54.5	54.4	53.6	52.5
3	91.7	79.8	75.8	73.1	73.1	73.1	73.1	73.1	73.0	71.7	69.8
4	114	99.6	95.1	91.2	91.0	...	...	...	...	...	...
5	126	110	104	101	101	...	...	...	...	...	...
6	126	110	104	101	101	...	...	...	...	...	...
7	138	120	113	109	109	...	...	...	...	...	...
8	195	170	161	155	155	...	...	...	...	...	...
9	57.2	49.8	47.5	45.5	45.5	45.5	45.5	45.5	45.5	44.7	43.5
10	80.7	70.2	66.1	64.2	64.1	64.1	64.1	64.1	64.1	63.0	61.5
11	114	99.6	95.1	91.2	91.0	...	...	...	...	...	...
12	345	330	323	318	315	312	311	310	309	308	306
13	264	257	254	251	248	247	247	246	245	245	244

NOTES TO TABLE 4
GENERAL NOTES

(a) The allowable stress values for bolting materials given in this Table do not exceed the lesser of one–third of the specified minimum yield strength or one–third of the yield strength at temperature, with credit granted for the enhancement of properties produced by heat treatment. They are intended for Section VIII, Division 2 use where flanges are designed in accordance with the rules of Part 5 and Annex 5.F when the bolting requirements are determined in accordance with 5.7.1 and 5.7.2. They are intended for Section III use in the design equations. For allowable values of actual preload and service stresses, see Section III NB–3230 and Nonmandatory Appendix E.

(b) Stress values for –30°C to 40°C are applicable for colder temperatures when toughness requirements of Section III or Section VIII are met.

(c) The following abbreviations are used: CD, Cold drawn; rel., relieved; Sol., Solution; str., stress; and treat., treated.

(d) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–193/SA–193M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–193 Grade B6 shall be used when SA–193M Grade B6 is used in construction.

(e) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(f) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (g) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 Stress values may result in relaxation of the bolting materials after prolonged service at temperatures of 250°C and higher, and the designer is to investigate the effect of this relaxation on the application.

G2 This material has reduced toughness at room temperature after exposure for about 5000 h at 325°C and after shorter exposure above 350°C.

G3 Stress values may result in relaxation of the bolting materials after prolonged service at temperatures of 325°C and higher, and the designer is to investigate the effect of this relaxation on the application.

G4 Stress values may result in relaxation of the bolting materials after prolonged service at temperatures of 375°C and higher, and the designer is to investigate the effect of this relaxation on the application.

Table 5A
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Bar, shapes	SA–675	45	...	...	...	1	1
2	Carbon steel	Plate	SA–285	A	K01700	...	...	1	1
3	Carbon steel	Smls. pipe	SA–106	A	K02501	...	...	1	1
4	Carbon steel	Bar, shapes	SA–675	50	...	...	...	1	1
5	Carbon steel	Plate	SA–283	B	...	...	...	1	1
6	Carbon steel	Plate	SA–285	B	K02200	...	$t \le 50$	1	1
7	Carbon steel	Bar, shapes	SA–675	55	...	...	...	1	1
8	Carbon steel	Plate	SA–285	C	K02801	...	$t \le 50$	1	1
9	Carbon steel	Smls. pipe	SA–333	1	K03008	...	...	1	1
10	Carbon steel	Smls. tube	SA–334	1	K03008	...	...	1	1
11	Carbon steel	Plate	SA–516	55	K01800	...	...	1	1
12	Carbon steel	Smls. pipe	SA–524	II	K02104	...	...	1	1
13	Carbon steel	Plate, bar, shapes	SA–36	...	K02600	...	...	1	1
14	Carbon steel	Plate	SA–662	A	K01701	...	...	1	1
15	Carbon steel	Forgings	SA–181	...	K03502	60	...	1	1
16	Carbon steel	Castings	SA–216	WCA	J02502	...	...	1	1
17	Carbon steel	Forgings	SA–266	1	K03506	...	...	1	1
18	Carbon steel	Forgings	SA–350	LF1	K03009	1	...	1	1
19	Carbon steel	Bar, shapes	SA–675	60	...	...	...	1	1
20	Carbon steel	Forgings	SA–765	I	K03046	...	...	1	1
21	Carbon steel	Plate	SA–515	60	K02401	...	...	1	1
22	Carbon steel	Plate	SA–516	60	K02100	...	...	1	1
23	Carbon steel	Plate	SA–283	D	K02702	...	...	1	1
24	Carbon steel	Smls. pipe	SA–106	B	K03006	...	...	1	1
25	Carbon steel	Fittings	SA–234	WPB	K03006	...	...	1	1
26	Carbon steel	Smls. pipe	SA–333	6	K03006	...	...	1	1
27	Carbon steel	Forgings	SA–372	A	K03002	...	...	1	1
28	Carbon steel	Fittings	SA–420	WPL6	...	...	...	1	1
29	Carbon steel	Smls. pipe	SA–524	I	K02104	...	...	1	1
30	Carbon steel	Forgings	SA–727	...	K02506	...	...	1	1
31	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	1	1
32	Carbon steel	Smls. tube	SA–210	A–1	K02707	...	...	1	1
33	Carbon steel	Bar, shapes	SA–675	65	...	...	...	1	1
34	Carbon steel	Castings	SA–352	LCB	J03003	...	...	1	1
35	Carbon steel	Plate	SA–515	65	K02800	...	...	1	1
36	Carbon steel	Plate	SA–516	65	K02403	...	...	1	1
37	Carbon steel	Plate	SA–662	B	K02203	...	...	1	1
38	Carbon steel	Plate	SA–537	...	K12437	1	$64 < t \le 100$	1	2
(**13**) 39	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	$150 < t \le 250$	1	2
(**13**) 40	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	$100 < t \le 150$	1	2
41	Carbon steel	Bar, shapes	SA–675	70	...	...	...	1	1
42	Carbon steel	Forgings	SA–105	...	K03504	...	...	1	2
43	Carbon steel	Forgings	SA–181	...	K03502	70	...	1	2
44	Carbon steel	Castings	SA–216	WCB	J03002	...	...	1	2

Table 5A
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	310	155	482	CS–6	G13, T4
2	310	165	482	CS–1	G13, T3
3	330	205	538	CS–2	G13, T1
4	345	170	482	CS–1	G13, T3
5	345	185	343	CS–1	T2
6	345	185	482	CS–1	G13, T2
7	380	190	482	CS–1	G13, T4
8	380	205	538	CS–2	G13, T3
9	380	205	538	CS–2	T3
10	380	205	371	CS–2	...
11	380	205	538	CS–2	G13, T3
12	380	205	538	CS–2	G13, T3
13	400	250	371	CS–2	G13
14	400	275	371	CS–2	...
15	415	205	538	CS–2	G13, T3
16	415	205	538	CS–2	G13, T3
17	415	205	538	CS–2	G13, T3
18	415	205	371	CS–2	G13
19	415	205	482	CS–2	G13, T3
20	415	205	538	CS–2	G13, T3
21	415	220	538	CS–2	G13, T3
22	415	220	538	CS–2	G13, T3
23	415	230	343	CS–2	...
24	415	240	371	CS–2	G13
25	415	240	538	CS–2	G13, T2
26	415	240	538	CS–2	G13, T2
27	415	240	343	CS–2	G9, H5
28	415	240	454	CS–2	G13, T2
29	414	240	538	CS–2	G13, T2
30	415	250	538	CS–2	G13, T2
31	415	255	538	CS–2	G6, G13, T2
32	415	255	538	CS–2	G13, T2
33	450	225	538	CS–2	G13, T3
34	450	240	343	CS–2	...
35	450	240	538	CS–2	G13, T2
36	450	240	538	CS–2	G13, T2
37	450	275	371	CS–2	T3
38	450	310	371	CS–2	...
39	470	280	538	CS–2	G13, T2
40	480	295	538	CS–2	G13, T2
41	485	240	538	CS–2	G13, T3
42	485	250	538	CS–2	G13, T3
43	485	250	538	CS–2	G13, T3
44	485	250	538	CS–2	G13, T3

Table 5A
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	103	97.3	94.3	92.8	91.4	90.1	88.6	87.0	85.1	83.0	80.7	78.4	76.0	73.7	71.5	*64.0*	*55.8*	*43.9*
2	110	104	101	98.9	97.5	96.1	94.6	92.8	90.8	88.5	86.1	83.6	81.1	78.6	*73.3*	*64.0*	*55.8*	*43.9*
3	138	130	126	124	122	120	118	116	113	111	108	105	*100*	*99.1*	*73.3*	*64.0*	*55.8*	*43.9*
4	115	108	105	103	102	100	98.5	96.6	94.5	92.2	89.7	87.1	84.5	81.9	*73.3*	*64.0*	*55.8*	*43.9*
5	124	117	113	111	110	108	106	104	102	99.6	96.9	94.1	91.2	*89.4*	...	...	...	...
6	124	117	113	111	110	108	106	104	102	99.6	96.9	94.1	91.2	*89.4*	*73.3*	*64.0*	*55.8*	*43.9*
7	126	119	115	113	112	110	108	106	104	101	98.7	95.8	92.9	90.1	87.4	*75.3*	*62.1*	*45.0*
8	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*89.0*	*75.3*	*62.1*	*45.0*
9	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
10	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	...	...	...	...
11	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*89.0*	*75.3*	*62.1*	*45.0*
12	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*89.0*	*75.3*	*62.1*	*45.0*
13	165	156	151	148	146	144	142	139	136	133	129	125	122	119	...	...	...	...
14	167	167	167	165	163	160	158	155	151	148	144	139	135	132	...	...	...	...
15	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
16	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
17	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
18	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	...	...	...	...
19	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
20	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	*95.1*	*79.5*	*62.6*	*45.0*
21	147	138	134	132	130	128	126	124	121	118	115	111	108	105	*95.1*	*79.5*	*62.6*	*45.0*
22	147	138	134	132	130	128	126	124	121	118	115	111	108	105	*95.1*	*79.5*	*62.6*	*45.0*
23	152	143	138	136	134	132	130	128	125	122	118	115	111	...	...	...	...	...
24	161	151	147	144	142	140	138	135	132	129	126	122	118	115	...	...	...	...
25	161	151	147	144	142	140	138	135	132	129	126	122	118	*115*	*95.1*	*79.5*	*62.6*	*45.0*
26	161	151	147	144	142	140	138	135	132	129	126	122	118	*115*	*95.1*	*79.5*	*62.6*	*45.0*
27	161	154	146	139	133	127	122	118	115	112	110	109	107	...	...	...	...	...
28	161	151	147	144	142	140	138	135	132	129	126	122	118	*115*	*95.1*	*79.5*	*62.6*	*45.0*
29	161	151	147	144	142	140	138	135	132	129	126	122	118	*115*	*95.1*	*79.5*	*62.6*	*45.0*
30	165	156	151	148	146	144	142	139	136	133	129	125	122	*119*	*95.1*	*79.5*	*62.6*	*45.0*
31	145	136	132	130	128	126	124	122	119	116	113	110	106	*104*	*80.8*	*67.6*	*53.2*	*38.3*
32	170	160	155	153	150	148	146	143	140	136	133	129	125	*122*	*95.1*	*79.5*	*62.6*	*45.0*
33	149	140	136	134	132	130	128	126	123	120	117	113	110	106	*95.1*	*79.5*	*64.4*	*47.7*
34	161	151	147	144	142	140	138	135	132	129	126	122	118	...	...	...	...	...
35	161	151	147	144	142	140	138	135	132	129	126	122	118	*113*	*95.1*	*79.5*	*64.4*	*47.7*
36	161	151	147	144	142	140	138	135	132	129	126	122	118	*113*	*95.1*	*79.5*	*64.4*	*47.7*
37	184	173	168	165	163	160	158	155	151	148	144	139	135	132	*95.1*	...	...	...
38	187	187	181	174	167	162	156	152	148	144	141	138	138	134	...	...	...	...
39	187	175	170	167	165	163	160	157	154	150	146	141	137	*123*	*101*	*83.8*	*66.8*	*50.3*
40	197	184	179	176	174	171	169	166	162	158	154	149	144	*123*	*101*	*83.3*	*66.8*	*50.3*
41	161	151	147	144	142	140	138	135	132	129	126	122	118	115	*101*	*83.8*	*66.8*	*50.3*
42	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
43	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
44	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*

Table 5A
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
4	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
9	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
12	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
16	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
17	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	*31.7*	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
21	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
22	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
26	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
30	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
31	*27.0*	*18.2*	*12.0*	...	...	...	...	...	...	...	...	...	...	...	
32	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
33	*32.5*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	*32.5*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
36	*32.5*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
40	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
41	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
42	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
43	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
44	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Forgings	SA–266	2	K03506	...	...	1	2
2	Carbon steel	Forgings	SA–266	4	K03017	...	...	1	2
3	Carbon steel	Forgings	SA–350	LF2	K03011	...	...	1	2
4	Carbon steel	Forgings	SA–508	1	K13502	...	...	1	2
5	Carbon steel	Forgings	SA–508	1A	K13502	...	...	1	2
6	Carbon steel	Forgings	SA–541	1	K03506	...	...	1	2
7	Carbon steel	Forgings	SA–541	1A	K03020	...	...	1	2
8	Carbon steel	Forgings	SA–765	II	K03047	...	...	1	2
9	Carbon steel	Plate	SA–515	70	K03101	...	...	1	2
10	Carbon steel	Plate	SA–516	70	K02700	...	...	1	2
11	Carbon steel	Smls. pipe	SA–106	C	K03501	...	...	1	2
12	Carbon steel	Smls. tube	SA–210	C	K03501	...	...	1	2
13	Carbon steel	Castings	SA–216	WCC	K02503	...	...	1	2
14	Carbon steel	Fittings	SA–234	WPC	K03501	...	...	1	2
15	Carbon steel	Plate	SA–537	...	K12437	3	$100 < t \le 150$	1	3
16	Carbon steel	Plate	SA–662	C	K02007	...	...	1	2
17	Carbon steel	Plate	SA–537	...	K12437	2	$100 < t \le 150$	1	3
18	Carbon steel	Plate	SA–738	C	K02008	...	$100 < t \le 150$	1	3
19	Carbon steel	Plate	SA–537	...	K12437	1	$t \le 64$	1	2
20	Carbon steel	Plate	SA–841	A	...	1	$t \le 64$	1	2
(13) 21	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	$60 < t \le 100$	1	2
(13) 22	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	$40 < t \le 60$	1	2
(13) 23	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	$16 < t \le 40$	1	2
(13) 24	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	≤16	1	2
25	Carbon steel	Forgings	SA–266	3	K05001	...	...	1	2
(13) 26	Carbon steel	Plate	SA–299	A	K02803	...	$t > 25$	1	2
(13) 27	Carbon steel	Plate	SA–299	A	K02803	...	$t \le 25$	1	2
28	Carbon steel	Forgings	SA–372	B	K04001	...	...	1	2
29	Carbon steel	Plate	SA–738	A	K12447	...	$t \le 64$	1	2
30	Carbon steel	Plate	SA–738	A	K12447	...	...	1	2
31	Carbon steel	Plate	SA–537	...	K12437	3	$64 < t \le 100$	1	3
32	Carbon steel	Plate	SA–537	...	K12437	2	$64 < t \le 100$	1	3
33	Carbon steel	Plate	SA–738	C	K02008	...	$64 < t \le 100$	1	3
(13) 34	Carbon steel	Plate	SA–299	B	K02803	...	$t > 25$	1	3
(13) 35	Carbon steel	Plate	SA–299	B	K02803	...	$t \le 25$	1	3
36	Carbon steel	Forgings	SA–765	IV	K02009	...	...	1	3
37	Carbon steel	Plate	SA–537	...	K12437	3	$t \le 64$	1	3
38	Carbon steel	Plate	SA–537	...	K12437	2	$t \le 64$	1	3
39	Carbon steel	Plate	SA–738	C	K02008	...	$t \le 64$	1	3
40	Carbon steel	Plate	SA–841	B	...	2	$t \le 64$	1	3

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	485	250	538	CS–2	G13, T3
2	485	250	538	CS–2	G13, T3
3	485	250	538	CS–2	G13, T2
4	485	250	538	CS–2	G13, T3
5	485	250	538	CS–2	G13, T3
6	485	250	538	CS–2	G13, T3
7	485	250	538	CS–2	G13, T3
8	485	250	538	CS–2	G13, T3
9	485	260	538	CS–2	G13, T2
10	485	260	538	CS–2	G13, T2
11	485	275	538	CS–2	G13, T2
12	485	275	538	CS–2	G13, T2
13	485	275	538	CS–2	G13, T2
14	485	275	427	CS–2	G13, T2
15	485	275	371	CS–2	T2
16	485	295	371	CS–3	...
17	485	345	371	CS–3	...
18	485	315	343	CS–3	T1
19	485	315	371	CS–3	T1
20	485	345	343	CS–3	...
21	490	315	538	CS–2	G13, T2
22	510	335	538	CS–2	G13, T2
23	510	345	538	CS–2	G13, T2
24	510	355	538	CS–2	G13, T2
25	515	260	538	CS–2	G13, T3, W1, W6
26	515	275	538	CS–2	G13, T3
27	515	290	538	CS–2	G13, T2
28	515	310	343	CS–3	G9, H5, W2, W6
29	515	310	371	CS–2	H7, T2
30	515	310	371	CS–2	H3, T2
31	515	345	371	CS–5	T1
32	515	380	343	CS–5	...
33	515	380	343	CS–5	...
34	550	310	538	CS–3	G13, T2
35	550	325	538	CS–3	G13, T2
36	550	345	371	CS–3	T1
37	550	380	371	CS–5	...
38	550	415	371	CS–5	...
39	550	415	371	CS–5	...
40	550	415	343	CS–3	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
2	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
3	165	156	151	148	146	144	142	139	136	133	129	125	122	*113*	*95.1*	*79.5*	*62.6*	*45.0*
4	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
5	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
6	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
7	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
8	165	156	151	148	146	144	142	139	136	133	129	125	122	118	*101*	*83.8*	*66.8*	*50.3*
9	175	164	159	157	154	152	150	147	144	140	136	132	128	*122*	*101*	*83.8*	*66.8*	*50.3*
10	175	164	159	157	154	152	150	147	144	140	136	132	128	*122*	*101*	*83.8*	*66.8*	*50.3*
11	184	173	168	165	163	160	158	155	151	148	144	139	138	*136*	*101*	*83.8*	*66.8*	*50.3*
12	184	173	168	165	163	160	158	155	151	148	144	139	138	*136*	*101*	*83.8*	*66.8*	*50.3*
13	184	173	168	165	163	160	158	155	151	148	144	139	138	*136*	*101*	*83.8*	*66.8*	*50.3*
14	184	173	168	165	163	160	158	155	151	148	144	139	138	*136*	*101*	*83.8*	*66.8*	...
15	184	175	168	164	160	157	153	151	148	146	143	141	138	*136*	...	...	...	...
16	198	186	180	177	175	172	169	166	163	159	154	150	145	142	...	...	...	...
17	201	196	185	178	171	165	160	155	151	148	144	141	150	147	...	...	...	...
18	201	199	193	190	187	184	181	178	174	170	165	160	*148*	...	...	...	...	...
19	201	201	201	201	200	196	192	188	185	182	179	176	*153*	*141*	*101*	...	...	...
20	201	201	201	201	201	197	195	193	191	189	186	183	179	...	...	...	...	...
21	204	197	191	188	186	183	180	177	173	169	164	159	154	*123*	*101*	*83.8*	*66.8*	*50.3*
22	213	209	203	200	197	195	192	188	184	179	174	169	164	*123*	*101*	*83.8*	*66.8*	*50.3*
23	213	213	209	206	203	201	197	194	189	185	180	174	169	*123*	*101*	*83.8*	*66.8*	*50.3*
24	213	213	213	212	209	206	203	199	195	190	185	179	174	*123*	*101*	*83.8*	*66.8*	*50.3*
25	172	162	157	155	152	150	148	145	142	138	135	131	127	123	*107*	*88.0*	*67.3*	*50.3*
26	184	173	168	165	163	160	158	155	151	148	144	139	135	131	*107*	*88.1*	*67.6*	*50.8*
27	193	182	176	173	171	168	165	162	159	155	151	146	142	*133*	*107*	*88.1*	*67.6*	*50.8*
28	207	195	189	186	183	180	177	174	170	166	161	157	152	...	...	...	...	...
29	207	192	181	174	167	162	156	152	148	144	141	138	135	*131*	...	...	...	...
30	207	192	181	174	167	162	156	152	148	144	141	138	135	*131*	...	...	...	...
31	215	215	210	205	200	196	192	188	185	182	179	176	*160*	*147*	...	...	...	...
32	215	215	215	215	215	215	211	207	204	200	197	194	168	...	...	...	...	...
33	215	215	215	215	215	215	211	207	204	200	197	194	168	167	...	...	...	...
34	207	194	188	185	183	180	177	174	170	166	161	157	152	*133*	*107*	*88.1*	*67.6*	*50.8*
35	216	203	197	194	191	188	185	182	178	173	169	164	159	*133*	*107*	*88.1*	*67.6*	*50.8*
36	230	216	210	206	203	200	197	193	189	184	179	174	*160*	*131*	...	...	...	...
37	230	230	230	225	220	215	211	207	204	200	197	194	177	166	...	...	...	...
38	230	230	230	230	230	230	230	226	222	218	215	211	177	166	...	...	...	...
39	230	230	230	230	230	230	230	226	222	218	215	211	177	166	...	...	...	...
40	230	230	230	230	230	230	230	230	229	226	223	220	215	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
2	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
3	*31.7*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
4	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
5	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
6	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
7	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
8	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
9	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
10	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
11	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
12	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
13	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
22	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
23	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
24	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
25	*33.2*	*21.4*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
26	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
27	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
35	*33.7*	*21.3*	*12.9*	...	...	...	...	...	...	...	...	...	...	...	(**13**)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	Carbon steel	Plate	SA–612	...	K02900	...	13 < t ≤ 25	10C	1
2	Carbon steel	Plate	SA–612	...	K02900	...	t ≤ 13	10C	1
3	Carbon steel	Plate	SA–738	B	K12007	...	...	1	3
4	Carbon steel	Forgings	SA–372	C	K04801	...	...	...	...
5	Carbon steel	Plate	SA–724	A	K11831	...	...	1	4
6	Carbon steel	Plate	SA–724	C	K12037	...	...	1	4
7	Carbon steel	Plate	SA–724	B	K12031	...	...	1	4
8	C–Mn–Si–Cb	Plate	SA–737	B	K12001	...	...	1	2
9	C–Mn–Si–V	Plate	SA–737	C	K12202	...	...	1	3
10	C–½Mo	Smls. tube	SA–209	T1b	K11422	...	...	3	1
11	C–½Mo	Smls. tube	SA–209	T1	K11522	...	...	3	1
12	C–½Mo	Fittings	SA–234	WP1	K12821	...	...	3	1
13	C–½Mo	Smls. pipe	SA–335	P1	K11522	...	...	3	1
14	C–½Mo	Forged pipe	SA–369	FP1	K11522	...	...	3	1
15	C–½Mo	Smls. tube	SA–209	T1a	K12023	...	...	3	1
16	C–½Mo	Castings	SA–217	WC1	J12524	...	...	3	1
17	C–½Mo	Castings	SA–352	LC1	J12522	...	...	3	1
18	C–½Mo	Plate	SA–204	A	K11820	...	...	3	1
19	C–½Mo	Forgings	SA–182	F1	K12822	...	...	3	2
20	C–½Mo	Plate	SA–204	B	K12020	...	...	3	2
21	C–½Mo	Forgings	SA–336	F1	K12520	...	...	3	2
22	C–½Mo	Plate	SA–204	C	K12320	...	...	3	2
23	½Cr–⅕Mo	Forgings	SA–372	G	K13049	70	...	11B	...
24	½Cr–⅕Mo	Forgings	SA–372	H	K13547	70	...	11B	...
25	½Cr–⅕Mo–V	Plate	SA–517	B	K11630	...	t ≤ 32	11B	4
26	½Cr–¼Mo–Si	Plate	SA–517	A	K11856	...	t ≤ 32	11B	1
27	½Cr–¼Mo–Si	Forgings	SA–592	A	K11856	...	t ≤ 64	11B	1
28	½Cr–½Mo	Smls. pipe	SA–335	P2	K11547	...	...	3	1
29	½Cr–½Mo	Forged pipe	SA–369	FP2	K11547	...	...	3	1
30	½Cr–½Mo	Plate	SA–387	2	K12143	1	...	3	1
31	½Cr–½Mo	Smls. tube	SA–213	T2	K11547	...	...	3	1
32	½Cr–½Mo	Forgings	SA–182	F2	K12122	...	...	3	2
33	½Cr–½Mo	Plate	SA–387	2	K12143	2	...	3	2
34	¾Cr–½Ni–Cu	Smls. tube	SA–423	1	K11535	...	...	4	2
35	¾Cr–¾Ni–Cu–Al	Smls. pipe	SA–333	4	K11267	...	...	4	2
36	1Cr–⅕Mo	Forgings	SA–372	E	K13047	70	...	11B	1
37	1Cr–⅕Mo	Forgings	SA–372	F	G41350	70	...	11B	1
38	1Cr–⅕Mo	Forgings	SA–372	J	K13548	70	...	11B	1
39	1Cr–⅕Mo	Forgings	SA–372	J	G41370	110	...	11B	1
40	1Cr–½Mo	Plate	SA–387	12	K11757	1	...	4	1
41	1Cr–½Mo	Forgings	SA–182	F12	K11562	1	...	4	1
42	1Cr–½Mo	Smls. tube	SA–213	T12	K11562	...	...	4	1
43	1Cr–½Mo	Fittings	SA–234	WP12	K12062	1	...	4	1
44	1Cr–½Mo	Smls. pipe	SA–335	P12	K11562	...	...	4	1
45	1Cr–½Mo	Forged pipe	SA–369	FP12	K11562	...	...	4	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	560	345	371	CS–3	H7
2	570	345	371	CS–3	H7
3	585	415	343	CS–5	T1
4	620	380	343	CS–3	G9, H5, T1, W2, W6
5	620	485	371	CS–5	...
6	620	485	371	CS–5	...
7	655	515	371	CS–5	...
8	485	345	371	CS–3	...
9	550	415	371	CS–3	...
10	365	195	538	CS–1	G14, T7
11	380	205	538	CS–2	G14, T7
12	380	205	538	CS–2	G14, T7
13	380	205	538	CS–2	G14, T7
14	380	210	538	CS–2	G14, T7
15	415	220	538	CS–2	G14, T7
16	450	240	538	CS–2	G14, T6
17	450	240	343	CS–2	...
18	450	255	538	CS–2	G14, T6
19	485	275	538	CS–2	G14, T6
20	485	275	538	CS–2	G14, T6
21	485	275	538	CS–2	G14, T6
22	515	295	538	CS–2	G14, T6
23	825	485	93	CS–3	G9, H4, W2, W6
24	825	485	93	CS–3	G9, H4, W2, W6
25	795	690	343	HT–1	...
26	795	690	343	HT–1	...
27	795	690	343	HT–1	...
28	380	205	538	CS–2	T7
29	380	210	538	CS–2	T7
30	380	230	538	CS–2	T7
31	415	205	538	CS–2	T7
32	485	275	538	CS–2	G14, T7
33	485	310	538	CS–3	H2, T7
34	415	255	343	CS–2	...
35	415	240	343	CS–2	...
36	825	485	343	CS–5	G9, H4, W2, W6
37	825	485	343	CS–5	G9, H4, W2, W6
38	825	485	343	CS–5	G9, H4, W2, W6
39	930	760	343	HT–1	H4, W2, W6
40	380	230	649	CS–2	T7
41	415	220	649	CS–2	T7
42	415	220	649	CS–2	T7
43	415	220	649	CS–2	T7
44	415	220	649	CS–2	T7
45	415	220	649	CS–2	T7

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	230	220	208	199	190	182	174	168	164	160	157	155	153	...	...	...	...	...
2	230	220	208	199	190	182	174	168	164	160	157	155	153	...	...	...	...	...
3	244	244	244	244	240	235	230	226	222	218	215	211	*160*	...	...	...	...	...
4	253	242	229	219	209	200	192	185	180	176	173	171	*160*	...	...	...	...	...
5	259	259	259	259	259	254	244	236	229	224	220	217	180	178	...	...	...	...
6	259	259	259	259	259	254	244	236	229	224	220	217	180	178	...	...	...	...
7	273	273	273	273	273	272	261	253	246	240	236	233	180	178	...	...	...	...
8	201	201	201	199	190	182	174	168	164	160	157	155	153	152	...	...	...	...
9	230	230	230	230	228	218	209	202	196	192	189	186	180	178	...	...	...	...
10	129	124	120	118	116	114	112	111	109	108	106	105	103	101	98.8	96.4	93.7	90.6
11	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
12	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
13	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
14	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
15	147	142	138	135	133	130	128	127	125	123	121	120	118	115	113	110	107	104
16	161	155	150	148	145	143	140	138	137	135	133	131	129	126	123	120	117	*109*
17	161	155	150	148	145	143	140	138	137	135	133	131	129	...	...	...	...	...
18	170	164	159	156	153	151	148	146	144	142	140	138	136	133	131	127	124	*109*
19	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	*109*
20	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	*109*
21	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	*109*
22	198	190	185	181	178	175	173	170	168	165	163	161	158	155	152	148	144	*109*
23	322	322	322	322	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	322	322	322	322	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
26	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
27	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
28	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
29	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
30	152	146	142	139	137	134	132	131	129	127	125	123	121	119	116	114	110	107
31	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
32	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	129
33	201	199	193	190	186	183	181	178	176	173	171	168	165	162	159	155	151	146
34	170	161	156	154	152	150	149	147	146	145	143	141	140	...	...	...	...	...
35	161	152	148	145	144	142	141	139	138	137	135	134	132	...	...	...	...	...
36	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
37	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
38	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
39	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
40	152	142	136	132	129	126	124	121	120	118	116	115	114	112	110	109	106	104
41	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
42	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
43	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
44	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
45	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
11	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
12	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
13	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
14	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
15	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
16	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
19	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
20	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
21	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
22	*68.0*	*42.3*	*30.5*	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*74.4*	*49.9*	*34.3*	...	...	...	...	...	...	...	...	...	...	...
29	*74.4*	*49.9*	*34.3*	...	...	...	...	...	...	...	...	...	...	...
30	*74.4*	*49.9*	*34.3*	...	...	...	...	...	...	...	...	...	...	...
31	*74.4*	*49.9*	*34.3*	...	...	...	...	...	...	...	...	...	...	...
32	*75.6*	*49.9*	*33.5*	...	...	...	...	...	...	...	...	...	...	...
33	*78.8*	*53.7*	*35.4*	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...
41	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...
42	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...
43	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...
44	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...
45	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
(**13**)	1	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	150 < t ≤ 250	4	1
(**13**)	2	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	100 < t ≤ 150	4	1
(**13**)	3	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	60 < t ≤ 100	4	1
	4	1Cr–½Mo	Plate	SA–387	12	K11757	2	...	4	1
(**13**)	5	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	16 < t ≤ 60	4	1
(**13**)	6	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	t ≤ 16	4	1
	7	1Cr–½Mo	Forgings	SA–182	F12	K11564	2	...	4	1
	8	1Cr–½Mo	Forgings	SA–336	F12	K11564	...	...	4	1
	9	1¼Cr–½Mo	Castings	SA–217	WC6	J12072	...	...	4	1
	10	1¼Cr–½Mo	Bar	SA–739	B11	K11797	...	...	4	1
	11	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11597	1	...	4	1
	12	1¼Cr–½Mo–Si	Smls. tube	SA–213	T11	K11597	...	...	4	1
	13	1¼Cr–½Mo–Si	Fittings	SA–234	WP11	...	1	...	4	1
	14	1¼Cr–½Mo–Si	Smls. pipe	SA–335	P11	K11597	...	...	4	1
	15	1¼Cr–½Mo–Si	Forged pipe	SA–369	FP11	K11597	...	...	4	1
	16	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	1	...	4	1
	17	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11572	2	...	4	1
	18	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	2	...	4	1
(**13**)	19	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	100 < t ≤ 250	4	1
(**13**)	20	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	60 < t ≤ 100	4	1
(**13**)	21	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	≤60	4	1
	22	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	3	...	4	1
	23	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	2	...	4	1
	24	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	64 < t ≤ 100	11B	2
	25	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	t ≤ 64	11B	2
	26	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	64 < t ≤ 150	11B	2
	27	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	t ≤ 64	11B	2
	28	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	1	...	5A	1
	29	2¼Cr–1Mo	Smls. tube	SA–213	T22	K21590	...	...	5A	1
	30	2¼Cr–1Mo	Fittings	SA–234	WP22	K21590	1	...	5A	1
	31	2¼Cr–1Mo	Smls. pipe	SA–335	P22	K21590	...	...	5A	1
	32	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	1	...	5A	1
	33	2¼Cr–1Mo	Forged pipe	SA–369	FP22	K21590	...	...	5A	1
	34	2¼Cr–1Mo	Plate	SA–387	22	K21590	1	...	5A	1
(**13**)	35	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	150 < t ≤ 250	5A	1
(**13**)	36	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	100 < t ≤ 150	5A	1
(**13**)	37	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	60 < t ≤ 100	5A	1
(**13**)	38	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	40 < t ≤ 60	5A	1
(**13**)	39	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	16 < t ≤ 40	5A	1
(**13**)	40	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	t ≤ 16	5A	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	420	245	649	CS–2	T7
2	430	255	649	CS–2	T7
3	440	270	649	CS–2	T7
4	450	275	649	CS–2	T7
5	450	290	649	CS–2	T7
6	450	300	649	CS–2	T7
7	485	275	649	CS–2	T7
8	485	275	649	CS–2	T7
9	485	275	593	CS–2	T7
10	483	310	649	CS–3	T7
11	415	205	649	CS–2	T7
12	415	205	649	CS–2	T7
13	415	205	649	CS–2	T7
14	415	205	649	CS–2	T7
15	415	210	649	CS–2	T7
16	415	240	649	CS–2	T7
17	485	275	649	CS–2	T7
18	485	275	649	CS–2	T7
19	490	380	570	CS–3	G15, T6
20	500	390	570	CS–3	G15, T6
21	510	400	570	CS–3	G15, T6
22	515	310	649	CS–3	T7
23	515	310	649	CS–3	T7
24	725	620	343	CS–5	S1
25	795	690	343	HT–1	...
26	725	620	343	CS–5	...
27	795	690	343	HT–1	...
28	415	205	649	CS–2	T6, W5
29	415	205	649	CS–2	T6, W5
30	415	205	649	CS–2	T6, W5
31	415	205	649	CS–2	T6, W5
32	415	205	649	CS–2	T6, W5
33	415	210	649	CS–2	T6, W5
34	415	210	649	CS–2	H1, T6, W5
35	450	250	593	CS–3	T7, W5
36	460	260	593	CS–3	T7, W5
37	470	280	593	CS–3	T6, W5
38	480	290	593	CS–3	T6, W5
39	480	300	593	CS–3	T6, W5
40	480	310	593	CS–3	T5, W5

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	163	153	147	142	139	136	133	131	129	127	125	124	122	121	119	117	115	112
2	170	160	153	148	145	141	139	136	134	132	131	129	127	126	124	122	119	116
3	180	169	161	157	153	150	147	144	142	140	138	137	135	133	131	129	126	123
4	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
5	188	181	173	169	164	161	158	155	152	150	148	147	145	143	141	138	136	132
6	188	188	179	174	170	166	163	160	158	156	154	152	150	148	146	143	140	137
7	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
8	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
9	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	106
10	201	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	108
11	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
12	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
13	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
14	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
15	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
16	161	153	148	144	141	138	136	134	131	129	127	125	123	121	119	116	113	106
17	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	109
18	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	109
19	204	204	204	204	204	204	204	204	204	204	204	204	204	202	198	194	189	*104*
20	208	208	208	208	208	208	208	208	208	208	208	208	208	208	203	199	194	*104*
21	213	213	213	213	213	213	213	213	213	213	213	213	213	213	209	204	199	*104*
22	207	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	119
23	207	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	119
24	302	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...
25	330	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...
26	302	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...
27	330	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...
28	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
29	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
30	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
31	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
32	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
33	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
34	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*99.6*
35	167	157	152	148	146	143	142	140	139	137	136	135	133	132	130	127	124	121
36	173	164	158	154	151	149	147	146	144	143	142	140	139	137	135	132	129	126
37	187	176	170	166	163	161	158	157	155	154	152	151	149	148	145	143	139	*128*
38	193	183	176	172	169	166	164	162	161	159	158	156	155	153	150	148	144	*128*
39	200	189	182	178	175	172	170	168	166	165	163	162	160	158	156	153	149	*128*
40	200	195	188	184	181	178	175	174	172	170	169	167	165	163	161	158	*151*	*128*

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	(**13**)
2	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	(**13**)
3	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	(**13**)
4	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...	
5	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	(**13**)
6	*94.4*	*60.2*	*40.8*	*26.3*	*17.3*	*11.7*	*7.40*	...	...	...	...	...	...	...	(**13**)
7	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...	
8	*92.1*	*61.1*	*40.4*	*26.4*	*17.4*	*11.6*	*7.44*	...	...	...	...	...	...	...	
9	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	...	...	...	...	...	...	...	...	
10	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
11	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
12	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
13	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
14	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
15	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
16	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
17	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
18	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
19	*73.7*	*52.0*	*36.3*	*25.2*	...	...	...	...	...	...	...	...	...	...	(**13**)
20	*73.7*	*52.0*	*36.3*	*25.2*	...	...	...	...	...	...	...	...	...	...	(**13**)
21	*73.7*	*52.0*	*36.3*	*25.2*	...	...	...	...	...	...	...	...	...	...	(**13**)
22	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
23	*73.7*	*52.0*	*36.3*	*25.2*	*17.6*	*12.3*	*8.12*	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
29	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
30	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
31	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
32	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
33	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
34	*80.9*	*63.3*	*47.5*	*34.2*	*23.5*	*15.3*	*9.45*	...	...	...	...	...	...	...	
35	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)
36	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)
37	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)
38	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)
39	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)
40	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	...	...	...	...	...	...	...	...	...	(**13**)

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...	...	5A	1
2	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	3	...	5A	1
3	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	3	...	5A	1
4	2¼Cr–1Mo	Plate	SA–387	22	K21590	2	...	5A	1
5	2¼Cr–1Mo	Bar	SA–739	B22	K21390	...	...	5A	1
6	2¼Cr–1Mo	Castings	SA–487	8	J22091	A	...	5C	1
7	2¼Cr–1Mo	Forgings	SA–508	22	K21590	3	...	5C	1
8	2¼Cr–1Mo	Forgings	SA–541	22	K21390	3	...	5C	1
9	2¼Cr–1Mo	Plate	SA–542	B	K21590	4	...	5C	1
10	2¼Cr–1Mo–V	Forgings	SA–182	F22V	K31835	...	...	5C	1
11	2¼Cr–1Mo–V	Forgings	SA–336	F22V	K31835	...	...	5C	1
12	2¼Cr–1Mo–V	Forgings	SA–541	22V	K31835	...	...	5C	1
13	2¼Cr–1Mo–V	Plate	SA–542	D	K31835	4a	...	5C	1
14	2¼Cr–1Mo–V	Plate	SA–832	22V	K31835	...	...	5C	1
15	3Cr–1Mo	Smls. tube	SA–213	T21	K31545	...	...	5A	1
16	3Cr–1Mo	Smls. pipe	SA–335	P21	K31545	...	...	5A	1
17	3Cr–1Mo	Forgings	SA–336	F21	K31545	1	...	5A	1
18	3Cr–1Mo	Forged pipe	SA–369	FP21	K31545	...	...	5A	1
19	3Cr–1Mo	Plate	SA–387	21	K31545	1	...	5A	1
20	3Cr–1Mo	Forgings	SA–182	F21	K31545	...	...	5A	1
21	3Cr–1Mo	Forgings	SA–336	F21	K31545	3	...	5A	1
22	3Cr–1Mo	Plate	SA–387	21	K31545	2	...	5A	1
23	3Cr–1Mo–¼V–Ti–B	Forgings	SA–182	F3V	K31830	...	...	5C	1
24	3Cr–1Mo–¼V–Ti–B	Forgings	SA–336	F3V	K31830	...	...	5C	1
25	3Cr–1Mo–¼V–Ti–B	Forgings	SA–508	3V	K31830	...	...	5C	1
26	3Cr–1Mo–¼V–Ti–B	Forgings	SA–541	3V	K31830	...	...	5C	1
27	3Cr–1Mo–¼V–Ti–B	Plate	SA–542	C	K31830	4a	...	5C	1
28	3Cr–1Mo–¼V–Ti–B	Plate	SA–832	21V	K31830	...	...	5C	1
29	5Cr–½Mo	Smls. tube	SA–213	T5	K41545	...	...	5B	1
30	5Cr–½Mo	Fittings	SA–234	WP5	K41545	...	...	5B	1
31	5Cr–½Mo	Smls. pipe	SA–335	P5	K41545	...	...	5B	1
32	5Cr–½Mo	Forged pipe	SA–369	FP5	K41545	...	...	5B	1
33	5Cr–½Mo	Plate	SA–387	5	K41545	1	...	5B	1
34	5Cr–½Mo	Forgings	SA–336	F5	K41545	...	...	5B	1
35	5Cr–½Mo	Forgings	SA–182	F5	K41545	...	...	5B	1
36	5Cr–½Mo	Plate	SA–387	5	K41545	2	...	5B	1
37	5Cr–½Mo	Forgings	SA–336	F5A	K42544	...	...	5B	1
38	5Cr–½Mo	Castings	SA–217	C5	J42045	...	...	5B	1
39	5Cr–½Mo	Forgings	SA–182	F5a	K42544	...	...	5B	1
40	5Cr–½Mo–Si	Smls. tube	SA–213	T5b	K51545	...	...	5B	1
41	5Cr–½Mo–Si	Smls. pipe	SA–335	P5b	K51545	...	...	5B	1
42	5Cr–½Mo–Ti	Smls. tube	SA–213	T5c	K41245	...	...	5B	1
43	5Cr–½Mo–Ti	Smls. pipe	SA–335	P5c	K41245	...	...	5B	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	485	275	649	CS-2	T6, W5
2	515	310	649	CS-3	T6, W5
3	515	310	649	CS-3	T6, W5
4	515	310	649	CS-3	T6, W5
5	517	310	649	CS-3	T6, W5
6	585	380	538	CS-3	T6, W5
7	586	380	454	CS-2	G12, T6
8	585	380	454	CS-2	G12, T6
9	585	380	454	CS-2	G12, T6
10	585	415	482	CS-2	G12, T5
11	585	415	482	CS-2	G12, T5
12	585	415	482	CS-2	G12, T5
13	585	415	482	CS-2	G12, T5
14	585	415	482	CS-2	G12, T5
15	415	205	649	CS-2	T6
16	415	205	649	CS-2	T6
17	415	205	649	CS-2	T6
18	415	210	649	CS-2	T6
19	415	210	649	CS-2	T6
20	515	310	649	CS-3	T6
21	515	310	649	CS-3	T6
22	515	310	649	CS-3	T6
23	585	415	482	CS-3	G12, T5
24	585	415	482	CS-3	G12, T5
25	585	415	482	CS-3	G12, T5
26	585	415	482	CS-3	G12, T5
27	585	415	482	CS-3	G12, T5
28	585	415	482	CS-3	G12, T5
29	415	205	649	CS-2	T6
30	415	205	649	CS-2	T6
31	415	205	649	CS-2	T6
32	415	210	649	CS-2	T6
33	415	210	649	CS-2	T6
34	415	250	649	CS-2	T6
35	485	275	649	CS-2	T6
36	515	310	649	CS-3	T6
37	550	345	649	CS-3	T6
38	620	415	649	CS-3	H2, T6
39	620	450	649	CS-5	T6
40	415	205	649	CS-2	T6
41	415	205	649	CS-2	T6
42	415	205	649	CS-2	T6
43	415	205	649	CS-2	T6

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	184	174	169	167	165	163	161	160	159	157	156	154	153	151	149	147	144	*119*
2	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*128*
3	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*128*
4	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*128*
5	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*128*
6	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	197	*119*
7	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	197	*119*
8	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	197	*119*
9	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	197	*119*
10	244	244	244	244	244	244	244	244	244	244	244	244	244	240	235	231	*205*	*173*
11	244	244	244	244	244	244	244	244	244	244	244	244	244	240	235	231	*205*	*173*
12	244	244	244	244	244	244	244	244	244	244	244	244	244	240	235	231	*205*	*173*
13	244	244	244	244	244	244	244	244	244	244	244	244	244	240	235	231	*205*	*173*
14	244	244	244	244	244	244	244	244	244	244	244	244	244	240	235	231	*205*	*173*
15	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*89.2*
16	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*89.2*
17	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*89.2*
18	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*89.2*
19	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	*89.2*
20	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*98.2*
21	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*98.2*
22	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	*98.2*
23	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
24	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
25	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
26	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
27	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
28	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	*183*	*153*
29	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
30	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
31	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
32	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
33	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
34	165	155	149	146	144	143	142	142	141	141	140	139	137	134	131	128	123	*80.6*
35	184	172	165	162	160	159	158	157	157	156	155	154	152	149	146	142	137	*80.6*
36	207	193	186	182	180	179	178	177	177	176	175	173	171	168	164	160	154	*80.6*
37	230	215	206	203	200	199	198	197	196	195	194	193	190	187	183	177	171	*80.6*
38	259	258	248	243	240	238	237	236	235	235	233	231	228	224	219	213	205	*80.6*
39	259	259	259	259	259	258	257	256	255	254	253	250	247	243	237	230	222	*80.6*
40	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
41	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
42	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*
43	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	*80.6*

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	*12.8*	*8.11*	...	...	...	...	...	...	...
2	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	*12.8*	*8.11*	...	...	...	...	...	...	...
3	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	*12.8*	*8.11*	...	...	...	...	...	...	...
4	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	*12.8*	*8.11*	...	...	...	...	...	...	...
5	*88.4*	*64.0*	*44.6*	*30.0*	*19.7*	*12.8*	*8.11*	...	...	...	...	...	...	...
6	*88.4*	*64.0*	*44.6*	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	*143*	...	...	...	...	...	...	...	...	...	...	...	...	...
11	*143*	...	...	...	...	...	...	...	...	...	...	...	...	...
12	*143*	...	...	...	...	...	...	...	...	...	...	...	...	...
13	*143*	...	...	...	...	...	...	...	...	...	...	...	...	...
14	*143*	...	...	...	...	...	...	...	...	...	...	...	...	...
15	*68.8*	*54.2*	*43.4*	*34.0*	*25.1*	*17.1*	*10.1*	...	...	...	...	...	...	...
16	*68.8*	*54.2*	*43.4*	*34.0*	*25.1*	*17.1*	*10.1*	...	...	...	...	...	...	...
17	*68.8*	*54.2*	*43.4*	*34.0*	*25.1*	*17.1*	*10.1*	...	...	...	...	...	...	...
18	*68.8*	*54.2*	*43.4*	*34.0*	*25.1*	*17.1*	*10.1*	...	...	...	...	...	...	...
19	*68.8*	*54.2*	*43.4*	*34.0*	*25.1*	*17.1*	*10.1*	...	...	...	...	...	...	...
20	*73.5*	*54.7*	*40.6*	*29.2*	*20.6*	*15.2*	*8.75*	...	...	...	...	...	...	...
21	*73.5*	*54.7*	*40.6*	*29.2*	*20.6*	*15.2*	*8.75*	...	...	...	...	...	...	...
22	*73.5*	*54.7*	*40.6*	*29.2*	*20.6*	*15.2*	*8.75*	...	...	...	...	...	...	...
23	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
24	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
25	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
26	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
27	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
28	*125*	...	...	...	...	...	...	...	...	...	...	...	...	...
29	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
30	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
31	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
32	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
33	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
34	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
35	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
36	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
37	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
38	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
39	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
40	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
41	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
42	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
43	*61.7*	*46.4*	*34.7*	*25.5*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	9Cr–1Mo	Smls. tube	SA–213	T9	K90941	...	...	5B	1
2	9Cr–1Mo	Fittings	SA–234	WP9	K90941	...	...	5B	1
3	9Cr–1Mo	Smls. pipe	SA–335	P9	K90941	...	...	5B	1
4	9Cr–1Mo	Forged pipe	SA–369	FP9	K90941	...	...	5B	1
5	9Cr–1Mo	Forgings	SA–182	F9	K90941	...	...	5B	1
6	9Cr–1Mo	Forgings	SA–336	F9	K90941	...	...	5B	1
7	9Cr–1Mo	Castings	SA–217	C12	J82090	...	...	5B	1
8	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...	...	15E	1
9	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...	...	15E	1
10	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...	...	15E	1
11	9Cr–1Mo–V	Plate	SA–387	91	K90901	2	...	15E	1
12	12Cr–Al	Plate	SA–240	405	S40500	...	...	7	1
13	12Cr–Al	Smls. tube	SA–268	TP405	S40500	...	...	7	1
14	13Cr	Plate	SA–240	410S	S41008	...	...	7	1
15	13Cr	Smls. tube	SA–268	TP410	S41000	...	...	6	1
16	13Cr	Plate	SA–240	410	S41000	...	...	6	1
17	13Cr	Forgings	SA–182	F6a	S41000	1	...	6	3
18	13Cr	Forgings	SA–182	F6a	S41000	2	...	6	3
19	13Cr	Forgings	SA–336	F6	S41000	...	...	6	3
20	13Cr	Castings	SA–217	CA15	J91150	...	...	6	3
21	15Cr	Smls. tube	SA–268	TP429	S42900	...	...	6	2
22	15Cr	Plate	SA–240	429	S42900	...	...	6	2
23	17Cr	Smls. tube	SA–268	TP430	S43000	...	...	7	2
24	17Cr	Plate	SA–240	430	S43000	...	...	7	2
25	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1100	...	...	...
26	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1100	...	...	...
27	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1100	...	...	...
28	26Cr–3Ni–3Mo	Plate	SA–240	26–3–3	S44660	...	$t \le 5$	10K	1
29	26Cr–3Ni–3Mo	Smls. tube	SA–268	26–3–3	S44660	...	$t \le 5$	10K	1
30	26Cr–3Ni–3Mo	Wld. tube	SA–268	26–3–3	S44660	...	$t \le 5$	10K	1
31	26Cr–3Ni–3Mo	Wld. tube	SA–803	26–3–3	S44660	...	$t \le 5$	10K	1
32	29Cr–4Mo–Ti	Smls. tube	SA–268	...	S44735	...	...	10J	1
33	Mn–¼Mo	Forgings	SA–372	D	K14508	...	...	11A	4
34	Mn–¼Mo	Forgings	SA–372	D	K10508	...	...	11A	4
35	Mn–½Mo	Plate	SA–302	A	K12021	...	...	3	2
36	Mn–½Mo	Plate	SA–302	B	K12022	...	...	3	3
37	Mn–½Mo	Plate	SA–533	A	K12521	1	...	3	3
38	Mn–½Mo	Plate	SA–533	A	K12521	2	...	3	3
39	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	2	...	3	3
40	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	3	...	11A	4
41	Mn–½Mo–½Ni	Plate	SA–302	C	K12039	...	...	3	3
42	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	1	...	3	3
43	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	2	...	3	3
44	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	3	...	11A	4

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	415	205	649	CS–2	T7
2	415	205	649	CS–2	T7
3	415	205	649	CS–2	T7
4	415	210	649	CS–2	T7
5	585	415	649	CS–3	T7
6	585	380	649	CS–3	T7
7	620	415	649	CS–3	H2, T7
8	585	415	649	CS–3	T8
9	585	415	649	CS–3	T8
10	585	415	649	CS–3	T8
11	585	415	649	CS–3	T8
12	415	170	538	CS–1	G8, T7
13	415	205	538	CS–2	G8, T7
14	415	205	649	CS–2	T6
15	415	205	649	CS–2	T6
16	450	205	649	CS–2	T6
17	485	275	649	CS–3	T5
18	585	380	649	CS–3	T5
19	585	380	649	CS–3	T5
20	620	450	649	CS–5	T5
21	415	240	649	CS–2	G8, T6
22	450	205	649	CS–2	G8, T6
23	415	240	649	CS–2	G8, T6
24	450	205	649	CS–2	G8, T6
25	965	795	316	HT–1	G8, W1
26	965	795	316	HT–1	G8, W1
27	965	795	316	HT–1	G8, W1
28	585	450	371	HA–5	G8, H6
29	585	450	371	HA–5	G8, H6
30	585	450	371	HA–5	G6, G8, H6
31	585	450	316	HA–5	G6, G8, H6
32	515	415	427	HA–6	G8
33	725	450	343	CS–5	G9, H3, T1, W2, W6
34	725	450	343	CS–5	G9, H5, W2, W6
35	515	319	538	CS–3	G14, T6
36	550	345	538	CS–3	G14, T6
37	550	345	538	CS–5	T6
38	620	485	427	CS–5	...
39	620	485	427	CS–5	...
40	690	570	399	CS–5	...
41	550	345	538	CS–3	G14, T6
42	550	345	427	CS–5	...
43	620	485	427	CS–5	...
44	690	570	427	CS–5	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
2	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
3	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
4	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
5	244	236	227	223	220	218	217	217	216	215	214	212	209	205	201	195	188	180
6	244	236	227	223	220	218	217	217	216	215	214	212	209	205	201	195	188	180
7	259	258	248	243	240	238	237	236	235	235	233	231	228	224	219	213	205	197
8	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
9	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
10	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
11	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
12	115	109	105	103	102	101	100	99.7	99.1	98.4	97.5	96.2	94.7	92.6	90.1	87.0	83.4	79.2
13	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	95.0
14	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	*92.5*
15	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	*92.5*
16	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	*92.5*
17	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	*125*	*92.5*
18	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	*125*	*92.5*
19	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	*125*	*92.5*
20	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	*125*	*92.5*
21	161	152	147	145	143	141	140	140	139	138	136	135	133	130	126	122	117	*88.7*
22	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	*88.7*
23	161	152	147	145	143	141	140	140	139	138	136	135	133	130	126	122	117	*88.7*
24	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	*88.7*
25	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
26	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
27	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
28	244	244	244	244	244	244	241	237	234	231	229	228	227	226	226	...	...	...
29	244	244	244	244	244	244	241	237	234	231	229	228	227	226	226	...	...	...
30	208	208	208	208	208	208	205	201	199	197	195	194	193	192	192	...	...	...
31	208	208	208	208	208	208	205	201	199	197	195	194	193	...	...	...	...	...
32	215	215	215	214	204	194	186	179	174	169	166	164	163	162	161	157	150	...
33	299	289	283	278	271	264	256	248	242	236	232	230	*160*	*131*	...	...	...	...
34	299	287	280	275	272	268	265	262	259	256	253	250	247	243	...	...	...	...
35	207	199	194	191	188	186	183	181	179	177	175	173	171	168	165	160	154	*104*
36	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	*104*
37	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	*104*
38	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
39	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
40	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	...	...
41	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	*104*
42	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
43	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
44	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	285	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	*83.2*	*60.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
2	*83.2*	*60.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
3	*83.2*	*60.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
4	*83.2*	*60.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
5	*87.5*	*61.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
6	*87.5*	*61.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
7	*87.5*	*61.2*	*42.9*	*29.9*	*20.6*	*14.4*	*10.2*	...	...	...	...	...	...	...
8	204	*151*	*115*	*87.0*	*64.7*	*45.1*	*29.1*	...	...	...	...	...	...	...
9	204	*151*	*115*	*87.0*	*64.7*	*45.1*	*29.1*	...	...	...	...	...	...	...
10	204	*151*	*115*	*87.0*	*64.7*	*45.1*	*29.1*	...	...	...	...	...	...	...
11	204	*151*	*115*	*87.0*	*64.7*	*45.1*	*29.1*	...	...	...	...	...	...	...
12	*70.1*	*38.8*	*19.9*	...	...	...	...	...	...	...	...	...	...	...
13	*70.1*	*38.8*	*19.9*	...	...	...	...	...	...	...	...	...	...	...
14	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
15	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
16	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
17	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
18	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
19	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
20	*68.4*	*51.1*	*37.4*	*26.3*	*17.8*	*11.4*	*6.73*	...	...	...	...	...	...	...
21	*69.8*	*52.6*	*38.1*	*27.6*	*20.6*	*15.9*	*12.3*	...	...	...	...	...	...	...
22	*69.8*	*52.6*	*38.1*	*27.6*	*20.6*	*15.9*	*12.3*	...	...	...	...	...	...	...
23	*69.8*	*52.6*	*38.1*	*27.6*	*20.6*	*15.9*	*12.3*	...	...	...	...	...	...	...
24	*69.8*	*52.6*	*38.1*	*27.6*	*20.6*	*15.9*	*12.3*	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	*68.0*	*42.3*	*26.1*	...	...	...	...	...	...	...	...	...	...	...
36	*68.0*	*42.3*	*26.1*	...	...	...	...	...	...	...	...	...	...	...
37	*68.0*	*42.3*	*26.1*	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	*68.0*	*42.3*	*26.1*	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
	1	Mn–½Mo–¾Ni	Plate	SA–302	D	K12054	...	...	3	3
	2	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	1	...	3	3
(**13**)	3	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	1	...	3	3
	4	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	2	...	3	3
(**13**)	5	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	2	...	3	3
	6	Mn–½Mo–¾Ni	Plate	SA–533	B	K12554	3	...	3	3
(**13**)	7	Mn–½Ni–V	Plate	SA/NF A 36–215	P440NJ4	...	...	$8 \le t \le 20$	10A	1
	8	Mn–½Ni–V	Plate	SA–225	C	K12524	...	...	10A	1
	9	Mn–V	Castings	SA–487	1	J13002	A	...	10A	1
	10	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	A	...	3	3
	11	½Ni–½Mo–V	Forgings	SA–541	3	K12045	1	...	3	3
	12	½Ni–½Mo–V	Forgings	SA–541	3	K12045	2	...	3	3
	13	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	$64 < t \le 100$	11B	3
	14	¾Ni–½Cr–½Mo–V	Plate	SA–517	F	K11576	...	$t \le 64$	11B	3
	15	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	$t \le 64$	11B	3
	16	¾Ni–½Cu–Mo	Smls. tube	SA–423	2	K11540	...	...	4	2
	17	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	1	...	3	3
	18	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	1	...	3	3
	19	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	2	...	3	3
	20	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	2	...	3	3
	21	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	1	...	3	3
	22	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	2	...	3	3
	23	¾Ni–1Mo–¾Cr	Castings	SA–217	WC5	J22000	...	...	4	1
	24	1Ni–½Cr–½Mo	Castings	SA–217	WC4	J12082	...	...	4	1
	25	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	$64 < t \le 100$	11B	8
	26	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	$t \le 64$	11B	8
	27	2Ni–1Cu	Forgings	SA–182	FR	K22035	...	...	9A	1
	28	2Ni–1Cu	Smls. pipe	SA–333	9	K22035	...	...	9A	1
	29	2Ni–1Cu	Smls. pipe	SA–334	9	K22035	...	...	9A	1
	30	2Ni–1Cu	Forgings	SA–350	LF9	K22036	...	...	9A	1
	31	2Ni–1Cu	Fittings	SA–420	WPL9	K22035	...	...	9A	1
	32	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	1	...	11B	10
	33	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2	...	11B	10
	34	2½Ni	Plate	SA–203	A	K21703	...	...	9A	1
	35	2½Ni	Plate	SA–203	B	K22103	...	...	9A	1
	36	2½Ni	Castings	SA–352	LC2	J22500	...	...	9A	1
	37	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	K34035	3	...	3	3
	38	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	K34035	1	...	11A	5
	39	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	K34035	2	...	11B	10
	40	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	1	...	11B	10
	41	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2	...	11B	10

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	550	345	538	CS–3	G14, T6
2	550	345	427	CS–5	...
3	550	345	427	CS–5	...
4	620	485	427	CS–5	...
5	620	485	427	CS–5	...
6	690	570	427	CS–5	...
7	630	440	65	CS–5	...
8	725	485	371	CS–5	T1
9	585	380	343	CS–3	H2, T1
10	620	415	343	CS–3	H2
11	550	340	427	CS–5	...
12	620	450	371	CS–5	...
13	725	620	343	CS–5	S1
14	795	690	343	HT–1	...
15	795	690	343	HT–1	...
16	415	255	343	CS–2	...
17	550	345	427	CS–5	...
18	550	340	427	CS–5	...
19	620	450	371	CS–5	...
20	620	450	371	CS–5	...
21	550	345	427	CS–5	...
22	620	450	371	CS–5	...
23	485	275	593	CS–2	T6
24	485	275	538	CS–2	T7
25	725	620	343	CS–5	...
26	795	690	343	HT–1	...
27	435	315	40	CS–3	...
28	435	315	40	CS–3	...
29	635	315	40	CS–3	...
30	435	315	40	CS–3	...
31	435	315	40	CS–3	...
32	795	690	343	HT–1	G10, G11, W1
33	930	825	343	HT–1	G11, W1
34	450	255	538	CS–2	T2
35	485	275	538	CS–2	T2
36	485	275	343	CS–2	...
37	620	485	343	CS–5	...
38	725	585	343	CS–5	...
39	795	690	343	HT–1	...
40	795	690	343	HT–1	G10, G11, W1
41	930	825	343	HT–1	G11, W1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	*104*
2	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
3	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
4	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
5	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
6	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	285	...
7	263	263	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	302	298	292	290	287	282	276	269	261	252	245	238	*160*	*131*	*107*	...	...	...
9	244	243	237	233	230	227	224	222	219	217	214	212	*160*	*131*	...	...	...	...
10	259	259	259	254	250	247	245	243	240	236	229	220	211	205	...	...	...	...
11	230	225	217	212	208	206	204	203	200	196	191	183	176	171	171	171	171	...
12	259	259	259	259	259	259	259	259	259	255	248	238	229	222	222	...	...	...
13	302	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...
14	330	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...
15	330	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...
16	170	161	156	154	152	150	149	147	146	145	143	141	140	138	...	...	...	...
17	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
18	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
19	259	259	259	259	259	259	259	259	259	256	253	250	247	243	238	...	...	...
20	259	259	259	259	259	259	259	259	259	256	253	250	247	243	238	...	...	...
21	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
22	259	259	259	259	259	259	259	259	259	256	253	250	247	243	238	...	...	...
23	184	177	172	169	167	165	163	161	159	158	156	154	152	149	146	142	137	*124*
24	184	177	172	169	167	165	163	161	159	158	156	154	152	149	146	142	137	131
25	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
26	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
27	181	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	181	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	181	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	181	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	181	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
33	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
34	170	160	155	152	150	148	146	143	140	136	131	126	120	*113*	*95.1*	*79.5*	*64.4*	*48.8*
35	184	173	168	165	162	160	158	155	151	147	142	136	130	*113*	*95.1*	*79.5*	*64.4*	*48.8*
36	184	173	168	165	162	160	158	155	151	147	142	136	130	...	...	...	...	...
37	259	259	259	259	259	259	259	259	259	259	259	259	259	...	...	...	...	...
38	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
39	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
40	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
41	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	*68.0*	*42.3*	*26.1*	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	*87.4*	*59.0*	*39.8*	*26.8*	*17.1*	*11.0*	...	...	...	...	...	...	...	...	
24	*75.6*	*49.9*	*33.5*	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34	*35.4*	*22.6*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
35	*35.4*	*22.6*	*14.2*	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	3	...	3	3
2	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	1	...	11A	5
3	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	2	...	11B	10
4	3½Ni	Smls. pipe	SA–333	3	K31918	...	...	9B	1
5	3½Ni	Smls. tube	SA–334	3	K31918	...	...	9B	1
6	3½Ni	Fittings	SA–420	WPL3	...	...	...	9B	1
7	3½Ni	Plate	SA–203	D	K31718	...	...	9B	1
8	3½Ni	Forgings	SA–350	LF3	K32025	...	...	9B	1
9	3½Ni	Forgings	SA–765	III	K32026	...	...	9B	1
10	3½Ni	Plate	SA–203	E	K32018	...	...	9B	1
11	3½Ni	Castings	SA–352	LC3	J31550	...	...	9B	1
12	3½Ni	Plate	SA–203	F	...	...	t > 50	9B	1
13	3½Ni	Plate	SA–203	F	...	...	t ≤ 50	9B	1
14	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	3	...	3	3
15	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	1	...	11A	5
16	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	2	...	11B	10
17	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	1	...	11B	10
18	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2	...	11B	10
19	5Ni–¼Mo	Plate	SA–645	A	K41583	...	...	11A	2
20	8Ni	Plate	SA–553	II	K71340	...	...	11A	1
21	8Ni	Plate	SA–553	II	K71340	...	...	11A	1
22	9Ni	Smls. pipe	SA–333	8	K81340	...	...	11A	1
23	9Ni	Smls. pipe	SA–333	8	K81340	...	...	11A	1
24	9Ni	Smls. tube	SA–334	8	K81340	...	...	11A	1
25	9Ni	Smls. tube	SA–334	8	K81340	...	...	11A	1
26	9Ni	Plate	SA–353	...	K81340	...	...	11A	1
27	9Ni	Plate	SA–353	...	K81340	...	...	11A	1
28	9Ni	Fittings	SA–420	WPL8	K81340	...	...	11A	1
29	9Ni	Fittings	SA–420	WPL8	K81340	...	...	11A	1
30	9Ni	Forgings	SA–522	I	K81340	...	...	11A	1
31	9Ni	Forgings	SA–522	I	K81340	...	...	11A	1
32	9Ni	Plate	SA–553	I	K81340	...	...	11A	1
33	9Ni	Plate	SA–553	I	K81340	...	...	11A	1
34	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...	...	8	3
35	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...	...	8	3
36	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	t > 125	8	1
37	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...	...	8	1
38	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	t ≤ 125	8	1
39	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...	...	8	1
40	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...	...	8	1
41	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	620	485	343	CS–5	...
2	725	585	343	CS–5	W7
3	795	690	343	HT–1	...
4	450	240	343	CS–2	...
5	450	240	343	CS–2	...
6	450	240	343	CS–2	...
7	450	255	538	CS–2	T2
8	485	260	343	CS–2	...
9	485	260	343	CS–2	...
10	485	275	538	CS–2	T2
11	485	275	343	CS–2	...
12	515	345	343	CS–3	T1
13	550	380	343	CS–3	...
14	620	485	343	CS–5	...
15	725	585	343	CS–5	W7
16	795	690	343	HT–1	...
17	795	690	343	HT–1	G10, G11, W1
18	930	825	343	HT–1	G11, W1
19	655	450	121	CS–3	W4
20	690	585	121	CS–3	W3
21	690	585	121	CS–3	W4
22	690	515	121	CS–3	W3
23	690	515	121	CS–3	W4
24	690	515	121	CS–3	W3
25	690	515	121	CS–3	W4
26	690	515	121	CS–3	W3
27	690	515	121	CS–3	W4
28	690	515	121	CS–3	W3
29	690	515	121	CS–3	W4
30	690	515	121	CS–3	G9, S2, W3
31	690	515	121	CS–3	G9, S2, W4
32	690	585	121	CS–3	W3
33	690	585	121	CS–3	W4
34	655	310	427	HA–6	...
35	655	310	427	HA–6	G2
36	450	170	454	HA–4	G2
37	450	170	454	HA–4	G2
38	485	170	454	HA–4	G2
39	485	170	454	HA–4	G2
40	485	170	454	HA–4	G2
41	485	170	454	HA–4	G2, G6

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	259	259	259	259	259	259	259	259	259	259	259	259	259	...	...	...	...	...
2	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
3	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
4	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
5	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
6	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
7	170	160	155	152	150	148	146	143	140	136	131	126	120	*113*	*95.1*	*79.5*	*64.4*	*48.8*
8	172	162	157	154	152	150	148	145	141	137	133	127	121	...	...	...	...	...
9	172	162	157	154	152	150	148	145	141	137	133	127	121	...	...	...	...	...
10	184	173	168	165	162	160	158	155	151	147	142	136	130	*122*	*101*	*83.8*	*66.8*	*49.2*
11	184	173	168	165	162	160	158	155	151	147	142	136	130	...	...	...	...	...
12	215	215	209	206	203	200	197	193	189	183	177	170	*148*	...	...	...	...	...
13	230	230	230	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	259	259	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	302	302	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	330	330	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
18	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
19	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	207	179	164	157	151	147	143	141	139	137	134	131	127	123	119	115	112	...
35	207	207	207	207	203	198	194	190	187	185	181	176	172	167	161	156	151	...
36	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
37	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
38	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
39	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
40	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
41	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	*35.4*	*22.6*	*14.2*	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	*35.4*	*22.6*	*13.3*	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	16Cr–12Ni–2Mo	Smls. pipe	SA–312	TP316L	S31603	...	...	8	1
2	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316L	S31603	...	...	8	1
3	16Cr–12Ni–2Mo	Fittings	SA–403	316L	S31603	CR	...	8	1
4	16Cr–12Ni–2Mo	Wld. fittings	SA–403	316L	S31603	WP–W	...	8	1
5	16Cr–12Ni–2Mo	Wld. fittings	SA–403	316L	S31603	WP–WX	...	8	1
6	16Cr–12Ni–2Mo	Wld. pipe	SA–688	TP316L	S31603	...	...	8	1
7	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...	...	8	1
8	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	t > 125	8	1
9	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...	...	8	1
10	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	t > 125	8	1
11	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...	...	8	1
12	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	t ≤ 125	8	1
13	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...	...	8	1
14	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...	...	8	1
15	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	8	1
16	16Cr–12Ni–2Mo	Smls. pipe	SA–312	TP316	S31600	...	...	8	1
17	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316	S31600	...	...	8	1
18	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...	...	8	1
19	16Cr–12Ni–2Mo	Fittings	SA–403	316	S31600	WP–S	...	8	1
20	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	8	1
21	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	t > 125	8	1
22	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...	...	8	1
23	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	8	1
24	16Cr–12Ni–2Mo	Smls. pipe	SA–312	TP316H	S31609	...	...	8	1
25	16Cr–12Ni–2Mo	Wld. pipe	SA–312	TP316H	S31609	...	...	8	1
26	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...	...	8	1
27	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...	t ≤ 125	8	1
28	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...	t ≤ 125	8	1
29	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	8	1
30	16Cr–12Ni–2Mo–N	Smls. pipe	SA–312	TP316N	S31651	...	t ≤ 125	8	1
31	16Cr–12Ni–2Mo–N	Wld. pipe	SA–312	TP316N	S31651	...	t ≤ 125	8	1
32	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...	...	8	1
33	16Cr–12Ni–2Mo–N	Fittings	SA–403	316N	S31651	CR	...	8	1
34	16Cr–12Ni–2Mo–N	Wld. fittings	SA–403	316N	S31651	WP–W	...	8	1
35	16Cr–12Ni–2Mo–N	Wld. fittings	SA–403	316N	S31651	WP–WX	...	8	1
36	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...	...	8	1
37	17.5Cr–17.5Ni–5.3Si	Plate	SA–240	...	S30601	...	...	8	1
38	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...	t > 5	8	3
39	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...	t ≤ 5	8	3
40	18Cr–5Ni–3Mo	Smls. tube	SA–789	...	S31500	...	...	10H	1
41	18Cr–5Ni–3Mo	Wld. tube	SA–789	...	S31500	...	...	10H	1
42	18Cr–5Ni–3Mo	Smls. pipe	SA–790	...	S31500	...	...	10H	1
43	18Cr–5Ni–3Mo	Wld. pipe	SA–790	...	S31500	...	...	10H	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	485	170	454	HA–4	G2
2	485	170	454	HA–4	G2, G6
3	485	170	454	HA–4	G2, G6
4	485	170	454	HA–4	G2, G6
5	485	170	454	HA–4	G2, G6
6	485	175	454	HA–4	G2, G6
7	485	205	816	HA–2	G2, G3, G4, G8, T10
8	485	205	816	HA–2	G2, T10
9	485	205	816	HA–2	G2, T10
10	485	205	816	HA–2	G2, T10
11	485	205	816	HA–2	G2, T10
12	515	205	816	HA–2	G2, G3, T10
13	515	205	816	HA–2	G2, G3, T10
14	515	205	816	HA–2	G2, G3, G4, T10
15	515	205	816	HA–2	G2, G3, G6, T10
16	515	205	816	HA–2	G2, G3, G4, T10
17	515	205	816	HA–2	G2, G3, G4, G6, T10
18	515	205	816	HA–2	G2, G3, G4, T10
19	515	205	816	HA–2	G2, T10
20	515	205	816	HA–2	G2, G3, G6, T10
21	515	205	816	HA–2	G2
22	515	205	816	HA–2	G2, T10
23	515	205	816	HA–2	G2, G6, T10
24	515	205	816	HA–2	G2, T10
25	515	205	816	HA–2	G2, G6, T10
26	515	205	816	HA–2	G2, G4, T10
27	550	240	649	HA–2	G2, T10
28	550	240	649	HA–2	G2, T10
29	550	240	649	HA–2	G2, G6, T10
30	550	240	649	HA–2	G2, T10
31	550	240	649	HA–2	G2, G6, T10
32	550	240	649	HA–2	G2, G4, T10
33	550	240	649	HA–2	G2, G6, T10
34	550	240	649	HA–2	G2, G6, T10
35	550	240	649	HA–2	G2, G6, T10
36	550	240	649	HA–2	G2, T10
37	540	255	204	HA–1	...
38	690	380	427	HA–6	G2
39	690	415	427	HA–6	G2
40	630	440	343	HA–5	G8
41	630	440	343	HA–5	G6, G8
42	630	440	343	HA–5	G8
43	630	440	343	HA–5	G6, G8

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	115	115	115	115	115	113	109	106	103	100	98.1	96.1	94.3	92.6	90.9	89.3	87.6	85.9
2	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0
3	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0
4	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0
5	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0
6	97.7	97.7	97.7	97.7	97.7	96.2	92.8	89.9	87.4	85.2	83.4	81.7	80.2	78.7	77.3	75.9	74.4	73.0
7	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
8	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
9	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
10	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
11	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
12	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
13	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
14	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
15	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
16	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
17	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
18	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
19	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
20	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
21	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	...	...	...
22	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
23	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
24	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
25	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
26	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
27	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
28	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
29	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
30	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
31	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
32	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
33	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
34	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
35	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
36	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
37	170	170	170	170	168	161	154	149	...	...	...	...	...	...	...	...	...	...
38	253	253	253	249	232	218	206	197	190	184	180	177	174	172	169	166	162	...
39	276	276	276	272	253	238	225	215	207	201	197	193	190	187	184	181	176	...
40	264	264	264	264	264	264	264	264	264	264	264	264	264	...	...	...	...	...
41	225	225	225	225	225	225	225	225	225	225	225	225	225	...	...	...	...	...
42	264	264	264	264	264	264	264	264	264	264	264	264	264	...	...	...	...	...
43	225	225	225	225	225	225	225	225	225	225	225	225	225	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
8	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
9	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
10	107	106	105	*97.8*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.4*	*13.3*	*10.4*	*8.18*
11	107	106	105	*97.8*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.4*	*13.3*	*10.4*	*8.18*
12	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
13	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
14	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
15	90.7	90.0	89.2	*83.1*	*68.7*	*55.2*	*42.9*	*33.3*	*25.9*	*20.1*	*15.6*	*12.1*	*9.41*	*7.31*
16	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
17	90.7	90.0	89.2	*83.1*	*68.7*	*55.2*	*42.9*	*33.3*	*25.9*	*20.1*	*15.6*	*12.1*	*9.41*	*7.31*
18	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
19	107	106	105	*97.8*	*80.8*	*65.0*	*50.5*	*39.2*	*30.4*	*23.6*	*18.4*	*14.3*	*11.1*	*8.60*
20	90.7	90.0	89.2	*83.1*	*68.7*	*55.2*	*42.9*	*33.3*	*25.9*	*20.1*	*15.6*	*12.1*	*9.41*	*7.31*
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	107	106	105	*97.8*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.4*	*13.3*	*10.4*	*8.18*
23	90.7	90.0	89.2	*83.1*	*68.7*	*55.2*	*42.9*	*32.8*	*25.2*	*19.5*	*14.8*	*11.3*	*8.85*	*6.95*
24	107	106	105	*97.8*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.4*	*13.3*	*10.4*	*8.18*
25	90.7	90.0	89.2	*83.1*	*68.7*	*55.2*	*42.9*	*32.8*	*25.2*	*19.5*	*14.8*	*11.3*	*8.85*	*6.95*
26	107	106	105	*97.8*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.4*	*13.3*	*10.4*	*8.18*
27	126	124	122	*100*	*80.3*	*65.0*	*50.5*	...	...	...	...	...	...	...
28	126	124	122	*100*	*80.3*	*65.0*	*50.5*	...	...	...	...	...	...	...
29	107	105	103	*85.0*	*68.3*	*55.2*	*42.9*	...	...	...	...	...	...	...
30	126	124	122	*100*	*80.3*	*65.0*	*50.5*	...	...	...	...	...	...	...
31	107	105	103	*85.0*	*68.3*	*55.2*	*42.9*	...	...	...	...	...	...	...
32	126	124	122	*100*	*80.3*	*65.0*	*50.5*	...	...	...	...	...	...	...
33	107	105	103	*85.0*	*68.3*	*55.2*	*42.9*	...	...	...	...	...	...	...
34	107	105	103	*85.0*	*68.3*	*55.2*	*42.9*	...	...	...	...	...	...	...
35	107	105	103	*85.0*	*68.3*	*55.2*	*42.9*	...	...	...	...	...	...	...
36	126	124	122	*100*	*80.3*	*65.0*	*50.5*	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	$t > 125$	8	1
2	18Cr–8Ni	Forgings	SA–965	F304L	S30403	...	...	8	1
3	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	$t \le 125$	8	1
4	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...	...	8	1
5	18Cr–8Ni	Plate	SA–240	304L	S30403	...	...	8	1
6	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	8	1
7	18Cr–8Ni	Smls. pipe	SA–312	TP304L	S30403	...	...	8	1
8	18Cr–8Ni	Wld. pipe	SA–312	TP304L	S30403	...	...	8	1
9	18Cr–8Ni	Fittings	SA–403	304L	S30403	WP–S	...	8	1
10	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	8	1
11	18Cr–8Ni	Castings	SA–351	CF3	J92500	...	...	8	1
12	18Cr–8Ni	Castings	SA–351	CF10	J92590	...	...	8	1
13	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	8	1
14	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	$t > 125$	8	1
(13) 15	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
16	18Cr–8Ni	Forgings	SA–965	F304	S30400	...	...	8	1
17	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	$t > 125$	8	1
18	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...	...	8	1
19	18Cr–8Ni	Plate	SA–240	302	S30200	...	...	8	1
20	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	$t \le 125$	8	1
21	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...	...	8	1
22	18Cr–8Ni	Plate	SA–240	304	S30400	...	...	8	1
23	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	8	1
24	18Cr–8Ni	Smls. pipe	SA–312	TP304	S30400	...	...	8	1
25	18Cr–8Ni	Wld. pipe	SA–312	TP304	S30400	...	...	8	1
(13) 26	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	8	1
27	18Cr–8Ni	Fittings	SA–403	304	S30400	CR	...	8	1
28	18Cr–8Ni	Fittings	SA–403	304	S30400	WP–S	...	8	1
29	18Cr–8Ni	Wld. fittings	SA–403	304	S30400	WP–W	...	8	1
30	18Cr–8Ni	Wld. fittings	SA–403	304	S30400	WP–WX	...	8	1
31	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	8	1
32	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	$t \le 125$	8	1
33	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...	...	8	1
34	18Cr–8Ni	Plate	SA–240	304H	S30409	...	...	8	1
35	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	8	1
36	18Cr–8Ni	Smls. pipe	SA–312	TP304H	S30409	...	...	8	1
37	18Cr–8Ni	Wld. pipe	SA–312	TP304H	S30409	...	...	8	1
38	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...	...	8	1
39	18Cr–8Ni	Fittings	SA–403	304H	S30409	CR	...	8	1
40	18Cr–8Ni	Fittings	SA–403	304H	S30409	WP–S	...	8	1
41	18Cr–8Ni	Wld. fittings	SA–403	304H	S30409	WP–W	...	8	1
42	18Cr–8Ni	Wld. fittings	SA–403	304H	S30409	WP–WX	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	450	170	649	HA–3	G2, T10
2	450	170	649	HA–3	G2, T10
3	485	170	649	HA–3	G2, T10
4	485	170	649	HA–3	G2, T10
5	485	170	649	HA–3	G2, T10
6	485	170	649	HA–3	G2, G6, T10
7	485	170	649	HA–3	G2, T10
8	485	170	649	HA–3	G2, G6, T10
9	485	170	649	HA–3	G2, T10
10	485	175	649	HA–3	G2, G6, T10
11	485	205	427	HA–3	G2, G8
12	485	205	816	HA–3	G2, G4, G8, T8
13	485	205	816	HA–1	G2, G3, G4, G8, T8
14	485	205	816	HA–1	G2, G3, G4, T10
15	485	205	816	HA–1	G2, G3, G4, S3, T10
16	485	205	816	HA–1	G2, G3, G4, T10
17	485	205	816	HA–1	G2, T10
18	485	205	816	HA–1	G2, T10
19	515	205	399	HA–1	G2, G3
20	515	205	816	HA–1	G2, G3, G4, T10
21	515	205	816	HA–1	G2, G3, T10
22	515	205	816	HA–1	G2, G3, G4, T10
23	515	205	816	HA–1	G2, G3, G6, T10
24	515	205	816	HA–1	G2, G3, G4, T10
25	515	205	816	HA–1	G2, G3, G4, G6, T10
26	515	205	816	HA–1	G2, G3, G4, S4, T10
27	515	205	816	HA–1	G2, G6, T10
28	515	205	816	HA–1	G2, T10
29	515	205	816	HA–1	G2, G6, T10
30	515	205	816	HA–1	G2, G6, T10
31	515	205	816	HA–1	G2, G3, G6, T10
32	515	205	816	HA–1	G2, T10
33	515	205	816	HA–1	G2, T10
34	515	205	816	HA–1	G2, T10
35	515	205	816	HA–1	G2, G6, T10
36	515	205	816	HA–1	G2, T10
37	515	205	816	HA–1	G2, G6, T10
38	515	205	816	HA–1	G2, G4, T10
39	515	205	816	HA–1	G2, G6, T10
40	515	205	816	HA–1	G2, T10
41	515	205	816	HA–1	G2, G6, T10
42	515	205	816	HA–1	G2, G6, T10

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
2	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
3	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
4	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
5	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
6	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
7	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
8	97.7	97.7	97.7	97.7	97.7	96.8	93.1	90.0	87.2	85.0	83.0	81.4	80.0	78.7	77.6	76.5	75.4	74.2
9	115	115	115	115	115	114	110	106	103	99.9	97.7	95.7	94.1	92.6	91.3	90.0	88.7	87.3
10	97.7	97.7	97.7	97.7	97.7	96.8	93.1	90.0	87.2	85.0	83.0	81.4	80.0	78.7	77.6	76.5	75.4	74.2
11	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	...
12	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
13	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
14	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
15	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
16	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
17	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
18	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
19	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	...	...
20	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
21	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
22	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
23	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
24	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
25	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
26	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
27	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
28	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
29	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
30	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
31	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
32	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
33	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
34	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
35	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
36	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
37	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
38	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
39	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
40	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
41	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
42	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
2	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
3	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
4	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
5	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
6	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
7	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
8	72.8	71.1	69.2	*34.4*	*28.2*	*22.7*	*18.6*	...	...	...	...	...	...	...	
9	85.6	83.7	81.4	*40.4*	*33.2*	*26.7*	*21.9*	...	...	...	...	...	...	...	
10	72.8	71.1	69.2	*34.4*	*28.2*	*22.7*	*18.6*	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	99.1	*94.4*	*75.3*	*60.4*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.8*	*14.7*	*12.8*	*11.1*	
13	99.1	*94.4*	*75.3*	*60.4*	*49.0*	*40.1*	*32.8*	*27.2*	*23.4*	*19.6*	*16.8*	*14.7*	*12.8*	*11.1*	
14	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
15	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	(**13**)
16	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
17	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
18	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
21	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
22	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
23	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
24	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
25	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
26	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	(**13**)
27	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
28	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
29	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
30	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
31	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
32	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
33	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
34	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
35	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
36	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
37	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
38	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
39	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
40	99.1	97.3	95.5	*78.9*	*63.8*	*51.6*	*41.6*	*32.9*	*26.5*	*21.3*	*17.2*	*14.1*	*11.2*	*8.80*	
41	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	
42	84.3	82.7	81.2	*67.1*	*54.3*	*43.9*	*35.4*	*28.0*	*22.5*	*18.1*	*14.7*	*11.9*	*9.56*	*7.48*	

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...	...	8	1
2	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...	...	8	1
3	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	8	1
4	18Cr–8Ni–N	Smls. pipe	SA–312	TP304N	S30451	...	...	8	1
5	18Cr–8Ni–N	Wld. pipe	SA–312	TP304N	S30451	...	...	8	1
6	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...	...	8	1
7	18Cr–8Ni–N	Fittings	SA–403	304N	S30451	CR	...	8	1
8	18Cr–8Ni–N	Wld. fittings	SA–403	304N	S30451	WP–W	...	8	1
9	18Cr–8Ni–N	Wld. fittings	SA–403	304N	S30451	WP–WX	...	8	1
10	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...	...	8	1
11	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	8	1
12	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	t > 125	8	1
13	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...	...	8	1
14	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	t > 125	8	1
15	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...	...	8	1
16	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	t > 125	8	1
17	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	t > 125	8	1
18	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	t ≤ 125	8	1
19	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...	...	8	1
20	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...	...	8	1
21	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	8	1
22	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347	S34700	...	...	8	1
23	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347	S34700	...	...	8	1
24	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...	...	8	1
25	18Cr–10Ni–Cb	Fittings	SA–403	347	S34700	CR	...	8	1
26	18Cr–10Ni–Cb	Fittings	SA–403	347	S34700	WP–S	...	8	1
27	18Cr–10Ni–Cb	Wld. fittings	SA–403	347	S34700	WP–W	...	8	1
28	18Cr–10Ni–Cb	Wld. fittings	SA–403	347	S34700	WP–WX	...	8	1
29	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	t ≤ 125	8	1
30	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...	...	8	1
31	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...	...	8	1
32	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	8	1
33	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347H	S34709	...	...	8	1
34	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP347H	S34709	...	...	8	1
35	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...	...	8	1
36	18Cr–10Ni–Cb	Fittings	SA–403	347H	S34709	CR	...	8	1
37	18Cr–10Ni–Cb	Fittings	SA–403	347H	S34709	WP–S	...	8	1
38	18Cr–10Ni–Cb	Wld. fittings	SA–403	347H	S34709	WP–W	...	8	1
39	18Cr–10Ni–Cb	Wld. fittings	SA–403	347H	S34709	WP–WX	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	550	240	649	HA–1	G2, T9
2	550	240	649	HA–1	G2, T9
3	550	240	649	HA–1	G2, G6, T9
4	550	240	649	HA–1	G2, T9
5	550	240	649	HA–1	G2, G6, T9
6	550	240	649	HA–1	G2, G4, T9
7	550	240	649	HA–1	G2, G6, T9
8	550	240	649	HA–1	G2, G6, T9
9	550	240	649	HA–1	G2, G6, T9
10	550	240	649	HA–1	G2, T9
11	485	205	816	HA–2	G2, G3, G8, T9
12	485	205	816	HA–2	G2, G3, T9
13	485	205	816	HA–2	G2, G3, T9
14	485	205	816	HA–2	G1, G2, T10
15	485	205	816	HA–2	G1, G2, T10
16	515	205	816	HA–2	G2, G3, T9
17	515	205	816	HA–2	G2, T10
18	515	205	816	HA–2	G2, G3, G4, T9
19	515	205	816	HA–2	G2, G3, G4, T9
20	515	205	816	HA–2	G2, G3, T9
21	515	205	816	HA–2	G2, G3, G6, T9
22	515	205	816	HA–2	G2, G3, T9
23	515	205	816	HA–2	G2, G3, G6, T9
24	515	205	816	HA–2	G2, G3, G4, T9
25	515	205	816	HA–2	G2, G6, T9
26	515	205	816	HA–2	G2, T9
27	515	205	816	HA–2	G2, G6, T9
28	515	205	816	HA–2	G2, G6, T9
29	517	205	816	HA–2	G1, G2, T10
30	515	205	816	HA–2	G1, G2, T10
31	515	205	816	HA–2	G1, G2, T10
32	515	205	816	HA–2	G2, G6, T10
33	515	205	816	HA–2	G1, G2, T10
34	515	205	816	HA–2	G1, G2, G6, T10
35	515	205	816	HA–2	G1, G2, T10
36	515	205	816	HA–2	G1, G2, G6, T10
37	515	205	816	HA–2	G1, G2, T10
38	515	205	816	HA–2	G1, G2, G6, T10
39	515	205	816	HA–2	G1, G2, G6, T10

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
2	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
3	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
4	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
5	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
6	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
7	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
8	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
9	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
10	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
11	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
12	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
13	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
14	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
15	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
16	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
17	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
18	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
19	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
20	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
21	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
22	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
23	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
24	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
25	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
26	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
27	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
28	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
29	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
30	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
31	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
32	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
33	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
34	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
35	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
36	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
37	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
38	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
39	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
2	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
3	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
4	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
5	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
6	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
7	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
8	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
9	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
10	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
11	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
12	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
13	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
14	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
15	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
16	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
17	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
18	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
19	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
20	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
21	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
22	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
23	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
24	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
25	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
26	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
27	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
28	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
29	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
30	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
31	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
32	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
33	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
34	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
35	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
36	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
37	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
38	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
39	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	$t \le 125$	8	1
2	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...	...	8	1
3	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...	...	8	1
4	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	8	1
5	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP348	S34800	...	...	8	1
6	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348	S34800	...	...	8	1
7	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...	...	8	1
8	18Cr–10Ni–Cb	Fittings	SA–403	348	S34800	CR	...	8	1
9	18Cr–10Ni–Cb	Fittings	SA–403	348	S34800	WP–S	...	8	1
10	18Cr–10Ni–Cb	Wld. fittings	SA–403	348	S34800	WP–W	...	8	1
11	18Cr–10Ni–Cb	Wld. fittings	SA–403	348	S34800	WP–WX	...	8	1
12	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	$t \le 125$	8	1
13	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...	...	8	1
14	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	8	1
15	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP348H	S34809	...	...	8	1
16	18Cr–10Ni–Cb	Wld. pipe	SA–312	TP348H	S34809	...	...	8	1
17	18Cr–10Ni–Cb	Fittings	SA–403	348H	S34809	CR	...	8	1
18	18Cr–10Ni–Cb	Fittings	SA–403	348H	S34809	WP–S	...	8	1
19	18Cr–10Ni–Cb	Wld. fittings	SA–403	348H	S34809	WP–W	...	8	1
20	18Cr–10Ni–Cb	Wld. fittings	SA–403	348H	S34809	WP–WX	...	8	1
21	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	$t > 10$	8	1
22	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	$t > 10$	8	1
23	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	$t > 5$	8	1
24	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	$t > 10$	8	1
25	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	$t > 125$	8	1
26	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...	...	8	1
27	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	$t > 125$	8	1
28	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...	...	8	1
29	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	$t \le 125$	8	1
30	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	8	1
31	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	8	1
32	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	8	1
33	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321	S32100	...	$t \le 10$	8	1
34	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321	S32100	...	...	8	1
35	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	$t \le 10$	8	1
36	18Cr–10Ni–Ti	Fittings	SA–403	321	S32100	CR	...	8	1
37	18Cr–10Ni–Ti	Fittings	SA–403	321	S32100	WP–S	...	8	1
38	18Cr–10Ni–Ti	Wld. fittings	SA–403	321	S32100	WP–W	...	8	1
39	18Cr–10Ni–Ti	Wld. fittings	SA–403	321	S32100	WP–WX	...	8	1
40	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	$t \le 125$	8	1
41	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...	...	8	1
42	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...	...	8	1
43	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	515	205	816	HA–2	G2, G3, T9
2	515	205	816	HA–2	G2, G3, T9
3	515	205	816	HA–2	G2, G3, T9
4	515	205	816	HA–2	G2, G3, G6, T9
5	515	205	816	HA–2	G2, G3, T9
6	515	205	816	HA–2	G2, G3, G6, T9
7	515	205	816	HA–2	G2, G3, G4, T9
8	515	205	816	HA–2	G1, G2, G6, T9
9	515	205	816	HA–2	G1, G2, T9
10	515	205	816	HA–2	G1, G2, G6, T9
11	515	205	816	HA–2	G1, G2, G6, T9
12	515	205	816	HA–2	G2, T10
13	515	205	816	HA–2	G1, G2, T10
14	515	205	816	HA–2	G2, G6, T10
15	515	205	816	HA–2	G1, G2, T10
16	515	205	816	HA–2	G1, G2, G6, T10
17	515	205	816	HA–2	G1, G2, G6, T10
18	515	205	816	HA–2	G1, G2, T10
19	515	205	816	HA–2	G1, G2, G6, T10
20	515	205	816	HA–2	G1, G2, G6, T10
21	485	170	816	HA–2	G2, G3, T9
22	480	170	816	HA–2	G2, G3, G4, T9
23	515	205	816	HA–2	G2, T10
24	480	170	816	HA–2	G1, G2, T10
25	485	205	816	HA–2	G2, G3, T9
26	485	205	816	HA–2	G2, G3, T9
27	485	205	816	HA–2	G1, G2, T9
28	485	205	816	HA–2	G1, G2, G3, T9
29	515	205	816	HA–2	G2, G3, T9
30	515	205	816	HA–2	G2, G3, T9
31	515	205	816	HA–2	G2, G3, T9
32	515	205	816	HA–2	G2, G3, G6, T9
33	515	205	816	HA–2	G2, G3, T9
34	515	205	816	HA–2	G2, G3, G6, T9
35	515	205	816	HA–2	G2, G3, G4, T9
36	515	205	816	HA–2	G2, G6, T9
37	515	205	816	HA–2	G2, T9
38	515	205	816	HA–2	G2, G6, T9
39	515	205	816	HA–2	G2, G6, T9
40	515	205	816	HA–2	G1, G2, T9
41	485	205	816	HA–2	G1, G2, T9
42	515	205	816	HA–2	G1, G2, T9
43	515	205	816	HA–2	G2, G6, T9

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
2	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
3	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
4	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
5	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
6	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
7	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
8	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
9	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
10	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
11	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
12	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
13	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
14	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
15	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
16	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
17	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
18	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
19	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
20	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
21	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3	95.3
22	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3	95.3
23	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3	95.3
24	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3	95.3
25	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
26	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
27	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
28	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
29	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
30	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
31	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
32	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
33	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
34	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
35	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
36	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
37	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
38	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
39	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
40	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
41	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
42	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
43	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
2	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
3	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
4	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
5	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
6	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
7	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
8	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
9	125	125	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
10	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
11	106	106	82.9	64.5	48.6	34.2	25.8	19.7	13.8	9.71	7.62	6.02	5.01	4.50
12	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
13	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
14	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
15	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
16	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
17	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
18	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
19	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
20	106	106	106	94.8	77.0	59.1	45.8	35.2	27.0	20.4	16.0	12.4	9.25	6.77
21	94.4	93.6	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
22	94.4	93.6	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
23	94.4	93.6	92.7	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
24	94.4	93.6	92.7	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
25	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
26	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
27	113	112	100	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
28	113	112	100	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
29	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
30	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
31	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
32	96.3	95.5	75.4	50.3	37.4	28.0	20.8	15.5	10.7	7.22	5.26	3.64	2.34	1.48
33	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
34	96.3	95.5	75.4	50.3	37.4	28.0	20.8	15.5	10.7	7.22	5.26	3.64	2.34	1.48
35	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
36	96.3	95.5	75.4	50.3	37.4	28.0	20.8	15.5	10.7	7.22	5.26	3.64	2.34	1.48
37	113	112	88.7	59.2	44.0	32.9	24.5	18.3	12.5	8.49	6.19	4.28	2.75	1.74
38	96.3	95.5	75.4	50.3	37.4	28.0	20.8	15.5	10.7	7.22	5.26	3.64	2.34	1.48
39	96.3	95.5	75.4	50.3	37.4	28.0	20.8	15.5	10.7	7.22	5.26	3.64	2.34	1.48
40	113	112	100	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
41	113	112	100	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
42	113	112	100	76.5	58.7	46.0	36.8	28.7	23.0	18.4	14.5	11.5	9.02	6.83
43	96.3	95.5	85.3	65.1	49.9	39.1	31.3	24.4	19.5	15.6	12.3	9.80	7.67	5.80

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	18Cr–10Ni–Ti	Smls. pipe	SA–312	TP321H	S32109	...	$t \le 5$	8	1
2	18Cr–10Ni–Ti	Wld. pipe	SA–312	TP321H	S32109	...	$t \le 5$	8	1
3	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	$t \le 10$	8	1
4	18Cr–10Ni–Ti	Fittings	SA–403	321H	S32109	CR	...	8	1
5	18Cr–10Ni–Ti	Fittings	SA–403	321H	S32109	WP–S	...	8	1
6	18Cr–10Ni–Ti	Wld. fittings	SA–403	321H	S32109	WP–W	...	8	1
7	18Cr–10Ni–Ti	Wld. fittings	SA–403	321H	S32109	WP–WX	...	8	1
8	18Cr–13Ni–3Mo	Plate	SA–240	317	S31700	...	$t \le 125$	8	1
9	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	8	1
10	18Cr–13Ni–3Mo	Smls. pipe	SA–312	TP317	S31700	...	$t \le 125$	8	1
11	18Cr–13Ni–3Mo	Wld. pipe	SA–312	TP317	S31700	...	$t \le 125$	8	1
12	18Cr–13Ni–3Mo	Fittings	SA–403	317	S31700	WP–S	...	8	1
13	18Cr–13Ni–3Mo	Plate	SA–240	317L	S31703	...	...	8	1
14	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	WP–S	...	8	1
15	18Cr–18Ni–2Si	Smls. tube	SA–213	XM–15	S38100	...	$t \le 125$	8	1
16	18Cr–18Ni–2Si	Plate	SA–240	XM–15	S38100	...	$t \le 125$	8	1
17	18Cr–18Ni–2Si	Wld. tube	SA–249	TPXM–15	S38100	...	$t \le 125$	8	1
18	18Cr–18Ni–2Si	Smls. pipe	SA–312	TPXM–15	S38100	...	$t \le 125$	8	1
19	18Cr–18Ni–2Si	Wld. pipe	SA–312	TPXM–15	S38100	...	$t \le 125$	8	1
20	21Cr–6Ni–9Mn	Forgings	SA–182	FXM–11	S21904	...	...	8	3
21	21Cr–6Ni–9Mn	Smls. pipe	SA–312	TPXM–11	S21904	...	...	8	3
22	21Cr–6Ni–9Mn	Wld. pipe	SA–312	TPXM–11	S21904	...	...	8	3
23	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...	...	8	3
24	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...	...	8	3
25	22Cr–5Ni–3Mo–N	Forgings	SA–182	F51	S31803	...	...	10H	1
26	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S31803	...	...	10H	1
27	22Cr–5Ni–3Mo–N	Smls. tube	SA–789	...	S31803	...	...	10H	1
28	22Cr–5Ni–3Mo–N	Wld. tube	SA–789	...	S31803	...	...	10H	1
29	22Cr–5Ni–3Mo–N	Smls. pipe	SA–790	...	S31803	...	...	10H	1
30	22Cr–5Ni–3Mo–N	Wld. pipe	SA–790	...	S31803	...	...	10H	1
(13) 31	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S32205	...	...	10H	1
(13) 32	22Cr–5Ni–3Mo–N	Smls. pipe	SA–790	...	S32205	...	...	10H	1
(13) 33	22Cr–5Ni–3Mo–N	Wld. pipe	SA–790	...	S32205	...	...	10H	1
(13) 34	22Cr–5Ni–3Mo–N	Forgings	SA–182	F60	S32205	...	...	10H	1
(13) 35	22Cr–5Ni–3Mo–N	Smls. tube	SA–789	...	S32205	...	O.D. ≤ 200	10H	1
(13) 36	22Cr–5Ni–3Mo–N	Wld. tube	SA–789	...	S32205	...	O.D. ≤ 200	10H	1
37	22Cr–13Ni–5Mn	Forgings	SA–182	FXM–19	S20910	...	...	8	3
38	22Cr–13Ni–5Mn	Plate	SA–240	XM–19	S20910	...	...	8	3
39	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...	...	8	3
40	22Cr–13Ni–5Mn	Smls. pipe	SA–312	TPXM–19	S20910	...	...	8	3
41	22Cr–13Ni–5Mn	Wld. pipe	SA–312	TPXM–19	S20910	...	...	8	3

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	485	170	816	HA–2	G2, T9
2	515	205	816	HA–2	G2, G6, T9
3	515	205	816	HA–2	G1, G2, T9
4	515	205	816	HA–2	G1, G2, G6, T9
5	515	205	816	HA–2	G1, G2, T9
6	515	205	816	HA–2	G1, G2, G6, T9
7	515	205	816	HA–2	G1, G2, G6, T9
8	515	205	816	HA–2	G2, G3, T10
9	515	205	816	HA–2	G2, G3, G6, T10
10	515	205	816	HA–2	G2, G3, T10
11	515	205	816	HA–2	G2, G3, G6, T10
12	515	205	816	HA–2	G2, T10
13	515	205	454	HA–4	G2
14	515	205	454	HA–4	G2
15	515	205	538	HA–2	G2, G3
16	515	205	538	HA–2	G2, G3
17	515	205	538	HA–2	G2, G3, G6
18	515	205	538	HA–2	G2, G3
19	515	205	538	HA–2	G2, G3, G6
20	620	345	316	HA–6	G2
21	620	345	316	HA–6	G2
22	620	345	316	HA–6	G2, G6
23	620	345	316	HA–6	G2
24	620	345	316	HA–6	G2
25	620	450	204	HA–5	G8
26	620	450	204	HA–5	G8
27	620	450	204	HA–5	G8
28	620	450	204	HA–5	G6, G8
29	620	450	204	HA–5	G8
30	620	450	204	HA–5	G6, G8
31	650	450	204	HA–5	G8
32	650	450	204	HA–5	G8
33	650	450	204	HA–5	G6, G8
34	650	480	204	HA–5	G8
35	650	480	204	HA–5	G8
36	650	480	204	HA–5	G6, G8
37	690	380	649	HA–6	G2, T11
38	690	380	649	HA–6	G2, T11
39	690	380	649	HA–6	G2, G6, T11
40	690	380	649	HA–6	G2, T11
41	690	380	649	HA–6	G2, G6, T11

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
2	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
3	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
4	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
5	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
6	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
7	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
8	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
9	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
10	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
11	117	117	117	117	117	117	114	110	107	104	101	98.9	97.1	95.6	94.3	93.2	92.3	91.5
12	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
13	138	138	138	138	138	136	131	127	123	120	118	115	113	111	109	107	105	103
14	138	138	138	138	138	136	131	127	123	120	118	115	113	111	109	107	105	103
15	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
16	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
17	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
18	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
19	117	117	117	117	117	114	110	106	103	101	98.5	96.4	94.4	92.5	90.7	89.0	87.4	85.8
20	230	230	230	218	204	193	184	176	170	165	161	159	157	...	...	...	...	...
21	230	230	230	218	204	193	184	176	170	165	161	159	157	...	...	...	...	...
22	195	195	195	185	174	164	156	150	145	140	137	135	133	...	...	...	...	...
23	230	230	230	218	204	193	184	176	170	165	161	159	157	...	...	...	...	...
24	230	230	230	218	204	193	184	176	170	165	161	159	157	...	...	...	...	...
25	259	259	259	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
26	259	259	259	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
27	259	259	259	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
28	220	220	220	216	210	205	201	198	...	...	...	...	...	...	...	...	...	...
29	259	259	259	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
30	220	220	220	220	220	220	220	219	...	...	...	...	...	...	...	...	...	...
31	273	273	263	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
32	273	273	263	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
33	232	232	224	216	210	205	201	198	...	...	...	...	...	...	...	...	...	...
34	273	273	273	273	266	259	255	251	...	...	...	...	...	...	...	...	...	...
35	273	273	273	273	266	259	255	251	...	...	...	...	...	...	...	...	...	...
36	232	232	232	232	226	220	216	213	...	...	...	...	...	...	...	...	...	...
37	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
38	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
39	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
40	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
41	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	
1	113	112	*100*	*76.5*	*58.7*	*46.0*	*36.8*	*28.7*	*23.0*	*18.4*	*14.5*	*11.5*	*9.02*	*6.83*	
2	96.3	95.5	*85.3*	*65.1*	*49.9*	*39.1*	*31.3*	*24.4*	*19.5*	*15.6*	*12.3*	*9.80*	*7.67*	*5.80*	
3	113	112	*100*	*76.5*	*58.7*	*46.0*	*36.8*	*28.7*	*23.0*	*18.4*	*14.5*	*11.5*	*9.02*	*6.83*	
4	96.3	95.5	*85.3*	*65.1*	*49.9*	*39.1*	*31.3*	*24.4*	*19.5*	*15.6*	*12.3*	*9.80*	*7.67*	*5.80*	
5	113	112	*100*	*76.5*	*58.7*	*46.0*	*36.8*	*28.7*	*23.0*	*18.4*	*14.5*	*11.5*	*9.02*	*6.83*	
6	96.3	95.5	*85.3*	*65.1*	*49.9*	*39.1*	*31.3*	*24.4*	*19.5*	*15.6*	*12.3*	*9.80*	*7.67*	*5.80*	
7	96.3	95.5	*85.3*	*65.1*	*49.9*	*39.1*	*31.3*	*24.4*	*19.5*	*15.6*	*12.3*	*9.80*	*7.67*	*5.80*	
8	107	106	105	*99.9*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.5*	*13.5*	*10.6*	*8.12*	
9	90.7	90.0	89.2	*84.9*	*68.7*	*55.2*	*42.9*	*32.8*	*25.2*	*19.5*	*14.8*	*11.5*	*8.97*	*6.90*	
10	107	106	105	*99.9*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.5*	*13.5*	*10.6*	*8.12*	
11	90.7	90.0	89.2	*84.9*	*68.7*	*55.2*	*42.9*	*32.8*	*25.2*	*19.5*	*14.8*	*11.5*	*8.97*	*6.90*	
12	107	106	105	*99.9*	*80.8*	*65.0*	*50.4*	*38.6*	*29.6*	*23.0*	*17.5*	*13.5*	*10.6*	*8.12*	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...	
16	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...	
17	84.3	82.7	81.2	...	...	...	...	...	...	...	...	...	...	...	
18	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...	
19	84.3	82.7	81.2	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
37	213	210	207	203	*126*	*84.2*	*56.2*	...	...	...	...	...	...	...	
38	213	210	207	203	*126*	*84.2*	*56.2*	...	...	...	...	...	...	...	
39	181	179	176	172	*107*	*71.5*	*47.8*	...	...	...	...	...	...	...	
40	213	210	207	203	*126*	*84.2*	*56.2*	...	...	...	...	...	...	...	
41	181	179	176	172	*107*	*71.5*	*47.8*	...	...	...	...	...	...	...	

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	22Cr–13Ni–5Mn	Fittings	SA–403	XM–19	S20910	CR	...	8	3
2	22Cr–13Ni–5Mn	Wld. fittings	SA–403	XM–19	S20910	WP–W	...	8	3
3	22Cr–13Ni–5Mn	Wld. fittings	SA–403	XM–19	S20910	WP–WX	...	8	3
4	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	...	...	8	3
5	22Cr–13Ni–5Mn	Forgings	SA–965	FXM–19	S20910	...	...	8	3
6	23Cr–4Ni–Mo–Cu–N	Plate	SA–240	...	S32304	...	...	10H	1
7	23Cr–12Ni	Fittings	SA–403	309	S30900	...	...	8	2
8	23Cr–12Ni	Fittings	SA–403	309	S30900	WP–S	...	8	2
9	23Cr–12Ni	Wld. fittings	SA–403	309	S30900	WP–W	...	8	2
10	23Cr–12Ni	Wld. fittings	SA–403	309	S30900	WP–WX	...	8	2
11	23Cr–12Ni	Smls. tube	SA–213	TP309S	S30908	...	...	8	2
12	23Cr–12Ni	Plate	SA–240	309S	S30908	...	...	8	2
13	23Cr–12Ni	Wld. tube	SA–249	TP309S	S30908	...	...	8	2
14	23Cr–12Ni	Smls. pipe	SA–312	TP309S	S30908	...	...	8	2
15	23Cr–12Ni	Wld. pipe	SA–312	TP309S	S30908	...	...	8	2
16	23Cr–12Ni	Wld. pipe	SA–813	TP309S	S30908	...	...	8	2
17	23Cr–12Ni	Wld. pipe	SA–814	TP309S	S30908	...	...	8	2
18	23Cr–12Ni	Smls. tube	SA–213	TP309H	S30909	...	...	8	2
19	23Cr–12Ni	Plate	SA–240	309H	S30909	...	...	8	2
20	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...	...	8	2
21	23Cr–12Ni	Smls. pipe	SA–312	TP309H	S30909	...	...	8	2
22	23Cr–12Ni	Wld. pipe	SA–312	TP309H	S30909	...	...	8	2
23	23Cr–12Ni	Bar	SA–479	309H	S30909	...	...	8	2
24	23Cr–12Ni–Cb	Smls. tube	SA–213	TP309Cb	S30940	...	...	8	2
25	23Cr–12Ni–Cb	Plate	SA–240	309Cb	S30940	...	...	8	2
26	23Cr–12Ni–Cb	Wld. tube	SA–249	TP309Cb	S30940	...	...	8	2
27	23Cr–12Ni–Cb	Smls. pipe	SA–312	TP309Cb	S30940	...	...	8	2
28	23Cr–12Ni–Cb	Wld. pipe	SA–312	TP309Cb	S30940	...	...	8	2
29	23Cr–12Ni–Cb	Wld. pipe	SA–813	TP309Cb	S30940	...	...	8	2
30	23Cr–12Ni–Cb	Wld. pipe	SA–814	TP309Cb	S30940	...	...	8	2
31	25Cr–5Ni–3Mo–2Cu	Plate	SA–240	255	S32550	...	...	10H	1
32	25Cr–6Ni–Mo–N	Plate	SA–240	...	S31200	...	...	10H	1
33	25Cr–12Ni	Castings	SA–351	CH8	J93400	...	...	8	2
34	25Cr–12Ni	Castings	SA–351	CH20	J93402	...	...	8	2
35	25Cr–20Ni	Castings	SA–351	CK20	J94202	...	...	8	2
36	25Cr–20Ni	Forgings	SA–182	F310	S31000	...	$t \le 125$	8	2
37	25Cr–20Ni	Forgings	SA–965	F310	S31000	...	...	8	2
38	25Cr–20Ni	Smls. tube	SA–213	TP310S	S31008	...	...	8	2
39	25Cr–20Ni	Plate	SA–240	310S	S31008	...	...	8	2
40	25Cr–20Ni	Wld. tube	SA–249	TP310S	S31008	...	...	8	2
41	25Cr–20Ni	Smls. pipe	SA–312	TP310S	S31008	...	...	8	2
42	25Cr–20Ni	Wld. pipe	SA–312	TP310S	S31008	...	...	8	2

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	690	380	649	HA–6	G2, G6, T11
2	690	380	649	HA–6	G2, G6, T11
3	690	380	649	HA–6	G2, G6, T11
4	690	380	649	HA–6	G2, T11
5	690	380	649	HA–6	G2, T11
6	600	400	316	HA–6	G2, G8
7	515	205	816	HA–2	G2, G6, T8
8	515	205	816	HA–2	G2, T8
9	515	205	816	HA–2	G2, G6, T8
10	515	205	816	HA–2	G2, G6, T8
11	515	205	816	HA–2	G2, G3, T8
12	515	205	816	HA–2	G2, G3, T8
13	515	205	816	HA–2	G2, G6, T8
14	515	205	816	HA–2	G2, G3, T8
15	515	205	816	HA–2	G2, G3, G6, T8
16	515	205	816	HA–2	G2, G3, G6, T8
17	515	205	816	HA–2	G2, G3, G6, T8
18	515	205	816	HA–2	G2, T8
19	515	205	816	HA–2	G2, G4, T8
20	515	205	816	HA–2	G2, G6, T8
21	515	205	816	HA–2	G2, T8
22	515	205	816	HA–2	G2, G6, T8
23	515	205	816	HA–2	G2, T8
24	515	205	816	HA–2	G2, G3, T8
25	515	205	816	HA–2	G2, G3, T8
26	515	205	816	HA–2	G2, G3, G6, T8
27	515	205	816	HA–2	G2, G3, T8
28	515	205	816	HA–2	G2, G3, G6, T8
29	515	205	816	HA–2	G2, G3, G6, T8
30	515	205	816	HA–2	G2, G3, G6, T8
31	760	550	260	HA–5	G8
32	690	450	343	HA–5	G2, G8
33	450	195	816	HA–3	G2, G3, G4, G8, T9
34	485	205	816	HA–2	G2, T9
35	485	205	816	HA–3	G2, T9
36	515	205	816	HA–2	G2, G3, G5, G7, T8
37	515	205	816	HA–2	G2, G3, G5, G7, T8
38	515	205	816	HA–2	G2, G3, G5, G7, T8
39	515	205	816	HA–2	G2, G3, G5, G7, T8
40	515	205	816	HA–2	G2, G3, G5, G6, G7, T6
41	515	205	816	HA–2	G2, G3, G5, G7, T8
42	515	205	40	HA–2	G2, G3, G5, G6, G7

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
2	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
3	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
4	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
5	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
6	250	242	227	219	213	208	205	202	200	198	195	192	...	...	...	...	...	...
7	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
8	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
9	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
10	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
11	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
12	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
13	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
14	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
15	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
16	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
17	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
18	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
19	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
20	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
21	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
22	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
23	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
24	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
25	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
26	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
27	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
28	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
29	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
30	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
31	316	316	316	306	295	286	279	274	271	269	...	...	...	...	...	...	...	...
32	287	287	287	287	287	287	287	287	284	279	274	268	260	...	...	...	...	...
33	129	129	129	129	129	128	126	124	123	121	119	117	115	112	109	106	103	100
34	138	138	138	138	138	137	135	133	131	129	128	125	123	120	117	114	111	107
35	129	129	129	129	129	128	126	124	123	121	119	117	115	112	109	106	103	100
36	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
37	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
38	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
39	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
40	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	*72.1*
41	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
42	117	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	181	179	176	172	*107*	*71.5*	*47.8*	...	...	...	...	...	...	...
2	181	179	176	172	*107*	*71.5*	*47.8*	...	...	...	...	...	...	...
3	181	179	176	172	*107*	*71.5*	*47.8*	...	...	...	...	...	...	...
4	213	210	207	203	*126*	*84.2*	*56.2*	...	...	...	...	...	...	...
5	213	210	207	203	*126*	*84.2*	*56.2*	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
8	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
9	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
10	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
11	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
12	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
13	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
14	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
15	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
16	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
17	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
18	117	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
19	117	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
20	99.7	*91.6*	*71.1*	*54.4*	*41.2*	*30.8*	*23.2*	*17.9*	*13.5*	*10.7*	*8.39*	*6.50*	*5.08*	*4.03*
21	117	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
22	99.7	*91.6*	*71.1*	*54.4*	*41.2*	*30.8*	*23.2*	*17.9*	*13.5*	*10.7*	*8.39*	*6.50*	*5.08*	*4.03*
23	117	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
24	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
25	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
26	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
27	117	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
28	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
29	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
30	99.7	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	96.9	93.7	*68.1*	*53.5*	*42.1*	*33.2*	*25.9*	*20.3*	*16.5*	*13.2*	*10.1*	*7.35*	*5.89*	*5.30*
34	104	100	*68.1*	*53.5*	*42.1*	*33.2*	*25.9*	*20.3*	*16.5*	*13.2*	*10.1*	*7.35*	*5.89*	*5.30*
35	96.9	93.7	*73.2*	*64.4*	*56.5*	*49.0*	*41.0*	*33.5*	*25.4*	*18.3*	*12.8*	*9.01*	*6.59*	*4.95*
36	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
37	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
38	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
39	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
40	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*	*0.71*	*1.02*
41	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	P-No.	Group No.
1	25Cr–20Ni	Fittings	SA–403	310S	S31008	CR	...	8	2
2	25Cr–20Ni	Fittings	SA–403	310S	S31008	WP–S	...	8	2
3	25Cr–20Ni	Wld. fittings	SA–403	310S	S31008	WP–W	...	8	2
4	25Cr–20Ni	Wld. fittings	SA–403	310S	S31008	WP–WX	...	8	2
5	25Cr–20Ni	Wld. pipe	SA–813	TP310S	S31008	...	...	8	2
6	25Cr–20Ni	Wld. pipe	SA–814	TP310S	S31008	...	...	8	2
7	25Cr–20Ni	Smls. tube	SA–213	TP310H	S31009	...	...	8	2
8	25Cr–20Ni	Plate	SA–240	310H	S31009	...	...	8	2
9	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...	...	8	2
10	25Cr–20Ni	Smls. pipe	SA–312	TP310H	S31009	...	...	8	2
11	25Cr–20Ni	Wld. pipe	SA–312	TP310H	S31009	...	...	8	2
12	25Cr–20Ni–Cb	Wld. tube	SA–249	TP310Cb	S31040	...	...	8	2
13	25Cr–20Ni–Cb	Wld. pipe	SA–312	TP310Cb	S31040	...	...	8	2
14	25Cr–20Ni–Cb	Wld. pipe	SA–813	TP310Cb	S31040	...	...	8	2
15	25Cr–20Ni–Cb	Wld. pipe	SA–814	TP310Cb	S31040	...	...	8	2
16	25Cr–22Ni–2Mo–N	Forgings	SA–182	F310MoLN	S31050	...	...	8	2
17	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
18	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
19	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	$6 < t \le 32$	8	2
20	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	...	8	2
21	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	$t \le 6$	8	2
22	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	$t \le 6$	8	2
23	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	$t \le 6$	8	2

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	515	205	816	HA–2	G2, G6, T6
2	515	205	816	HA–2	G2, T8
3	515	205	816	HA–2	G2, G6, T6
4	515	205	816	HA–2	G2, G6, T6
5	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
6	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
7	515	205	816	HA–2	G2, T8
8	515	205	816	HA–2	G2, T8
9	515	205	816	HA–2	G2, G6, T8
10	515	205	816	HA–2	G2, T8
11	515	205	816	HA–2	G2, G6, T8
12	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
13	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
14	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
15	515	205	816	HA–2	G2, G3, G5, G6, G7, T8
16	540	255	482	HA–2	...
17	540	255	482	HA–2	...
18	540	255	482	HA–2	G6
19	540	255	482	HA–2	G6
20	550	240	316	HA–2	...
21	580	270	482	HA–2	...
22	580	270	482	HA–2	G6
23	580	270	482	HA–2	G6

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	*72.1*
2	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
3	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	*72.1*
4	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	*72.1*
5	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
6	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
7	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
8	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
9	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
10	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
11	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
12	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
13	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
14	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
15	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
16	170	170	170	170	170	170	166	162	158	154	150	147	144	140	137	134	131	128
17	170	170	170	170	170	170	166	162	158	154	150	147	144	140	137	134	131	128
18	145	145	145	145	145	145	141	138	134	131	128	125	122	119	117	114	111	109
19	145	145	145	145	145	145	141	138	134	131	128	125	122	119	117	114	111	109
20	161	161	161	161	161	161	157	153	149	146	142	139	...	...	...	...	...	...
21	179	179	179	179	179	179	175	171	166	162	159	155	151	148	145	141	138	135
22	152	152	152	152	152	152	149	145	141	138	135	132	129	126	123	120	117	115
23	152	152	152	152	152	152	149	145	141	138	135	132	129	126	123	120	117	115

Table 5A (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Ferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding													
	500	525	550	575	600	625	650	675	700	725	750	775	800	825
1	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*	*0.71*	*1.20*
2	116	*84.9*	*59.0*	*43.5*	*31.9*	*23.6*	*16.9*	*10.7*	*6.10*	*3.90*	*2.99*	*2.36*	*1.73*	*1.20*
3	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*	*0.71*	*1.02*
4	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*	*0.71*	*1.20*
5	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
6	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
7	116	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
8	116	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
9	98.2	*91.6*	*71.1*	*54.4*	*41.2*	*30.8*	*23.2*	*17.9*	*13.5*	*10.7*	*8.39*	*6.50*	*5.08*	*4.03*
10	116	*108*	*83.7*	*64.0*	*48.5*	*36.3*	*27.3*	*21.0*	*15.9*	*12.5*	*9.87*	*7.65*	*5.97*	*4.74*
11	98.2	*91.6*	*71.1*	*54.4*	*41.2*	*30.8*	*23.2*	*17.9*	*13.5*	*10.7*	*8.39*	*6.50*	*5.08*	*4.03*
12	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
13	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
14	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
15	98.2	*72.1*	*50.1*	*36.9*	*27.1*	*20.0*	*14.4*	*9.06*	*5.18*	*3.31*	*2.54*	*2.01*	*1.47*	*1.02*
16	126	...	...	...	...	...	...	...	...	...	...	...	...	...
17	126	...	...	...	...	...	...	...	...	...	...	...	...	...
18	107	...	...	...	...	...	...	...	...	...	...	...	...	...
19	107	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	133	...	...	...	...	...	...	...	...	...	...	...	...	...
22	113	...	...	...	...	...	...	...	...	...	...	...	...	...
23	113	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 5A

GENERAL NOTES

(a) The following abbreviations are used: Smls., Seamless; Temp., Temperature; and Wld., Welded.

(b) An alternative typeface is used for stress values obtained from time–dependent properties (see Notes T1 through T11).

(c) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–516/SA–516M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–516 Grade 70 shall be used when SA–516M Grade 485 is used in construction.

(d) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(e) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (f) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating to a minimum temperature of 1095°C, and quenching in water or rapidly cooling by other means.

G2 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66^{2}/_{3}$% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G3 At temperatures over 550°C, these stress values apply only when the carbon is 0.04% or higher. This note is applicable only when stresses above 550°C are published.

G4 For temperatures above 550°C, these stress values may be used only if the material has been heat treated by heating to a minimum temperature of 1040°C and quenching in water or rapidly cooling by other means. This note is applicable only when stresses above 550°C are published.

G5 These stress values at temperatures of 575°C and above should be used only when assurance is provided that the steel has a predominant grain size not finer than ASTM No. 6. This note is applicable only when stresses above 550°C are published.

G6 A quality factor of 0.85 has been applied in arriving at the maximum allowable stress values for this material.

G7 These stress values shall be considered basic values to be used when no effort is made to control or check the grain size of the steel.

G8 This steel may be expected to develop embrittlement after service at moderately elevated temperature; see Nonmandatory Appendix A, A–207 and A–208.

G9 The tensile strength shall not be in excess of 140 MPa above the specified minimum.

G10 All forgings shall have a maximum tensile strength not in excess of 175 MPa above the specified minimum.

G11 SA–723 is exempt from the requirement in Section VIII, Division 2, AF–730.3(b) that the average of the individual Brinell hardness numbers shall not be more than 10% below or 25% above the number corresponding to the tensile strength.

G12 See Section VIII, Division 2, Appendix 26.

G13 Upon prolonged exposure to temperatures above 425°C, the carbide phase of carbon steel may be converted to graphite. See Nonmandatory Appendix A, A–201 and A–202.

G14 Upon prolonged exposure to temperatures above 475°C, the carbide phase of carbon–molybdenum steel may be converted to graphite. See Nonmandatory Appendix A, A–201 and A–202.

(**13**) G15 This material may be susceptible to temper embrittlement. See Nonmandatory Appendix A, A–203.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 Annealed.

H2 Normalized and tempered.

H3 Quenched and tempered.

H4 Liquid quenched and tempered.

H5 Normalized, normalized and tempered, or quenched and tempered.

H6 For applications involving consideration of heat treatment after forming or welding, see Section VIII, Division 2, Table AF–402.1 for P–No. 10K, Group No. 1 materials.

H7 Normalized.

NOTES – SIZE REQUIREMENTS

S1 The maximum thickness of forgings shall not exceed 95 mm (100 mm as heat treated).

S2 The maximum section thickness shall not exceed 75 mm for double–normalized–and–tempered forgings, or 125 mm for quenched–and–tempered forgings.

S3 Both DN 200 and larger, and schedule 140 and heavier.

(**13**) S4 Either DN 200 and larger and less than schedule 140 wall, or less than DN 200 and all wall thicknesses.

NOTES TO TABLE 5A (CONT'D)

NOTES – TIME–DEPENDENT PROPERTIES

T1 Allowable stresses for temperatures of 350°C and above are values obtained from time–dependent properties.
T2 Allowable stresses for temperatures of 375°C and above are values obtained from time–dependent properties.
T3 Allowable stresses for temperatures of 400°C and above are values obtained from time–dependent properties.
T4 Allowable stresses for temperatures of 425°C and above are values obtained from time–dependent properties.
T5 Allowable stresses for temperatures of 450°C and above are values obtained from time–dependent properties.
T6 Allowable stresses for temperatures of 475°C and above are values obtained from time–dependent properties.
T7 Allowable stresses for temperatures of 500°C and above are values obtained from time–dependent properties.
T8 Allowable stresses for temperatures of 525°C and above are values obtained from time–dependent properties.
T9 Allowable stresses for temperatures of 550°C and above are values obtained from time–dependent properties.
T10 Allowable stresses for temperatures of 575°C and above are values obtained from time–dependent properties.
T11 Allowable stresses for temperatures of 600°C and above are values obtained from time–dependent properties.

NOTES – WELDING REQUIREMENTS

W1 Not for welded construction.
W2 Welding is not permitted when carbon content exceeds 0.35% by ladle analysis except for limited types of welding, as allowed in Section VIII, Division 2, Part AF.
W3 Nonwelded, or welded if the tensile strength of the Section IX reduced section tension test is not less than 690 MPa.
W4 Welded, with the tensile strength of the Section IX reduced section tension test less than 690 MPa but not less than 655 MPa.
W5 In welded construction, for temperatures above 450°C, the weld metal shall have a carbon content of greater than 0.05%.
W6 Section IX, QW–250 Variables QW–404.12, QW–406.3, QW–407.2, and QW–409.1 shall also apply to this material. These variables shall be applied in accordance with the rules for welding of Section VIII, Division 2, Part AF.
W7 The following, in addition to the variables in Section IX, QW–250, shall be considered as essential variables requiring requalification of the welding procedure.

(a) An increase in the maximum or a decrease in the minimum specified preheat or interpass temperatures. The specified range of preheat temperatures shall not exceed 85°C.

(b) A change in the thickness T of the welding procedure qualification test plate as follows:

(1) For welded joints that are quenched and tempered after welding, any increase in thickness (the minimum thickness qualified in all cases is 6 mm).

(2) For welded joints that are not quenched and tempered after welding, any change as follows:

(a) for T less than 16 mm, any decrease in thickness (the maximum thickness qualified is $2T$);

(b) for T equal to 16 mm and over, any departure from the range of 16 mm to $2T$.

Table 5B
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Drawn smls. tube	SB–210	Alclad 3003	O
2	...	Drawn smls. tube	SB–210	Alclad 3003	H113
3	...	Smls. extr. tube	SB–241	Alclad 3003	O
4	...	Smls. extr. tube	SB–241	Alclad 3003	H112
5	...	Plate, sheet	SB–209	A93003	O
6	...	Plate, sheet	SB–209	A93003	H112
7	...	Plate, sheet	SB–209	A93003	H112
8	...	Plate, sheet	SB–209	A93003	H112
9	...	Drawn smls. tube	SB–210	A93003	O
10	...	Drawn smls. tube	SB–210	A93003	H113
11	...	Bar, rod, shapes	SB–221	A93003	O
12	...	Bar, rod, shapes	SB–221	A93003	H112
13	...	Smls. extr. tube	SB–241	A93003	O
14	...	Smls. pipe	SB–241	A93003	H112
15	...	Smls. extr. tube	SB–241	A93003	H112
16	...	Plate, sheet	SB–209	A93004	O
17	...	Plate, sheet	SB–209	A93004	H112
18	...	Plate, sheet	SB–209	A95052	O
19	...	Plate, sheet	SB–209	A95052	H112
20	...	Plate, sheet	SB–209	A95052	H112
21	...	Plate, sheet	SB–209	A95083	O
22	...	Plate, sheet	SB–209	A95083	O
23	...	Plate, sheet	SB–209	A95083	O
24	...	Plate, sheet	SB–209	A95083	O
25	...	Plate, sheet	SB–209	A95083	O
26	...	Plate, sheet	SB–209	A95083	H112
27	...	Plate, sheet	SB–209	A95083	H112
28	...	Bar, rod, shapes	SB–221	A95083	H111
29	...	Smls. extr. tube	SB–241	A95083	H111
30	...	Plate, sheet	SB–209	A95086	O
31	...	Plate, sheet	SB–209	A95086	H112
32	...	Plate, sheet	SB–209	A95086	H112
33	...	Plate, sheet	SB–209	A95086	H112
34	...	Plate, sheet	SB–209	A95086	H112
35	...	Plate, sheet	SB–209	A95454	O
36	...	Plate, sheet	SB–209	A95454	H112
37	...	Plate, sheet	SB–209	A95454	H112
38	...	Bar, rod, shapes	SB–221	A95454	O
39	...	Bar, rod, shapes	SB–221	A95454	H112
40	...	Smls. extr. tube	SB–241	A95454	O
41	...	Smls. extr. tube	SB–241	A95454	H112
42	...	Plate, sheet	SB–209	A96061	T4
43	...	Plate, sheet	SB–209	A96061	T451
44	...	Plate, sheet	SB–209	A96061	T6
45	...	Plate, sheet	SB–209	A96061	T651
46	...	Plate, sheet	SB–209	A96061	T651

Table 5B
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	0.254 ≤ t ≤ 13	21	90	30	204	NFA–7	G4, T3
2	1.27 ≤ t ≤ 13	21	90	30	204	NFA–7	G4, T3, W2
3	...	21	90	30	204	NFA–7	G4, T3
4	...	21	90	30	204	NFA–7	G4, T3, W2
5	0.1524 ≤ t ≤ 75	21	100	40	204	NFA–1	G4, T2
6	6 ≤ t < 13	21	95	45	204	NFA–1	G4, T4, W2
7	13 ≤ t ≤ 50	21	115	70	204	NFA–1	G4, T2, W2
8	50 < t ≤ 75	21	105	40	204	NFA–1	G4, T2, W2
9	0.254 ≤ t ≤ 13	21	95	35	204	NFA–1	G4, T2
10	0.254 ≤ t ≤ 13	21	95	35	204	NFA–1	G4, T2, W2
11	...	21	95	35	204	NFA–1	G2, G4, T2
12	...	21	95	35	204	NFA–1	G2, G4, T2, W2
13	...	21	95	35	204	NFA–1	G4, T2
14	t ≥ 25	21	95	35	204	NFA–1	G4, T2
15	...	21	95	35	204	NFA–1	G4, T2, W2
16	0.152 ≤ t ≤ 75	22	150	60	204	NFA–3	G4, T2
17	6 ≤ t ≤ 75	22	160	60	204	NFA–3	G4, T2, W2
18	1.295 ≤ t ≤ 75	22	170	65	204	NFA–8	G4, T2
19	6 ≤ t < 13	22	195	110	204	NFA–8	G4, T2, W2
20	13 ≤ t ≤ 75	22	170	65	204	NFA–8	G4, T2, W2
21	1.295 ≤ t ≤ 38	25	275	125	65	NFA–11	G4, G6
22	38 < t ≤ 76	25	270	115	65	NFA–11	G4, G6
23	76 < t ≤ 125	25	260	110	65	NFA–11	G4, G6
24	125 ≤ t ≤ 178	25	255	105	65	NFA–11	G4, G6
25	178 < t ≤ 204	25	250	95	65	NFA–11	G4, G6
26	6 ≤ t ≤ 38	25	275	125	65	NFA–11	G4, G6, W2
27	38 < t ≤ 76	25	270	115	65	NFA–11	G4, G6, W2
28	t ≤ 125	25	275	165	65	NFA–11	G2, G4, G6, W2
29	...	25	275	165	65	NFA–11	G4, G6, W2
30	1.295 ≤ t ≤ 50	25	240	95	65	NFA–9	G4, G6
31	1.6002 ≤ t < 13	25	250	125	65	NFA–9	G4, G6, W2
32	13 ≤ t < 25	25	240	110	65	NFA–9	G4, G6, W2
33	25 < t ≤ 50	25	240	95	65	NFA–9	G4, G6, W2
34	50 < t ≤ 76	25	235	95	65	NFA–9	G4, G6, W2
35	1.295 ≤ t ≤ 75	22	215	85	204	NFA–6	G4, T1
36	6 ≤ t ≤ 13	22	220	125	204	NFA–6	G4, T2, W2
37	13 ≤ t ≤ 75	22	215	85	204	NFA–6	G4, T1, W2
38	t ≤ 125	22	215	85	204	NFA–6	G2, G4, T1
39	t ≤ 125	22	215	85	204	NFA–6	G2, G4, T1, W2
40	t ≤ 125	22	215	85	204	NFA–6	G4, T1
41	t ≤ 125	22	215	85	204	NFA–6	G4, T1, W2
42	1.295 ≤ t ≤ 6	23	205	110	204	NFA–13	G4, G8, T4, W3
43	6 ≤ t ≤ 75	23	205	110	204	NFA–13	G4, G8, T4, W3
44	1.295 ≤ t ≤ 6	23	290	240	204	NFA–12	G4, G8, T2, W3
45	6 ≤ t ≤ 100	23	290	240	204	NFA–12,13	G4, G8, T2, W3, W4
46	100 < t ≤ 150	23	275	240	204	NFA–12,13	G4, G8, T2, W3, W4

Table 5B
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	20.7	19.9	19.3	18.4	17.3	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
2	20.7	19.9	19.3	18.4	17.3	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
3	20.7	19.9	19.3	18.4	17.3	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
4	20.7	19.9	19.3	18.4	17.3	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
5	27.6	26.5	25.7	24.6	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
6	23.0	22.3	21.3	20.3	19.2	17.9	*16.7*	*8.88*	...	...	...	...	...	...	...	...	...	...
7	46.0	44.4	42.7	40.7	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
8	27.6	26.6	25.6	24.4	*18.2*	*13.6*	*10.9*	*13.3*	...	...	...	...	...	...	...	...	...	...
9	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
10	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
11	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
12	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
13	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
14	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
15	23.0	22.1	21.4	20.5	*18.2*	*13.6*	*10.9*	*8.88*	...	...	...	...	...	...	...	...	...	...
16	39.1	39.1	39.1	39.1	*38.9*	*26.9*	*17.4*	*11.2*	...	...	...	...	...	...	...	...	...	...
17	41.4	41.4	41.4	41.4	*38.9*	*26.9*	*17.4*	*11.2*	...	...	...	...	...	...	...	...	...	...
18	43.7	43.7	43.7	43.6	*41.6*	*28.8*	*17.6*	*10.6*	...	...	...	...	...	...	...	...	...	...
19	73.5	73.5	73.5	73.5	*41.6*	*28.8*	*17.6*	*10.6*	...	...	...	...	...	...	...	...	...	...
20	43.7	43.7	43.7	43.6	*41.6*	*28.8*	*17.6*	*10.6*	...	...	...	...	...	...	...	...	...	...
21	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	78.1	78.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	78.1	78.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	110	110	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	110	110	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
36	82.7	82.7	82.7	82.7	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
37	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
38	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
39	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
40	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
41	55.2	55.2	55.2	*50.7*	*37.5*	*28.6*	*21.7*	*16.5*	...	...	...	...	...	...	...	...	...	...
42	73.5	72.1	71.1	70.0	70.0	70.0	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
43	73.5	72.1	71.1	70.0	70.0	70.0	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
44	121	121	121	121	*113*	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
45	121	121	121	121	*113*	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
46	115	115	115	115	*113*	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...

Table 5B
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Designation/UNS No.	Class/Condition/Temper
1	...	Drawn smls. tube	SB–210	A96061	T4
2	...	Drawn smls. tube	SB–210	A96061	T6
3	...	Bar, rod, shapes	SB–221	A96061	T4
4	...	Bar, rod, shapes	SB–221	A96061	T6
5	...	Smls. extr. tube/pipe	SB–241	A96061	T4
6	...	Smls. extr. tube/pipe	SB–241	A96061	T6
7	...	Smls. drawn pipe	SB–241	A96061	T6
8	...	Smls. drawn pipe	SB–241	A96061	T6
9	...	Shapes	SB–308	A96061	T6
10	...	Drawn smls. tube	SB–210	A96063	T6
11	...	Bar, rod, shapes	SB–221	A96063	T5
12	...	Bar, rod, shapes	SB–221	A96063	T5
13	...	Bar, rod, shapes	SB–221	A96063	T6
14	...	Smls. extr. tube	SB–241	A96063	T5
15	...	Smls. extr. tube	SB–241	A96063	T5
16	...	Smls. extr. tube	SB–241	A96063	T6
17	...	Bar, rod	SB–187	C10200	O60
18	...	Bar, rod	SB–187	C11000	O60
19	...	Smls. tube	SB–111	C28000	O61
20	...	Smls. tube	SB–111	C44300	O61
21	...	Smls. tube	SB–111	C44400	O61
22	...	Smls. tube	SB–111	C44500	O61
23	...	Plate	SB–171	C46400	M20 or O25
24	...	Plate	SB–171	C46400	M20 or O25
25	...	Smls. tube	SB–111	C60800	O61
26	...	Plate, sheet	SB–169	C61400	O25 or O60
27	...	Plate, sheet	SB–169	C61400	O25 or O60
28	...	Plate, sheet	SB–169	C61400	O25 or O60
29	...	Plate, sheet	SB–96	C65500	O61
30	...	Plate	SB–171	C70600	M20 or O25
31	...	Cond. tube	SB–111	C70600	O61
32	...	Smls. U–bend tube	SB–395	C70600	O61
33	...	Plate	SB–171	C71500	M20 or O25
34	...	Plate	SB–171	C71500	M20 or O25
35	...	Cond. tube	SB–111	C71500	O61
36	...	Smls. U–bend tube	SB–395	C71500	O61
37	99Ni	Smls. pipe & tube	SB–161	N02200	Annealed
38	99Ni	Bar, rod	SB–160	N02200	Annealed
39	99Ni	Smls. pipe & tube	SB–161	N02200	Annealed
40	99Ni	Plate, sheet, strip	SB–162	N02200	Annealed
41	99Ni	Smls. tube	SB–163	N02200	Annealed
42	99Ni	Plate, sheet, strip	SB–162	N02200	As rolled
43	99Ni–Low C	Bar, rod	SB–160	N02201	Annealed
44	99Ni–Low C	Smls. pipe & tube	SB–161	N02201	Annealed
45	99Ni–Low C	Bar, rod	SB–160	N02201	Hot fin.

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	0.635 ≤ t ≤ 13	23	205	110	204	NFA–13	G4, T4, W3
2	0.635 ≤ t ≤ 13	23	290	240	204	NFA–12,13	G4, T2, W3, W4
3	...	23	180	110	204	NFA–13	G2, G4, G8, T4, W3
4	...	23	260	240	204	NFA–12,13	G2, G4, G8, T3, W3, W4
5	...	23	180	110	204	NFA–13	G4, G8, T4, W3
6	...	23	260	240	204	NFA–12,13	G4, G8, T3, W3, W4
7	DN < 25	23	290	240	204	NFA–12,13	G4, T2, W3, W4
8	DN ≥ 25	23	260	240	204	NFA–12,13	G4, T3, W3, W4
9	...	23	260	240	204	NFA–12,13	G2, G4, T3, W3, W4
10	0.635 ≤ t ≤ 13	23	225	195	204	NFA–1	G4, T1, W3
11	t ≤ 13	23	150	110	204	NFA–1	G2, G4, T1, W3
12	13 < t ≤ 25	23	145	105	204	NFA–1	G2, G4, T1, W3
13	t ≤ 25	23	205	170	204	NFA–1	G2, G4, T1, W3
14	t ≤ 13	23	150	110	204	NFA–1	G4, T1, W3
15	13 < t ≤ 25	23	145	105	204	NFA–1	G4, T1, W3
16	t ≤ 25	23	205	170	204	NFA–1	G4, T1, W3
17	...	31	195	55	204	NFC–1	G3, T3
18	...	31	195	55	204	NFC–1	G3, T3
19	...	32	345	140	204	NFC–3	G3, G5, T4
20	...	32	310	105	204	NFC–2	G3, G5, T4
21	...	32	310	105	204	NFC–2	G3, G5, T4
22	...	32	310	105	204	NFC–2	G3, G5, T4
23	75 < t ≤ 125	32	345	125	204	NFC–2	G3, T4
24	t ≤ 75	32	345	140	204	NFC–2	G3, T4
25	...	35	345	130	260	NFC–3	G3, G5, T4
26	50 < t ≤ 125	35	450	195	260	NFC–8	G3
27	13 < t ≤ 50	35	485	205	260	NFC–8	G3
28	t ≤ 13	35	495	220	260	NFC–8	G3
29	...	33	345	125	177	NFC–2	G3, G9, T3
30	t ≤ 125	34	275	105	316	NFC–3	G3, T5
31	...	34	275	105	316	NFC–3	G3, T5
32	...	34	275	105	316	NFC–3	G3, T5
33	64 < t ≤ 125	34	310	125	371	NFC–4	G1, G3, T5
34	t ≤ 64	34	345	140	371	NFC–4	G1, G3, T7
35	...	34	360	125	371	NFC–4	G3, T6
36	...	34	360	125	371	NFC–4	G3, T6
37	O.D. ≤ 125	41	380	80	316	NFN–2	G3
38	...	41	380	105	316	NFN–2	G2, G3
39	O.D. > 125	41	380	105	316	NFN–2	G3
40	...	41	380	100	316	NFN–2	G3
41	...	41	380	100	316	NFN–2	G3
42	...	41	380	135	316	NFN–2	G3
43	...	41	345	70	316	NFN–1	G2, G3
44	O.D. ≤ 125	41	345	70	649	NFN–1	G3, T10
45	...	41	345	70	316	NFN–1	G2, G3

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	73.5	72.1	71.1	70.0	70.0	70.0	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
2	121	121	121	121	*113*	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
3	73.5	72.9	70.8	70.8	70.8	70.8	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
4	109	109	109	109	109	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
5	73.5	72.9	70.8	70.8	70.8	70.8	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
6	109	109	109	109	109	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
7	121	121	121	121	*113*	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
8	109	109	109	109	109	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
9	109	109	109	109	109	*75.6*	*40.2*	*21.1*	...	...	...	...	...	...	...	...	...	...
10	94.8	94.8	94.8	*64.0*	*49.2*	*27.5*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
11	63.2	63.2	63.2	*59.4*	*31.6*	*24.0*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
12	60.3	60.3	60.3	*59.4*	*31.6*	*24.0*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
13	86.2	86.2	86.2	*64.0*	*49.2*	*27.5*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
14	63.2	63.2	63.2	*59.4*	*31.6*	*24.0*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
15	60.3	60.3	60.3	*59.4*	*31.6*	*24.0*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
16	86.2	86.2	86.2	*64.0*	*49.2*	*27.5*	*15.3*	*8.53*	...	...	...	...	...	...	...	...	...	...
17	36.8	31.1	29.7	29.2	28.8	*28.0*	*21.7*	*16.7*	...	...	...	...	...	...	...	...	...	...
18	36.8	31.1	29.7	29.2	28.8	*28.0*	*21.7*	*16.7*	...	...	...	...	...	...	...	...	...	...
19	91.9	91.9	91.9	91.9	91.9	91.9	*41.0*	*19.1*	...	...	...	...	...	...	...	...	...	...
20	68.9	68.9	68.9	68.9	68.9	68.9	*28.5*	*16.4*	...	...	...	...	...	...	...	...	...	...
21	68.9	68.9	68.9	68.9	68.9	68.9	*28.5*	*16.4*	...	...	...	...	...	...	...	...	...	...
22	68.9	68.9	68.9	68.9	68.9	68.9	*28.5*	*16.4*	...	...	...	...	...	...	...	...	...	...
23	82.7	82.7	82.7	82.4	82.4	82.4	*20.0*	*8.70*	...	...	...	...	...	...	...	...	...	...
24	91.9	91.9	91.9	91.5	91.5	91.5	*20.0*	*8.70*	...	...	...	...	...	...	...	...	...	...
25	87.3	84.3	84.3	84.0	82.6	80.5	*44.9*	*30.6*	*17.7*	*9.48*	...	...	...	...	...	...	...	...
26	129	128	127	127	126	125	124	123	122	121	...	...	...	...	...	...	...	...
27	138	137	136	136	135	134	133	131	130	129	...	...	...	...	...	...	...	...
28	147	147	145	144	144	143	142	140	139	137	...	...	...	...	...	...	...	...
29	82.7	82.3	81.5	80.8	80.0	*36.8*	*24.6*	...	...	...	...	...	...	...	...	...	...	...
30	68.9	67.0	65.0	63.6	62.2	61.0	59.9	59.0	58.3	*51.3*	*45.1*	*39.3*	...	...	...	...	...	...
31	68.9	67.0	65.0	63.6	62.2	61.0	59.9	59.0	58.3	*51.3*	*45.1*	*39.3*	...	...	...	...	...	...
32	68.9	67.0	65.0	63.6	62.2	61.0	59.9	59.0	58.3	*51.3*	*45.1*	*39.3*	...	...	...	...	...	...
33	82.7	79.9	77.5	75.9	74.3	72.8	71.4	70.1	68.9	*67.8*	*66.8*	*66.0*	*65.3*	*64.7*	...	...	...	...
34	91.9	88.7	86.1	84.3	82.6	81.0	79.4	78.0	76.6	75.3	74.2	73.2	72.5	*71.1*	...	...	...	...
35	82.7	79.9	77.5	75.9	74.3	72.8	71.4	70.1	68.9	67.8	66.8	*66.0*	*65.3*	*64.7*	...	...	...	...
36	82.7	79.9	77.5	75.9	74.3	72.8	71.4	70.1	68.9	67.8	66.8	*66.0*	*65.3*	*64.7*	...	...	...	...
37	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
38	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
39	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
40	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
41	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
42	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...	...	...
43	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	...	...	...	...	...	...
44	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	*41.4*	*33.1*
45	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	*27.4*	*22.8*	*18.7*	*15.6*	*12.9*	*10.0*	*8.20*	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Designation/UNS No.	Class/Condition/Temper
1	99Ni–Low C	Smls. pipe & tube	SB–161	N02201	Annealed
2	99Ni–Low C	Plate, sheet, strip	SB–162	N02201	Annealed
3	99Ni–Low C	Smls. tube	SB–163	N02201	Annealed
4	67Ni–30Cu	Bar, rod	SB–164	N04400	Annealed
5	67Ni–30Cu	Smls. pipe & tube	SB–165	N04400	Annealed
6	67Ni–30Cu	Forgings	SB–564	N04400	Annealed
7	67Ni–30Cu	Plate	SB–127	N04400	Annealed
8	67Ni–30Cu	Smls. tube	SB–163	N04400	Annealed
9	67Ni–30Cu	Smls. pipe & tube	SB–165	N04400	Annealed
10	67Ni–30Cu	Plate	SB–127	N04400	As rolled
11	67Ni–30Cu	Smls. tube	SB–163	N04400	Stress rel.
12	67Ni–30Cu–S	Bar, rod	SB–164	N04405	Annealed
13	47Ni–22Cr–9Mo–18Fe	Plate	SB–435	N06002	Annealed
14	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	N06002	Annealed
15	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	N06002	Solution ann.
16	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	N06002	Solution ann.
17	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	N06002	Solution ann.
18	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	N06002	Solution ann.
19	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	N06007	Solution ann.
20	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	N06007	Solution ann.
21	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	N06007	Solution ann.
22	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	N06007	Solution ann.
23	47Ni–22Cr–19Fe–6Mo	Wld. pipe	SB–619	N06007	Solution ann.
24	47Ni–22Cr–19Fe–6Mo	Smls. pipe & tube	SB–622	N06007	Solution ann.
25	47Ni–22Cr–19Fe–6Mo	Wld. tube	SB–626	N06007	Solution ann.
26	55Ni–21Cr–13.5Mo	Smls. & wld. fittings	SB–366	N06022	Solution ann.
27	55Ni–21Cr–13.5Mo	Forgings	SB–462	N06022	Solution ann.
28	55Ni–21Cr–13.5Mo	Forgings	SB–564	N06022	Solution ann.
29	55Ni–21Cr–13.5Mo	Rod	SB–574	N06022	Solution ann.
30	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	N06022	Solution ann.
31	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	N06022	Solution ann.
32	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	N06022	Solution ann.
33	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	N06022	Solution ann.
34	59Ni–23Cr–16Mo	Wld. fittings	SB–366	N06059	Solution ann.
35	59Ni–23Cr–16Mo	Smls. fittings	SB–366	N06059	Solution ann.
36	59Ni–23Cr–16Mo	Forged fittings	SB–462	N06059	Solution ann.
37	59Ni–23Cr–16Mo	Forgings	SB–564	N06059	Solution ann.
38	59Ni–23Cr–16Mo	Bar, rod	SB–574	N06059	Solution ann.
39	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	N06059	Solution ann.
40	59Ni–23Cr–16Mo	Wld. pipe	SB–619	N06059	Solution ann.
41	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	N06059	Solution ann.
42	59Ni–23Cr–16Mo	Wld. tube	SB–626	N06059	Solution ann.

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	O.D. > 125	41	345	80	649	NFN–1	G3, T9
2	...	41	345	80	316	NFN–1	G3
3	...	41	345	80	649	NFN–1	G3, T9
4	...	42	480	170	482	NFN–3	G1, G2, G3, T9
5	O.D. > 125	42	480	170	482	NFN–3	G1, G3, T9
6	...	42	480	170	482	NFN–3	G1, G2, G3, T9
7	...	42	485	195	482	NFN–3	G1, G3, T9
8	...	42	485	195	482	NFN–3	G1, G3, T9
9	O.D. ≤ 125	42	480	195	482	NFN–3	G1, G3, T9
10	...	42	515	275	482	NFN–3	G1, G3, T8
11	...	42	585	380	427	NFN–3	G1, G3, T8, W1
12	...	42	480	170	482	NFN–3	G1, G2, G3, T9
13	$5 < t \le 64$	43	655	240	482	NFN–15	G1, G3, G13
14	$1.5 < t \le 5$	43	655	240	482	NFN–15	G1, G3, G13
15	$t > 5$	43	660	240	482	NFN–15	G1, G2, G3, G13
16	...	43	690	275	899	NFN–15	G1, G3, G7, G13, T11
17	...	43	690	275	899	NFN–15	G1, G3, G13, T11
18	...	43	690	275	899	NFN–15	G1, G3, G7, G13, T11
19	$t > 19$	45	585	205	538	NFN–11	G1, G2, G3
20	$t > 19$	45	585	205	538	NFN–11	G1, G3
21	$8 < t \le 19$	45	620	240	538	NFN–11	G1, G2, G3, T11
22	$5 < t \le 19$	45	620	240	538	NFN–11	G1, G3, T11
23	...	45	620	240	538	NFN–11	G1, G3, G7, T11
24	...	45	620	240	538	NFN–11	G1, G3, T11
25	...	45	620	240	538	NFN–11	G1, G3, G7, T11
26	...	43	690	310	677	NFN–10	G1, G12, T14
27	...	43	690	310	677	NFN–10	G1, G12, T14
28	...	43	690	310	677	NFN–10	G1, G12, T14
29	...	43	690	310	677	NFN–10	G1, G12, T14
30	...	43	690	310	677	NFN–10	G1, G12, T14
31	...	43	690	310	677	NFN–10	G1, G7, G12, T14
32	...	43	690	310	677	NFN–10	G1, G12, T14
33	...	43	690	310	677	NFN–10	G1, G7, G12, T14
34	...	43	690	310	760	NFN–14	G1, G3, G7, G11, T14
35	...	43	690	310	760	NFN–14	G1, G3, G11, T14
36	...	43	690	310	760	NFN–14	G1, G3, G11, T14
37	...	43	690	310	760	NFN–14	G1, G3, G11, T14
38	...	43	690	310	760	NFN–14	G1, G3, G11, T14
39	...	43	690	310	760	NFN–14	G1, G3, G11, T14
40	...	43	690	310	760	NFN–14	G1, G3, G7, G11, T14
41	...	43	690	310	760	NFN–14	G1, G3, G11, T14
42	...	43	690	310	760	NFN–14	G1, G3, G7, G11, T14

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	*50.3*	*41.4*	*33.1*
2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
3	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	*50.3*	*41.4*	*33.1*
4	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	*105*	*79.7*	*59.9*
5	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	*105*	*79.7*	*59.9*
6	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	*105*	*79.7*	*59.9*
7	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	*105*	*79.7*	*59.9*
8	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	*105*	*79.7*	*59.9*
9	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	*105*	*79.7*	*59.9*
10	184	184	184	184	184	184	184	184	184	184	184	184	184	184	*144*	*102*	*63.8*	*33.5*
11	244	244	244	244	244	244	244	244	244	244	244	244	244	244	*122*	*89.4*	*65.3*	...
12	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	*105*	*79.7*	*59.9*
13	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
14	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
15	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
16	156	156	156	156	156	156	156	156	151	147	144	141	138	136	134	133	132	131
17	184	184	184	184	184	184	184	184	178	173	169	165	162	160	158	157	155	154
18	156	156	156	156	156	156	156	156	151	147	144	141	138	136	134	133	132	131
19	138	138	138	138	138	138	138	138	138	138	135	134	132	131	130	129	128	128
20	138	138	138	138	138	138	138	138	138	138	135	134	132	131	130	129	128	128
21	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	151	150	149
22	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	151	150	149
23	137	137	137	137	137	137	137	137	137	136	134	132	131	130	129	128	127	127
24	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	151	150	149
25	137	137	137	137	137	137	137	137	137	136	134	132	131	130	129	128	127	127
26	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
27	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
28	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
29	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
30	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
31	176	176	176	176	176	176	176	176	172	168	164	160	157	155	153	151	149	148
32	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
33	176	176	176	176	176	176	176	176	172	168	164	160	157	155	153	151	149	148
34	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144
35	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
36	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
37	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
38	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
39	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
40	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144
41	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
42	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	*27.4*	*22.8*	*18.7*	*15.6*	*12.9*	*10.0*	*8.20*	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	*27.4*	*22.8*	*18.7*	*15.6*	*12.9*	*10.0*	*8.20*	...	...	...	...	...	...	...	...	...	...
4	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	*17.0*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	*40.8*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	*114*	*114*	*113*	*109*	*97.4*	*80.1*	*65.7*	*55.1*	*46.5*	*38.0*	*30.7*	*24.8*	*20.1*	*16.2*	*13.1*	*10.6*	*8.57*
17	*135*	*134*	*133*	*129*	*115*	*94.2*	*77.3*	*64.9*	*54.7*	*44.7*	*36.1*	*29.2*	*23.6*	*19.1*	*15.4*	*12.5*	*10.1*
18	*114*	*114*	*113*	*109*	*97.4*	*80.1*	*65.7*	*55.1*	*46.5*	*38.0*	*30.7*	*24.8*	*20.1*	*16.2*	*13.1*	*10.6*	*8.57*
19	127	127	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	127	127	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	*136*	*132*	*129*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	*136*	*132*	*129*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	*115*	*112*	*109*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	*136*	*132*	*129*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	*115*	*112*	*109*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
27	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
28	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
29	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
30	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
31	146	145	145	*127*	*95.0*	*71.6*	*55.7*	*45.2*	*35.0*	...	...	...	...	...	...	...	...
32	172	171	170	*149*	*112*	*84.2*	*65.6*	*53.1*	*41.2*	...	...	...	...	...	...	...	...
33	146	145	145	*127*	*95.0*	*71.6*	*55.7*	*45.2*	*35.0*	...	...	...	...	...	...	...	...
34	142	141	140	*130*	*104*	*82.9*	*67.4*	*55.8*	*45.1*	*36.7*	*30.3*	*25.2*	...	...	...	...	...
35	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
36	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
37	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
38	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
39	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
40	142	141	140	*130*	*104*	*82.9*	*67.4*	*55.8*	*45.1*	*36.7*	*30.3*	*25.2*	...	...	...	...	...
41	167	166	165	*153*	*122*	*97.5*	*79.3*	*65.6*	*53.0*	*43.1*	*35.6*	*29.6*	...	...	...	...	...
42	142	141	140	*130*	*104*	*82.9*	*67.4*	*55.8*	*45.1*	*36.7*	*30.3*	*25.2*	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Desig./UNS No.	Class/Condition/Temper
1	61Ni–16Mo–16Cr	Rod	SB–574	N06455	Solution ann.
2	61Ni–16Mo–16Cr	Plate, sheet, strip	SB–575	N06455	Solution ann.
3	61Ni–16Mo–16Cr	Wld. pipe	SB–619	N06455	Solution ann.
4	61Ni–16Mo–16Cr	Smls. pipe & tube	SB–622	N06455	Solution ann.
5	61Ni–16Mo–16Cr	Wld. tube	SB–626	N06455	Solution ann.
6	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	N06600	Annealed
7	72Ni–15Cr–8Fe	Smls. tube	SB–163	N06600	Annealed
8	72Ni–15Cr–8Fe	Bar, rod	SB–166	N06600	Annealed
9	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	N06600	Annealed
10	72Ni–15Cr–8Fe	Plate	SB–168	N06600	Annealed
11	72Ni–15Cr–8Fe	Forgings	SB–564	N06600	Annealed
12	72Ni–15Cr–8Fe	Wld. tube	SB–516	N06600	Cold drawn/ann.
13	72Ni–15Cr–8Fe	Wld. pipe	SB–517	N06600	Cold drawn/ann.
14	35Ni–19Cr–1 1/4Si	Bar	SB–511	N08330	Annealed
15	35Ni–19Cr–1 1/4Si	Smls. & wld. pipe	SB–535	N08330	Annealed
16	35Ni–19Cr–1 1/4Si	Plate, sheet, strip	SB–536	N08330	Annealed
17	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08800	Annealed
18	42Fe–33Ni–21Cr	Smls. pipe & tube	SB–407	N08800	Annealed
19	42Fe–33Ni–21Cr	Plate	SB–409	N08800	Annealed
20	42Fe–33Ni–21Cr	Wld. pipe	SB–514	N08800	Annealed
21	42Fe–33Ni–21Cr	Wld. tube	SB–515	N08800	Annealed
22	42Fe–33Ni–21Cr	Forgings	SB–564	N08800	Annealed
23	42Fe–33Ni–21Cr	Bar, rod	SB–408	N08800	Hot fin.
24	42Fe–33Ni–21Cr	Smls. tube	SB–163	N08810	Annealed
25	42Fe–33Ni–21Cr	Smls. pipe & tube	SB–407	N08810	Annealed
26	42Fe–33Ni–21Cr	Bar, rod	SB–408	N08810	Annealed
27	42Fe–33Ni–21Cr	Plate	SB–409	N08810	Annealed
28	42Fe–33Ni–21Cr	Wld. pipe	SB–514	N08810	Annealed
29	42Fe–33Ni–21Cr	Wld. tube	SB–515	N08810	Annealed
30	42Fe–33Ni–21Cr	Forgings	SB–564	N08810	Annealed
31	42Ni–21.5Cr–5Mo–2.3Cu	Smls. tube	SB–163	N08825	Annealed
32	42Ni–21.5Cr–5Mo–2.3Cu	Smls. pipe & tube	SB–423	N08825	Annealed
(13) 33	42Ni–21.5Cr–5Mo–2.3Cu	Plate, sheet, strip	SB–424	N08825	Annealed
(13) 34	42Ni–21.5Cr–5Mo–2.3Cu	Bar, rod	SB–425	N08825	Annealed
(13) 35	42Ni–21.5Cr–5Mo–2.3Cu	Forgings	SB–564	N08825	Annealed
36	62Ni–28Mo–5Fe	Plate	SB–333	N10001	Solution ann.
37	62Ni–28Mo–5Fe	Wld. pipe	SB–619	N10001	Solution ann.
38	62Ni–28Mo–5Fe	Smls. pipe & tube	SB–622	N10001	Solution ann.
39	62Ni–28Mo–5Fe	Wld. tube	SB–626	N10001	Solution ann.
40	62Ni–28Mo–5Fe	Rod	SB–335	N10001	Solution ann.
41	62Ni–28Mo–5Fe	Rod	SB–335	N10001	Solution ann.
42	62Ni–28Mo–5Fe	Sheet, strip	SB–333	N10001	Solution ann.
43	70Ni–16Mo–7Cr–5Fe	Plate, sheet, strip	SB–434	N10003	Annealed
44	70Ni–16Mo–7Cr–5Fe	Rod	SB–573	N10003	Solution ann.

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	...	43	690	275	427	NFN–14	G1, G2, G3
2	...	43	690	275	427	NFN–14	G1, G3
3	...	43	690	275	427	NFN–14	G1, G3, G7
4	...	43	690	275	427	NFN–14	G1, G3
5	...	43	690	275	427	NFN–14	G1, G3, G7
6	O.D. > 125	43	550	205	649	NFN–4	G1, G3, T11
7	...	43	550	240	649	NFN–4	G1, G3, T11
8	...	43	550	240	649	NFN–4	G1, G2, G3, T11
9	O.D. ≤ 125	43	550	240	649	NFN–4	G1, G3, T11
10	...	43	550	240	649	NFN–4	G1, G3, T11
11	...	43	550	240	649	NFN–4	G1, G2, G3, T11
12	O.D. ≤ 114	43	550	240	649	NFN–4	G1, G3, G7, T11
13	O.D. ≤ 114	43	550	240	649	NFN–4	G1, G3, G7, T11
14	...	46	485	205	899	NFN–13	G1, G2, G3, G13, H1, T12
15	...	46	485	205	899	NFN–13	G1, G3, G7, G10, H2, T12
16	...	46	485	205	899	NFN–13	G1, G3, G10, H2, T12
17	...	45	520	205	816	NFN–8	G1, G3, T13
18	...	45	520	205	816	NFN–8	G1, G3, T13
19	...	45	520	205	816	NFN–8	G1, G3, T13
20	...	45	520	205	816	NFN–8	G1, G3, G7, T13
21	...	45	520	205	816	NFN–8	G1, G3, G7, T13
22	...	45	520	205	816	NFN–8	G1, G2, G3, T13
23	...	45	520	205	816	NFN–8	G1, G2, G3, T13
24	...	45	450	170	899	NFN–9	G1, G3, G13, T14
25	...	45	450	170	899	NFN–9	G1, G3, G13, T14
26	...	45	450	170	899	NFN–9	G1, G2, G3, G13, T14
27	...	45	450	170	899	NFN–9	G1, G3, G13, T14
28	...	45	450	170	899	NFN–9	G1, G3, G7, G13, T14
29	...	45	450	170	899	NFN–9	G1, G3, G7, G13, T14
30	...	45	448	172	899	NFN–9	G1, G2, G3, G13, T14
31	...	45	585	240	538	NFN–7	G1, G3
32	...	45	585	240	538	NFN–7	G1, G3
33	...	45	585	240	538	NFN–7	G1, G3
34	...	45	585	240	538	NFN–7	G1, G2, G3
35	...	45	585	240	538	NFN–7	G1, G3
36	$5 \le t \le 64$	44	690	310	427	NFN–5	G1, G3
37	...	44	690	310	427	NFN–5	G1, G3, G7
38	...	44	690	310	427	NFN–5	G1, G3
39	...	44	690	310	427	NFN–5	G1, G3, G7
40	$38 < t \le 89$	44	690	315	427	NFN–5	G1, G2, G3
41	$8 \le t \le 38$	44	795	315	427	NFN–5	G1, G2, G3
42	$t < 5$	44	795	345	427	NFN–5	G1, G3
43	$t < 64$	44	690	280	427	NFN–6	G3
44	...	44	690	280	427	NFN–6	G1, G2, G3

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
2	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
3	156	156	156	156	156	156	156	156	156	156	156	156	156	155	153	151	150	...
4	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
5	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	154	...
6	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
7	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
8	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
9	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
10	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
11	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
12	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
13	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
14	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
15	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
16	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
17	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
18	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
19	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
20	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
21	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
22	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
23	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
24	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
25	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
26	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
27	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
28	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	95.7	93.6	91.7	89.9	88.2	86.6	85.2
29	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.7	95.7	93.6	91.7	89.9	88.2	86.6	85.2
30	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
31	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
32	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
33	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
34	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
35	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
36	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206	205	...
37	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	175	174	...
38	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206	205	...
39	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	175	174	...
40	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	205	...
41	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	205	...
42	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	229	228	...
43	184	184	184	184	184	184	184	184	184	184	181	179	177	176	174	172	169	...
44	184	184	184	184	184	184	184	184	184	184	181	179	177	176	174	172	169	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900	
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
7	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
8	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
9	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
10	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
11	*84.8*	*58.4*	*39.7*	*27.0*	*19.2*	*15.0*	*13.7*	...	...	...	...	...	...	...	...	...	...	
12	*72.0*	*49.6*	*33.8*	*23.0*	*16.3*	*12.7*	*11.7*	...	...	...	...	...	...	...	...	...	...	
13	*72.0*	*49.6*	*33.8*	*23.0*	*16.3*	*12.7*	*11.7*	...	...	...	...	...	...	...	...	...	...	
14	114	*97.7*	*78.8*	*63.4*	*50.5*	*40.0*	*32.1*	*26.5*	*22.1*	*17.7*	*13.8*	*11.2*	*9.02*	*7.08*	*5.80*	*4.47*	*3.26*	
15	114	*97.7*	*78.8*	*63.4*	*50.5*	*40.0*	*32.1*	*26.5*	*22.1*	*17.7*	*13.8*	*11.2*	*9.02*	*7.08*	*5.80*	*4.47*	*3.26*	
16	114	*97.7*	*78.8*	*63.4*	*50.5*	*40.0*	*32.1*	*26.5*	*22.1*	*17.7*	*13.8*	*11.2*	*9.02*	*7.08*	*5.80*	*4.47*	*3.26*	
17	138	138	*116*	*91.3*	*71.4*	*54.2*	*37.9*	*25.5*	*13.2*	*10.2*	*7.48*	*6.14*	*5.31*	...	...	...	...	
18	138	138	*116*	*91.3*	*71.4*	*54.2*	*37.9*	*25.5*	*13.2*	*10.2*	*7.48*	*6.14*	*5.31*	...	...	...	...	
19	138	138	*116*	*91.3*	*71.4*	*54.2*	*37.9*	*25.5*	*13.2*	*10.2*	*7.48*	*6.14*	*5.31*	...	...	...	...	
20	117	117	*98.7*	*77.6*	*60.7*	*46.0*	*32.2*	*21.7*	*11.2*	*8.63*	*6.36*	*5.22*	*4.52*	...	...	...	...	
21	117	117	*98.7*	*77.6*	*60.7*	*46.0*	*32.2*	*21.7*	*11.2*	*8.63*	*6.36*	*5.22*	*4.52*	...	...	...	...	
22	138	138	*116*	*91.3*	*71.4*	*54.2*	*37.9*	*25.5*	*13.2*	*10.2*	*7.48*	*6.14*	*5.31*	...	...	...	...	
23	138	138	*116*	*91.3*	*71.4*	*54.2*	*37.9*	*25.5*	*13.2*	*10.2*	*7.48*	*6.14*	*5.31*	...	...	...	...	
24	98.6	97.1	95.7	*91.8*	*75.8*	*62.1*	*50.6*	*41.2*	*33.6*	*27.7*	*22.5*	*18.3*	*14.9*	*12.1*	*9.80*	*8.04*	*6.70*	
25	98.6	97.1	95.7	*91.8*	*75.8*	*62.1*	*50.6*	*41.2*	*33.6*	*27.7*	*22.5*	*18.3*	*14.9*	*12.1*	*9.80*	*8.04*	*6.70*	
26	98.6	97.1	95.7	*91.8*	*75.8*	*62.1*	*50.6*	*41.2*	*33.6*	*27.7*	*22.5*	*18.3*	*14.9*	*12.1*	*9.80*	*8.04*	*6.70*	
27	98.6	97.1	95.7	*91.8*	*75.8*	*62.1*	*50.6*	*41.2*	*33.6*	*27.7*	*22.5*	*18.3*	*14.9*	*12.1*	*9.80*	*8.04*	*6.70*	
28	83.8	82.6	81.3	*78.1*	*64.5*	*52.8*	*43.0*	*35.1*	*28.6*	*23.5*	*19.1*	*15.6*	*12.7*	*10.3*	*8.33*	*6.84*	*5.70*	
29	83.8	82.6	81.3	*78.1*	*64.5*	*52.8*	*43.0*	*35.1*	*28.6*	*23.5*	*19.1*	*15.6*	*12.7*	*10.3*	*8.33*	*6.84*	*5.70*	
30	98.6	97.1	95.7	*91.8*	*75.8*	*62.1*	*50.6*	*41.2*	*33.6*	*27.7*	*22.5*	*18.3*	*14.9*	*12.1*	*9.80*	*8.04*	*6.70*	
31	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
33	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
34	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
35	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(**13**)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Designation/UNS No.	Class/Condition/Temper
1	54Ni–16Mo–15Cr	Smls. fittings	SB–366	N10276	Solution ann.
2	54Ni–16Mo–15Cr	Wld. fittings	SB–366	N10276	Solution ann.
3	54Ni–16Mo–15Cr	Forgings	SB–462	N10276	Solution ann.
4	54Ni–16Mo–15Cr	Rod	SB–574	N10276	Solution ann.
5	54Ni–16Mo–15Cr	Plate, sheet, strip	SB–575	N10276	Solution ann.
6	54Ni–16Mo–15Cr	Wld. pipe	SB–619	N10276	Solution ann.
7	54Ni–16Mo–15Cr	Smls. pipe & tube	SB–622	N10276	Solution ann.
8	54Ni–16Mo–15Cr	Wld. tube	SB–626	N10276	Solution ann.
9	65Ni–28Mo–2Fe	Plate, sheet, strip	SB–333	N10665	Solution ann.
10	65Ni–28Mo–2Fe	Rod	SB–335	N10665	Solution ann.
11	65Ni–28Mo–2Fe	Smls. fittings	SB–366	N10665	Solution ann.
12	65Ni–28Mo–2Fe	Wld. fittings	SB–366	N10665	Solution ann.
13	65Ni–28Mo–2Fe	Forgings	SB–462	N10665	Solution ann.
14	65Ni–28Mo–2Fe	Wld. pipe	SB–619	N10665	Solution ann.
15	65Ni–28Mo–2Fe	Smls. pipe & tube	SB–622	N10665	Solution ann.
16	65Ni–28Mo–2Fe	Wld. tube	SB–626	N10665	Solution ann.
17	Ti	Plate, sheet, strip	SB–265	R50250	Annealed
18	Ti	Bar, billet	SB–348	R50250	Annealed
19	Ti	Forgings	SB–381	R50250	Annealed
20	Ti	Smls. tube	SB–338	R50250	Smls. ann.
21	Ti	Smls. pipe	SB–861	R50250	Smls. ann.
22	Ti	Wld. tube	SB–338	R50250	Wld. ann.
23	Ti	Wld. pipe	SB–862	R50250	Wld. ann.
24	Ti	Plate, sheet, strip	SB–265	R50400	Annealed
25	Ti	Bar, billet	SB–348	R50400	Annealed
26	Ti	Forgings	SB–381	R50400	Annealed
27	Ti	Smls. tube	SB–338	R50400	Smls. ann.
28	Ti	Smls. pipe	SB–861	R50400	Smls. ann.
29	Ti	Wld. tube	SB–338	R50400	Wld. ann.
30	Ti	Wld. pipe	SB–862	R50400	Wld. ann.
31	Ti	Plate, sheet, strip	SB–265	R50550	Annealed
32	Ti	Bar, billet	SB–348	R50550	Annealed
33	Ti	Forgings	SB–381	R50550	Annealed
34	Ti	Smls. tube	SB–338	R50550	Smls. ann.
35	Ti	Smls. pipe	SB–861	R50550	Smls. ann.
36	Ti	Wld. tube	SB–338	R50550	Wld. ann.
37	Ti	Wld. pipe	SB–862	R50550	Wld. ann.
38	Ti–Pd	Plate, sheet, strip	SB–265	R52400	Annealed
39	Ti–Pd	Bar, billet	SB–348	R52400	Annealed
40	Ti–Pd	Forgings	SB–381	R52400	Annealed
41	Ti–Pd	Smls. tube	SB–338	R52400	Smls. ann.
42	Ti–Pd	Smls. pipe	SB–861	R52400	Smls. ann.
43	Ti–Pd	Wld. tube	SB–338	R52400	Wld. ann.
44	Ti–Pd	Wld. pipe	SB–862	R52400	Wld. ann.

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	...	43	690	285	427	NFN–10	G1, G3
2	...	43	690	285	427	NFN–10	G1, G3, G7
3	...	43	690	285	427	NFN–10	G1, G3
4	...	43	690	285	677	NFN–10	G1, G2, G3, T13
5	...	43	690	285	677	NFN–10	G1, G3, T13
6	...	43	690	285	677	NFN–10	G1, G3, G7, T13
7	...	43	690	285	677	NFN–10	G1, G3, T13
8	...	43	690	285	677	NFN–10	G1, G3, G7, T13
9	...	44	760	350	427	NFN–16	G1, G3
10	...	44	760	350	427	NFN–16	G1, G2, G3
11	...	44	760	350	427	NFN–16	G1, G3
12	...	44	760	350	427	NFN–16	G1, G3, G7
13	...	44	760	350	427	NFN–16	G1, G3
14	...	44	760	350	427	NFN–16	G1, G3, G7
15	...	44	760	350	427	NFN–16	G1, G3
16	...	44	760	350	427	NFN–16	G1, G3, G7
17	...	51	240	170	316	NFT–3	...
18	...	51	240	170	316	NFT–3	...
19	...	51	240	170	316	NFT–3	...
20	...	51	240	170	316	NFT–3	...
21	...	51	240	170	316	NFT–3	...
22	...	51	240	170	316	NFT–3	G7
23	...	51	240	170	316	NFT–3	G7
24	...	51	345	275	316	NFT–2	...
25	...	51	345	275	316	NFT–2	...
26	...	51	345	275	316	NFT–2	...
27	...	51	345	275	316	NFT–2	...
28	...	51	345	275	316	NFT–2	...
29	...	51	345	275	316	NFT–2	G7
30	...	51	345	275	316	NFT–2	G7
31	...	52	450	380	316	NFT–1	...
32	...	52	450	380	316	NFT–1	...
33	...	52	450	380	316	NFT–1	...
34	...	52	450	380	316	NFT–1	...
35	...	52	450	380	316	NFT–1	...
36	...	52	450	380	316	NFT–1	G7
37	...	52	450	380	316	NFT–1	G7
38	...	51	345	275	316	NFT–2	...
39	...	51	345	275	316	NFT–2	...
40	...	51	345	275	316	NFT–2	...
41	...	51	345	275	316	NFT–2	...
42	...	51	345	275	316	NFT–2	...
43	...	51	345	275	316	NFT–2	G7
44	...	51	345	275	316	NFT–2	G7

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	...
2	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	...
3	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	...
4	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
5	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
6	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	133
7	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
8	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	133
9	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
10	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
11	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
12	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
13	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
14	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
15	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
16	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
17	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
18	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
19	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
20	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
21	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
22	85.5	78.6	66.3	58.9	52.3	46.3	40.9	36.1	32.1	28.9	26.7	25.6	...	...	...	...	...	...
23	85.5	78.6	66.3	58.9	52.3	46.3	40.9	36.1	32.1	28.9	26.7	25.6	...	...	...	...	...	...
24	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
25	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
26	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
27	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
28	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
29	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
30	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
31	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
32	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
33	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
34	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
35	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
36	159	159	159	153	139	126	114	103	92.1	82.2	72.6	62.9	...	...	...	...	...	...
37	159	159	159	153	139	126	114	103	92.1	82.2	72.6	62.9	...	...	...	...	...	...
38	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
39	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
40	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
41	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
42	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
43	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
44	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	155	154	*143*	*119*	*98.4*	*81.6*	*67.0*	*54.5*	*44.4*	...	...	...	...	...	...	...	...
5	155	154	*143*	*119*	*98.4*	*81.6*	*67.0*	*54.5*	*44.4*	...	...	...	...	...	...	...	...
6	132	131	*122*	*101*	*83.7*	*69.3*	*56.9*	*46.3*	*37.7*	...	...	...	...	...	...	...	...
7	155	154	*143*	*119*	*98.4*	*81.6*	*67.0*	*54.5*	*44.4*	...	...	...	...	...	...	...	...
8	132	131	*122*	*101*	*83.7*	*69.3*	*56.9*	*46.3*	*37.7*	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Alloy Designation/UNS No.	Class/Condition/Temper
1	Ti–Pd	Plate, sheet, strip	SB–265	R52402	Annealed
2	Ti–Pd	Smls. tube	SB–338	R52402	Annealed
3	Ti–Pd	Wld. tube	SB–338	R52402	Annealed
4	Ti–Pd	Bar, billet	SB–348	R52402	Annealed
5	Ti–Pd	Forgings	SB–381	R52402	Annealed
6	Ti–0.3Mo–0.8Ni	Plate, sheet, strip	SB–265	R53400	Annealed
7	Ti–0.3Mo–0.8Ni	Bar, billet	SB–348	R53400	Annealed
8	Ti–0.3Mo–0.8Ni	Forgings	SB–381	R53400	Annealed
9	Ti–0.3Mo–0.8Ni	Smls. tube	SB–338	R53400	Smls. ann.
10	Ti–0.3Mo–0.8Ni	Smls. pipe	SB–861	R53400	Smls. ann.
11	Ti–0.3Mo–0.8Ni	Wld. tube	SB–338	R53400	Wld. ann.
12	Ti–0.3Mo–0.8Ni	Wld. pipe	SB–862	R53400	Wld. ann.

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Size/Thickness, mm	P-No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	...	51	345	275	316	NFT–2	...
2	...	51	345	275	316	NFT–2	...
3	...	51	345	275	316	NFT–2	...
4	...	51	345	275	316	NFT–2	...
5	...	51	345	275	316	NFT–2	...
6	...	52	483	345	316	NFT–1	...
7	...	52	483	345	316	NFT–1	...
8	...	52	483	345	316	NFT–1	...
9	...	52	483	345	316	NFT–1	...
10	...	52	483	345	316	NFT–1	...
11	...	52	483	345	316	NFT–1	G7
12	...	52	483	345	316	NFT–1	G7

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	−30 to 40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
2	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
3	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
4	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
5	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
6	201	201	177	162	146	131	115	101	89.0	79.3	72.2	67.4	...	...	...	...	...	...
7	201	201	177	162	146	131	115	101	89.0	79.3	72.2	67.4	...	...	...	...	...	...
8	201	201	177	162	146	131	115	101	89.0	79.3	72.2	67.4	...	...	...	...	...	...
9	201	201	177	162	146	131	115	101	89.0	79.3	72.2	67.4	...	...	...	...	...	...
10	201	201	177	162	146	131	115	101	89.0	79.3	72.2	67.4	...	...	...	...	...	...
11	171	171	150	138	124	111	98.2	86.1	75.7	67.4	61.4	57.3	...	...	...	...	...	...
12	171	171	150	138	124	111	98.2	86.1	75.7	67.4	61.4	57.3	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2
Maximum Allowable Stress Values S_m for Nonferrous Materials

Line No.	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 5B

GENERAL NOTES

(a) The following abbreviations are used: ann., annealed; Cond., Condenser; extr., extruded; fin., finished; rel., relieved; Smls., Seamless; and Wld., Welded.

(b) An alternative typeface is used for stress values obtained from time–dependent properties (see Notes T1 through T14).

(c) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SB–407/SB–407M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SB–407 Grade N08800 shall be used when SB–407M Grade N08800 is used in construction.

(d) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(e) The properties of steels are influenced by the processing history, heat treatment, melting practice, and level of residual elements. See Nonmandatory Appendix A for more information.

(**13**) (f) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES – GENERAL REQUIREMENTS

G1 Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short–time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}$% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.

G2 Use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.

G3 Maximum allowable stress values for 40°C may be used at temperatures down to –200°C without additional specification requirements.

G4 Maximum allowable stress values for 40°C may be used at temperatures down to –270°C without additional specification requirements.

G5 Maximum temperature for external pressure design not to exceed 175°C.

G6 These alloys are occasionally subject to the hazard of stress corrosion cracking. Even though they are suitable for engineering use under a wide variety of corrosive conditions, with no particular hazard with respect to stress corrosion, the supplier of the material should be consulted before applying them.

G7 A joint efficiency factor of 0.85 has been applied in arriving at the maximum allowable stress values for this material.

G8 For stress relieved tempers (T451, T4510, T4511, T651, T6510, T6511), stress values for materials in the basic temper shall be used.

G9 Copper–silicon alloys are not always suitable when exposed to certain media and high temperature, particularly steam above 100°C. The user should satisfy him/herself that the alloy selected is satisfactory for the service for which it is to be used.

G10 At temperatures over 550°C, these stress values apply only when the carbon is 0.04% or higher.

G11 This alloy is subject to severe loss of impact strength at room temperatures after exposure in the range of 550°C to 750°C.

G12 Alloy N06022 in the solution annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 550°C to 675°C.

G13 Creep–fatigue, thermal ratcheting, and environmental effects are increasingly significant failure modes at temperatures in excess of 825°C and shall be considered in the design.

NOTES – HEAT TREATMENT REQUIREMENTS

H1 For temperatures above 550°C, these stress values may be used only if the material is annealed at a minimum temperature of 1040°C and has a carbon content of 0.04% or higher.

H2 For temperatures above 550°C, these stress values may be used only if the material is heat treated by heating it to a minimum temperature of 1040°C and quenching in water or rapidly cooling by other means.

NOTES – TIME–DEPENDENT PROPERTIES

T1 Allowable stresses for temperatures of 125°C and above are values obtained from time–dependent properties.

T2 Allowable stresses for temperatures of 150°C and above are values obtained from time–dependent properties.

T3 Allowable stresses for temperatures of 175°C and above are values obtained from time–dependent properties.

T4 Allowable stresses for temperatures of 200°C and above are values obtained from time–dependent properties.

T5 Allowable stresses for temperatures of 275°C and above are values obtained from time–dependent properties.

T6 Allowable stresses for temperatures of 325°C and above are values obtained from time–dependent properties.

T7 Allowable stresses for temperatures of 375°C and above are values obtained from time–dependent properties.

T8 Allowable stresses for temperatures of 400°C and above are values obtained from time–dependent properties.

T9 Allowable stresses for temperatures of 425°C and above are values obtained from time–dependent properties.

T10 Allowable stresses for temperatures of 450°C and above are values obtained from time–dependent properties.

T11 Allowable stresses for temperatures of 500°C and above are values obtained from time–dependent properties.

T12 Allowable stresses for temperatures of 525°C and above are values obtained from time–dependent properties.

T13 Allowable stresses for temperatures of 550°C and above are values obtained from time–dependent properties.

T14 Allowable stresses for temperatures of 575°C and above are values obtained from time–dependent properties.

NOTES TO TABLE 5B (CONT'D)

NOTES – WELDING REQUIREMENTS

W1 Welding except for seal welds is not permitted.

W2 For welded construction, stress values for material at O temper shall be used.

W3 The stress values given for this material are not applicable when either welding or thermal cutting is employed.

W4 Use NFA–12 when welded with 5356 or 5556 filler metal, all thicknesses, or 4043 or 5554 filler metal, thickness ≤ 10 mm. Use NFA–13 when welded with 4043 or 5554 filler metal, thickness > 10 mm.

Table U
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials							
1	Carbon steel	Sheet	SA–1008	CS–A	...	...	...	275
2	Carbon steel	Sheet	SA–1008	CS–B	...	...	...	275
3	Carbon steel	Bar	SA–675	45	...	...	...	310
4	Carbon steel	Wld. pipe	SA–134	A283A	...	...	...	310
5	Carbon steel	Plate	SA–283	A	...	...	...	310
6	Carbon steel	Plate	SA–285	A	K01700	...	...	310
7	Carbon steel	Wld. pipe	SA–672	A45	K01700	...	...	310
8	Carbon steel	Sheet	SA–414	A	K01501	...	...	310
9	Carbon steel	Wld. tube	SA–178	A	K01200	...	...	325
10	Carbon steel	Smls. tube	SA–179	...	K01200	...	...	325
11	Carbon steel	Smls. tube	SA–192	...	K01201	...	...	325
12	Carbon steel	Wld. tube	SA–214	...	K01807	...	...	325
13	Carbon steel	Smls. tube	SA–556	A2	K01807	...	...	325
14	Carbon steel	Wld. tube	SA–557	A2	K01807	...	...	325
15	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...	...	330
16	Carbon steel	Smls. pipe	SA–53	S/A	K02504	...	...	330
17	Carbon steel	Smls. pipe	SA–106	A	K02501	...	...	330
18	Carbon steel	Wld. pipe	SA–135	A	...	...	...	330
19	Carbon steel	Forged pipe	SA–369	FPA	K02501	...	...	330
20	Carbon steel	Wld. pipe	SA–587	...	K11500	...	...	330
21	Carbon steel	Bar	SA–675	50	...	...	...	345
22	Carbon steel	Wld. pipe	SA–134	A283B	...	...	...	345
23	Carbon steel	Plate	SA–283	B	...	...	...	345
24	Carbon steel	Plate	SA–285	B	K02200	...	...	345
25	Carbon steel	Wld. pipe	SA–672	A50	K02200	...	...	345
26	Carbon steel	Sheet	SA–414	B	K02201	...	...	345
27	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	150 < t ≤ 250	350
(**13**) 28	Carbon steel	Plate	SA/EN 10028–2	P235GH	...	...	≤60	360
29	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	100 < t ≤ 150	360
(**13**) 30	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...	t ≤ 60	360
(**13**) 31	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	60 < t ≤ 100	370
32	Carbon steel	Bar	SA–675	55	...	...	...	380
33	Carbon steel	Wld. pipe	SA–134	A283C	K02401	...	...	380
34	Carbon steel	Plate	SA–283	C	K02401	...	...	380
35	Carbon steel	Plate	SA–285	C	K02801	...	...	380
36	Carbon steel	Smls. & wld. pipe	SA–333	1	K03008	...	...	380
37	Carbon steel	Smls. & wld. tube	SA–334	1	K03008	...	...	380
38	Carbon steel	Plate	SA–516	55	K01800	...	...	380
39	Carbon steel	Smls. pipe	SA–524	II	K02104	...	...	380
40	Carbon steel	Wld. pipe	SA–671	CA55	K02801	...	...	380
41	Carbon steel	Wld. pipe	SA–671	CE55	K02202	...	...	380

Table U
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials
1	276	276	276	276	276	276	276	276	276	272	255	235	213	189	169
2	276	276	276	276	276	276	276	276	276	272	255	235	213	189	169
3	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
4	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
5	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
6	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
7	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
8	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
9	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
10	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
11	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
12	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
13	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
14	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
15	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
16	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
17	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
18	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
19	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
20	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
21	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
22	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
23	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
24	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
25	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
26	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
27	350	350	350	350	350	350	350	350	350	345	323	298	270	241	214
28	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
29	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
30	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
31	369	369	369	369	369	369	369	369	369	365	343	316	286	255	225
32	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
33	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
34	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
35	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
36	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
37	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
38	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
39	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
40	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
41	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	Carbon steel	Wld. pipe	SA–672	A55	K02801	...	...	380
	2	Carbon steel	Wld. pipe	SA–672	B55	K02001	...	...	380
	3	Carbon steel	Wld. pipe	SA–672	C55	K01800	...	...	380
	4	Carbon steel	Wld. pipe	SA–672	E55	K02202	...	...	380
	5	Carbon steel	Sheet	SA–414	C	K02503	...	...	380
(13)	6	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...	≤60	390
	7	Carbon steel	Plate, sheet, bar	SA–36	...	K02600	...	...	400
	8	Carbon steel	Plate, sheet	SA–662	A	K01701	...	...	400
(13)	9	Carbon steel	Plate	SA/EN 10028–2	P265GH	...	...	≤60	410
(13)	10	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...	$t \le 60$	410
(13)	11	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	...	410
(13)	12	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...	...	410
(13)	13	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	...	410
	14	Carbon steel	Forgings	SA–181	...	K03502	60	...	415
	15	Carbon steel	Castings	SA–216	WCA	J02502	...	...	415
	16	Carbon steel	Forgings	SA–266	1	K03506	...	...	415
	17	Carbon steel	Bolting	SA–307	B	...	...	...	415
	18	Carbon steel	Forgings	SA–350	LF1	K03009	1	...	415
	19	Carbon steel	Castings	SA–352	LCA	J02504	...	...	415
	20	Carbon steel	Cast pipe	SA–660	WCA	J02504	...	...	415
	21	Carbon steel	Bar	SA–675	60	...	...	...	415
	22	Carbon steel	Forgings	SA–765	I	K03046	...	...	415
	23	Carbon steel	Plate	SA–515	60	K02401	...	...	415
	24	Carbon steel	Plate	SA–516	60	K02100	...	...	415
	25	Carbon steel	Wld. pipe	SA–671	CB60	K02401	...	...	415
	26	Carbon steel	Wld. pipe	SA–671	CC60	K02100	...	...	415
	27	Carbon steel	Wld. pipe	SA–671	CE60	K02402	...	...	415
	28	Carbon steel	Wld. pipe	SA–672	B60	K02401	...	...	415
	29	Carbon steel	Wld. pipe	SA–672	C60	K02100	...	...	415
	30	Carbon steel	Wld. pipe	SA–672	E60	K02402	...	...	415
	31	Carbon steel	Wld. pipe	SA–134	A283D	K02702	...	...	415
	32	Carbon steel	Plate	SA–283	D	K02702	...	...	415
	33	Carbon steel	Wld. pipe	SA–53	E/B	K03005	...	...	415
	34	Carbon steel	Smls. pipe	SA–53	S/B	K03005	...	...	415
	35	Carbon steel	Smls. pipe	SA–106	B	K03006	...	...	415
	36	Carbon steel	Wld. pipe	SA–135	B	...	...	...	415
	37	Carbon steel	Smls. & wld. fittings	SA–234	WPB	K03006	...	...	415
	38	Carbon steel	Smls. & wld. pipe	SA–333	6	K03006	...	...	415
	39	Carbon steel	Smls. & wld. tube	SA–334	6	K03006	...	...	415
	40	Carbon steel	Forged pipe	SA–369	FPB	K03006	...	...	415
	41	Carbon steel	Forgings	SA–372	A	K03002	...	...	415
	42	Carbon steel	Sheet	SA–414	D	K02505	...	...	415
	43	Carbon steel	Smls. & wld. fittings	SA–420	WPL6	...	...	...	415

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
2	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
3	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
4	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
5	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
6	390	390	390	390	390	390	390	390	390	385	361	333	302	269	238
7	400	400	400	400	400	400	400	400	400	394	369	340	308	275	245
8	400	400	400	400	400	400	400	400	400	394	369	340	308	275	245
9	410	410	410	410	410	410	410	410	410	404	379	349	316	282	250
10	410	410	410	410	410	410	410	410	410	404	379	349	316	282	250
11	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
12	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
13	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
14	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
15	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
16	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
17	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
18	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
19	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
20	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
21	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
22	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
23	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
24	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
25	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
26	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
27	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
28	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
29	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
30	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
31	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
32	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
33	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
34	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
35	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
36	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
37	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
38	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
39	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
40	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
41	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
42	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
43	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	Carbon steel	Smls. pipe	SA–524	I	K02104	...	...	415
(13)	2	...	...	...	...	...	...	...	...
	3	Carbon steel	Bar	SA–696	B	K03200	...	...	415
	4	Carbon steel	Forgings	SA–727	...	K02506	...	...	415
	5	Carbon steel	Wld. tube	SA–178	C	K03503	...	...	415
	6	Carbon steel	Smls. tube	SA–210	A–1	K02707	...	...	415
	7	Carbon steel	Smls. tube	SA–556	B2	K02707	...	...	415
	8	Carbon steel	Wld. tube	SA–557	B2	K03007	...	...	415
	9	Carbon steel	Plate, bar	SA/CSA–G40.21	38W	...	...	...	415
	10	Carbon steel	Plate	SA/AS 1548	PT430	...	...	≤150	430
	11	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	150 < t ≤ 250	430
	12	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	100 < t ≤ 150	440
	13	Carbon steel	Bar	SA–675	65	...	...	...	450
	14	Carbon steel	Castings	SA–352	LCB	J03003	...	...	450
	15	Carbon steel	Plate	SA–515	65	K02800	...	...	450
	16	Carbon steel	Plate	SA–516	65	K02403	...	...	450
	17	Carbon steel	Wld. pipe	SA–671	CB65	K02800	...	...	450
	18	Carbon steel	Wld. pipe	SA–671	CC65	K02403	...	...	450
	19	Carbon steel	Wld. pipe	SA–672	B65	K02800	...	...	450
	20	Carbon steel	Wld. pipe	SA–672	C65	K02403	...	...	450
	21	Carbon steel	Sheet	SA–414	E	K02704	...	...	450
	22	Carbon steel	Plate	SA–662	B	K02203	...	...	450
(13)	23	...	...	...	...	...	...	...	...
	24	Carbon steel	Plate	SA–537	...	K12437	1	64 < t ≤ 100	450
	25	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	64 < t ≤ 100	450
(13)	26	Carbon steel	Plate, bar	SA/CSA–G40.21	44W	...	...	t ≤ 200	450
(13)	27	Carbon steel	Plate, bar	SA/CSA–G40.21	50W	...	...	t ≤ 150	450
	28	Carbon steel	Plate	SA/AS 1548	PT460	...	...	≤150	460
	29	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...	≤100	460
(13)	30	...	...	...	...	...	...	...	...
(13)	31	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	150 < t ≤ 250	470
(13)	32	Carbon steel	Plate	SA/GB 713	Q345R	...	...	150 < t ≤ 200	470
(13)	33	...	...	...	...	...	...	...	...
(13)	34	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	100 < t ≤ 150	480
(13)	35	Carbon steel	Plate	SA/GB 713	Q345R	...	...	100 < t ≤ 150	480
	36	Carbon steel	Plate	SA–455	...	K03300	...	15 < t ≤ 19	485
	37	Carbon steel	Bar	SA–675	70	...	...	...	485
	38	Carbon steel	Forgings	SA–105	...	K03504	...	...	485
	39	Carbon steel	Forgings	SA–181	...	K03502	70	...	485
	40	Carbon steel	Castings	SA–216	WCB	J03002	...	...	485
	41	Carbon steel	Forgings	SA–266	2	K03506	...	...	485
	42	Carbon steel	Forgings	SA–266	4	K03017	...	...	485
	43	Carbon steel	Forgings	SA–350	LF2	K03011	...	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
4	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
5	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
6	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
7	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
8	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
9	414	400	400	400	400	400	400	400	399	395	370	340	308	275	245
10	431	431	431	431	431	431	431	431	431	425	398	366	332	296	264
11	430	430	430	430	430	430	430	430	430	424	397	366	331	296	263
12	441	441	441	441	441	441	441	441	441	435	408	375	338	303	270
13	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
14	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
15	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
16	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
17	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
18	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
19	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
20	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
21	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
22	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
25	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
26	448	448	448	448	448	448	448	448	448	441	414	382	346	309	274
27	448	448	448	448	448	448	448	448	448	441	414	382	346	309	274
28	458	458	458	458	458	458	458	458	458	452	424	389	353	315	281
29	458	458	458	458	458	458	458	458	458	452	424	389	353	315	281
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	470	470	470	470	470	470	470	470	470	451	430	402	368	327	283
32	470	470	470	470	470	470	470	470	470	463	433	399	361	322	286
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	480	480	480	480	480	480	480	480	480	461	439	411	376	334	289
35	480	480	480	480	480	480	480	480	480	473	443	407	368	329	293
36	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
37	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
38	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
39	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
40	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
41	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
42	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
43	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	Carbon steel	Forgings	SA–508	1	K13502	...	...	485
2	Carbon steel	Forgings	SA–508	1A	K13502	...	...	485
3	Carbon steel	Forgings	SA–541	1	K03506	...	...	485
4	Carbon steel	Forgings	SA–541	1A	K03020	...	...	485
5	Carbon steel	Cast pipe	SA–660	WCB	J03003	...	...	485
6	Carbon steel	Forgings	SA–765	II	K03047	...	...	485
7	Carbon steel	Plate	SA–515	70	K03101	...	...	485
8	Carbon steel	Plate	SA–516	70	K02700	...	...	485
9	Carbon steel	Wld. pipe	SA–671	CB70	K03101	...	...	485
10	Carbon steel	Wld. pipe	SA–671	CC70	K02700	...	...	485
11	Carbon steel	Wld. pipe	SA–672	B70	K03101	...	...	485
12	Carbon steel	Wld. pipe	SA–672	C70	K02700	...	...	485
13	Carbon steel	Smls. pipe	SA–106	C	K03501	...	...	485
14	Carbon steel	Wld. tube	SA–178	D	...	...	...	485
15	Carbon steel	Smls. tube	SA–210	C	K03501	...	...	485
16	Carbon steel	Castings	SA–216	WCC	J02503	...	...	485
17	Carbon steel	Smls. & wld. fittings	SA–234	WPC	K03501	...	...	485
18	Carbon steel	Castings	SA–352	LCC	J02505	...	...	485
19	Carbon steel	Castings	SA–487	16	...	A	...	485
20	Carbon steel	Plate	SA–537	...	K12437	3	100 < t ≤ 150	485
21	Carbon steel	Smls. tube	SA–556	C2	K03006	...	...	485
22	Carbon steel	Tube	SA–557	C2	K03505	...	...	485
23	Carbon steel	Cast pipe	SA–660	WCC	J02505	...	...	485
(**13**) 24	...	...	...	...	...	...	...	...
25	Carbon steel	Bar	SA–696	C	K03200	...	...	485
26	Carbon steel	Sheet	SA–414	F	K03102	...	...	485
27	Carbon steel	Plate	SA–662	C	K02007	...	...	485
28	Carbon steel	Plate	SA–537	...	K12437	2	100 < t ≤ 150	485
29	Carbon steel	Plate	SA–738	C	K02008	...	100 < t ≤ 150	485
30	Carbon steel	Plate	SA–537	...	K12437	1	≤64	485
31	Carbon steel	Wld. pipe	SA–671	CD70	K12437	...	≤64	485
32	Carbon steel	Wld. pipe	SA–672	D70	K12437	...	≤64	485
33	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...	≤64	485
34	Carbon steel	Plate	SA–841	A	...	1	≤64	485
(**13**) 35	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	60 < t ≤ 100	490
(**13**) 36	Carbon steel	Plate	SA/GB 713	Q345R	...	...	36 < t ≤ 100	490
(**13**) 37	...	...	...	...	...	...	...	...
(**13**) 38	Carbon steel	Plate	SA/GB 713	Q345R	...	...	16 < t ≤ 36	500
39	Carbon steel	Plate	SA–455	...	K03300	...	10 < t ≤ 16	505
(**13**) 40	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...	≤60	510
(**13**) 41	Carbon steel	Plate	SA/GB 713	Q345R	...	...	3 ≤ t ≤ 16	510
(**13**) 42	...	...	...	...	...	...	...	...
43	Carbon steel	Forgings	SA–266	3	K05001	...	...	515
44	Carbon steel	Plate	SA–455	...	K03300	...	≤10	515

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
2	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
3	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
4	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
5	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
6	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
7	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
8	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
9	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
10	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
11	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
12	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
13	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
14	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
15	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
16	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
17	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
18	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
19	483	477	452	437	432	432	432	432	431	429	410	390	...	...	...
20	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
21	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
22	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
23	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
26	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
27	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
28	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
29	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
30	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
31	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
32	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
33	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
34	483	483	483	483	483	483	480	468	448	421	...	...	...	...	...
35	490	490	490	490	490	490	490	490	490	470	449	419	383	341	295
36	490	490	490	490	490	490	490	490	490	482	452	416	376	336	299
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	500	500	500	500	500	500	500	500	500	492	461	424	384	342	305
39	503	503	503	503	503	503	503	503	503	496	465	428	388	346	308
40	510	510	510	510	510	510	510	510	510	490	467	437	399	355	307
41	510	510	510	510	510	510	510	510	510	502	470	433	391	349	311
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
44	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	Carbon steel	Plate	SA–299	A	K02803	...	>25	515
2	Carbon steel	Wld. pipe	SA–671	CK75	K02803	...	>25	515
3	Carbon steel	Wld. pipe	SA–672	N75	K02803	...	>25	515
4	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	>25	515
5	Carbon steel	Plate	SA–299	A	K02803	...	≤25	515
6	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...	≤25	515
7	Carbon steel	Forgings	SA–372	B	K04001	...	...	515
8	Carbon steel	Sheet	SA–414	G	K03103	...	...	515
9	Carbon steel	Plate	SA–738	A	K12447	...	...	515
10	Carbon steel	Plate	SA–537	...	K12437	3	64 < t ≤ 100	515
11	Carbon steel	Plate	SA–537	...	K12437	2	64 < t ≤ 100	515
12	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	64 < t ≤ 100	515
13	Carbon steel	Plate	SA–738	C	K02008	...	64 < t ≤ 100	515
14	Carbon steel	Plate	SA–299	B	K02803	...	>25	550
15	Carbon steel	Plate	SA–299	B	K02803	...	≤25	550
16	Carbon steel	Forgings	SA–765	IV	K02009	...	...	550
17	Carbon steel	Plate	SA–537	...	K12437	3	≤64	550
18	Carbon steel	Plate	SA–537	...	K12437	2	≤64	550
19	Carbon steel	Wld. pipe	SA–671	CD80	K12437	...	≤64	550
20	Carbon steel	Wld. pipe	SA–672	D80	K12437	...	≤64	550
21	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...	≤64	550
22	Carbon steel	Plate	SA–738	C	K02008	...	≤64	550
23	Carbon steel	Plate	SA–841	B	...	2	≤64	550
24	Carbon steel	Plate	SA–612	...	K02900	...	13 < t ≤ 25	560
(**13**) 25	Carbon steel	Plate	SA–841	F	...	6	t ≤ 32	565
26	Carbon steel	Plate	SA–612	...	K02900	...	≤13	570
27	Carbon steel	Plate	SA–738	B	K12007	...	...	585
(**13**) 28	Carbon steel	Plate	SA–841	F	...	7	t ≤ 25	593
29	Carbon steel	Forgings	SA–372	C	K04801	...	...	620
30	Carbon steel	Bolting	SA–449	...	K04200	...	38 < t ≤ 75	620
31	Carbon steel	Plate	SA–724	A	K11831	...	...	620
32	Carbon steel	Plate	SA–724	C	K12037	...	...	620
33	Carbon steel	Plate	SA–724	B	K12031	...	...	655
34	Carbon steel	Bolting	SA–325	...	...	...	...	725
35	Carbon steel	Bolting	SA–325	1	K02706	...	32 < t ≤ 38	725
36	Carbon steel	Bolting	SA–449	...	K04200	...	25 < t ≤ 38	725
37	Carbon steel	Bolting	SA–354	BC	K04100	...	64 < t ≤ 100	795
38	Carbon steel	Bolting	SA–325	1	K02706	...	13 < t ≤ 25	825
39	Carbon steel	Bolting	SA–449	...	K04200	...	≤25	825
40	Carbon steel	Bolting	SA–354	BC	K04100	...	6 < t ≤ 64	860
41	Carbon steel	Bolting	SA–354	BD	K04100	...	64 < t ≤ 100	965
42	Carbon steel	Bolting	SA–354	BD	K04100	...	6 < t ≤ 64	1035

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
2	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
3	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
4	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
5	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
6	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
7	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
8	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
9	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
10	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
11	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
12	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
13	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
14	552	552	552	552	552	552	552	552	552	543	509	469	425	379	337
15	552	552	552	552	552	552	552	552	552	543	509	469	425	379	337
16	552	552	551	546	545	545	545	542	535	...	...	...	...	...	...
17	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
18	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
19	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
20	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
21	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
22	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
23	552	552	552	552	552	552	548	535	512	482	...	...	...	...	...
24	558	558	547	547	547	547	547	547	547	...	...	...	...	...	...
25	565	565	565	565	565	565	560	551	...	...	...	...	...	...	...
26	572	571	561	561	561	561	561	561	561	...	...	...	...	...	...
27	586	586	586	586	586	583	578	569	556	539	516	493	...	...	...
28	593	593	593	593	593	593	587	578	...	...	...	...	...	...	...
29	621	621	621	621	621	621	621	621	621	612	573	528	478	426	380
30	621	621	621	621	621	621	621	621	621	612	573	528	478	426	380
31	621	620	612	606	606	606	606	606	606	599	581	563	...	...	...
32	621	620	612	606	606	606	606	606	606	599	581	563	...	...	...
33	655	654	646	640	640	640	640	640	640	633	614	594	...	...	...
34	724	723	714	708	707	707	707	707	706	699	678	640	577	483	335
35	724	723	714	708	707	707	707	707	706	699	678	640	577	483	335
36	724	723	714	708	707	707	707	707	706	699	678	640	577	483	335
37	793	793	793	793	793	793	793	791	779	726	667	603	538	479	423
38	827	827	816	809	808	808	808	808	808	800	775	732	660	552	384
39	827	827	816	809	808	808	808	808	808	800	775	732	660	552	384
40	862	862	862	862	862	862	862	862	862	850	796	733	664	592	528
41	965	965	965	965	965	965	965	965	965	952	891	820	744	663	591
42	1030	1030	1030	1030	1030	1030	1030	1030	1030	1020	952	875	792	706	627

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
(13)	1	Ductile cast iron	Castings	SA–874	...	...	...	300 < t < 530	300
(13)	2	Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT	...	...	300 < t < 530	300
	3	C–Mn–Si–Cb	Plate	SA–737	B	K12001	...	...	485
	4	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490	...	...	≤150	490
(13)	5	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized	36 < t ≤ 60	520
(13)	6	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized	10 ≤ t ≤ 36	530
	7	C–Mn–Si–V	Plate	SA–737	C	K12202	...	...	550
	8	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤50	414
	9	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤50	414
	10	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤40	483
	11	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤40	483
	12	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤25	552
	13	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤25	552
	14	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...	≤20	621
	15	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...	≤20	621
	16	C–Mn–Ti	Plate, sheet	SA–562	...	K11224	...	...	380
	17	C–Si–Ti	Forgings	SA–836	...	...	1	...	380
	18	C–¼Mo	Bolting	SA–320	L7A	G40370	...	≤64	860
	19	C–¼Mo	Bolting	SA–574	4037	G40370	...	≥16	1170
	20	C–¼Mo	Bolting	SA–574	4042	G40420	...	≥16	1170
	21	C–¼Mo	Bolting	SA–574	4140	G41400	...	≥16	1170
	22	C–¼Mo	Bolting	SA–574	4037	G40370	...	≤13	1240
	23	C–¼Mo	Bolting	SA–574	4042	G40420	...	≤13	1240
(13)	24	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...	t ≤ 60	450
	25	C–½Mo	Smls. tube	SA–209	T1b	K11422	...	...	365
	26	C–½Mo	Wld. tube	SA–250	T1b	K11422	...	...	365
	27	C–½Mo	Smls. tube	SA–209	T1	K11522	...	...	380
	28	C–½Mo	Smls. & wld. fittings	SA–234	WP1	K12821	...	...	380
	29	C–½Mo	Wld. tube	SA–250	T1	K11522	...	...	380
	30	C–½Mo	Smls. pipe	SA–335	P1	K11522	...	...	380
	31	C–½Mo	Forged pipe	SA–369	FP1	K11522	...	...	380
	32	C–½Mo	Smls. tube	SA–209	T1a	K12023	...	...	415
	33	C–½Mo	Wld. tube	SA–250	T1a	K12023	...	...	415
	34	C–½Mo	Castings	SA–217	WC1	J12524	...	...	450
	35	C–½Mo	Castings	SA–352	LC1	J12522	...	...	450
	36	C–½Mo	Cast pipe	SA–426	CP1	J12521	...	...	450
	37	C–½Mo	Plate	SA–204	A	K11820	...	...	450
	38	C–½Mo	Wld. pipe	SA–672	L65	K11820	...	...	450
	39	C–½Mo	Wld. pipe	SA–691	CM–65	K11820	...	...	450
	40	C–½Mo	Forgings	SA–182	F1	K12822	...	...	485
	41	C–½Mo	Plate	SA–204	B	K12020	...	...	485
	42	C–½Mo	Forgings	SA–336	F1	K12520	...	...	485
	43	C–½Mo	Wld. pipe	SA–672	L70	K12020	...	...	485
	44	C–½Mo	Wld. pipe	SA–691	CM–70	K12020	...	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	300	297	285	276	270	267	263	257	...	...	...	...	...	...	...
2	300	297	285	276	270	267	263	257	...	...	...	...	...	...	...
3	483	483	483	483	483	483	483	482	477	459	436	407	373	338	303
4	490	490	490	490	490	490	490	489	484	466	442	413	379	343	308
5	520	520	520	520	520	520	520	520	520	497	469	436	400	363	327
6	530	530	530	530	530	530	530	530	530	507	478	444	408	370	334
7	552	552	552	552	552	552	552	552	545	525	498	465	427	387	346
8	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
9	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
10	483	483	483	483	483	483	483	483	...	...	...	...	...	...	...
11	483	483	483	483	483	483	483	483	...	...	...	...	...	...	...
12	552	552	552	552	552	552	552	552	...	...	...	...	...	...	...
13	552	552	552	552	552	552	552	552	...	...	...	...	...	...	...
14	621	621	621	621	621	621	621	621	...	...	...	...	...	...	...
15	621	621	621	621	621	621	621	621	...	...	...	...	...	...	...
16	379	301	286	273	264	257	253	249	245	240	...	...	...	...	...
17	379	372	349	334	323	314	309	304	299	293	...	...	...	...	...
18	862	862	862	862	862	862	862	862	862	850	796	733	664	592	528
19	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
20	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
21	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
22	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1220	1170	1110	1040
23	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1220	1170	1110	1040
24	450	450	450	450	450	450	450	450	450	450	450	442	424	403	377
25	365	365	365	365	365	365	365	365	365	365	365	359	345	327	306
26	365	365	365	365	365	365	365	365	365	365	365	359	345	327	306
27	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
28	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
29	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
30	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
31	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
32	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
33	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
34	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
35	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
36	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
37	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
38	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
39	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
40	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
41	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
42	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
43	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
44	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	C–½Mo	Plate	SA–204	C	K12320	...	...	515
2	C–½Mo	Wld. pipe	SA–672	L75	K12320	...	...	515
3	C–½Mo	Wld. pipe	SA–691	CM–75	K12320	...	...	515
4	½Cr–⅕Mo	Forgings	SA–372	G	K13049	70	...	825
5	½Cr–⅕Mo	Forgings	SA–372	H	K13547	70	...	825
6	½Cr–⅕Mo–V	Plate	SA–517	B	K11630	...	≤32	795
7	½Cr–¼Mo–Si	Plate	SA–517	A	K11856	...	≤32	795
8	½Cr–¼Mo–Si	Forgings	SA–592	A	K11856	...	≤64	795
9	½Cr–½Mo	Smls. pipe	SA–335	P2	K11547	...	...	380
10	½Cr–½Mo	Forged pipe	SA–369	FP2	K11547	...	...	380
11	½Cr–½Mo	Plate	SA–387	2	K12143	1	...	380
12	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	380
13	½Cr–½Mo	Smls. tube	SA–213	T2	K11547	...	...	415
14	½Cr–½Mo	Cast pipe	SA–426	CP2	J11547	...	...	415
15	½Cr–½Mo	Forgings	SA–182	F2	K12122	...	...	485
16	½Cr–½Mo	Plate	SA–387	2	K12143	2	...	485
17	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...	...	485
18	½Cr–1¼Mn–Si	Plate	SA–202	A	K11742	...	...	515
19	½Cr–1¼Mn–Si	Plate	SA–202	B	K12542	...	...	585
20	¾Cr–½Ni–Cu	Wld. tube	SA–423	1	K11535	...	...	415
21	¾Cr–¾Ni–Cu–Al	Pipe	SA–333	4	K11267	...	...	415
22	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	100 < t ≤ 175	690
23	1Cr–⅕Mo	Bolting	SA–193	B7M	G41400	...	≤64	690
24	1Cr–⅕Mo	Bolting	SA–320	L7M	G41400	...	≤64	690
25	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	64 < t ≤ 100	795
26	1Cr–⅕Mo	Forgings	SA–372	E	K13047	70	...	825
27	1Cr–⅕Mo	Forgings	SA–372	F	G41350	70	...	825
28	1Cr–⅕Mo	Forgings	SA–372	J	K13548	70	...	825
29	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...	≤64	860
30	1Cr–⅕Mo	Bolting	SA–320	L7	G41400	...	≤64	860
31	1Cr–⅕Mo	Forgings	SA–372	J	G41370	110	...	930
32	1Cr–½Mo	Plate	SA–387	12	K11757	1	...	380
33	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...	...	380
34	1Cr–½Mo	Cast pipe	SA–426	CP12	J11562	...	...	415
35	1Cr–½Mo	Forgings	SA–182	F12	K11562	1	...	415
36	1Cr–½Mo	Smls. tube	SA–213	T12	K11562	...	...	415
37	1Cr–½Mo	Smls. & wld. fittings	SA–234	WP12	K12062	1	...	415
38	1Cr–½Mo	Smls. pipe	SA–335	P12	K11562	...	...	415
39	1Cr–½Mo	Forged pipe	SA–369	FP12	K11562	...	...	415
(**13**) 40	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	150 < t ≤ 250	420
(**13**) 41	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	100 < t ≤ 150	430
(**13**) 42	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	60 < t ≤ 100	440
(**13**) 43	1Cr–½Mo	Smls. tube	SA/EN 10216–2	13CrMo4–5	...	...	t ≤ 60	440
(**13**) 44	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	...	100 < t ≤ 150	440
45	1Cr–½Mo	Plate	SA–387	12	K11757	2	...	450

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
2	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
3	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
4	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
5	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
6	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
7	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
8	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
9	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
10	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
11	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
12	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
13	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
14	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
15	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
16	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
17	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
18	517	517	517	517	517	517	517	514	486	457	429	404	378	350	311
19	586	586	586	586	586	586	586	581	551	518	487	457	428	396	353
20	414	414	414	414	414	414	414	414	414	414	414	414	414	...	...
21	414	414	414	414	414	414	414	414	414	414	414	414	414	...	...
22	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
23	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
24	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
25	793	793	793	793	793	793	792	785	754	723	690	652	612	569	522
26	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
27	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
28	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
29	862	862	862	862	862	862	862	852	819	787	750	709	666	618	567
30	862	862	862	862	862	862	862	852	819	787	750	709	666	618	567
31	931	931	931	931	931	931	930	919	889	853	812	766	716	664	612
32	379	371	365	365	365	365	365	365	365	365	365	365	358	344	326
33	379	371	365	365	365	365	365	365	365	365	365	365	358	344	326
34	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
35	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
36	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
37	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
38	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
39	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
40	420	411	407	404	404	403	403	403	403	403	403	402	396	383	361
41	430	420	416	414	413	413	413	413	413	413	413	412	405	392	369
42	440	430	426	424	423	423	423	423	423	423	423	422	415	401	378
43	440	440	440	440	440	440	440	440	440	440	440	430	414	395	371
44	440	430	426	424	423	423	423	423	423	423	423	422	415	401	378
45	448	439	431	431	431	431	431	431	431	431	431	431	424	407	385

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...	...	450
(13) 2	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...	$t \le 60$	450
(13) 3	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	...	$6 \le t \le 100$	450
4	1Cr–½Mo	Forgings	SA–182	F12	K11564	2	...	485
5	1Cr–½Mo	Forgings	SA–336	F12	K11564	...	...	485
6	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...	$100 < t \le 175$	690
7	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...	$64 < t \le 100$	760
8	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	5	$50 < t \le 200$	795
9	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	5	≤50	825
10	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...	≤64	860
11	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	4	≤150	930
12	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	3	≤150	1000
13	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	2	≤100	1070
14	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	1	≤100	1140
15	1Cr–V	Smls. tube	SA–213	T17	K12047	...	...	415
16	1¼Cr–½Mo	Castings	SA–217	WC6	J12072	...	...	485
17	1¼Cr–½Mo	Cast pipe	SA–426	CP11	J12072	...	...	485
18	1¼Cr–½Mo	Bar	SA–739	B11	K11797	...	...	485
19	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11597	1	...	415
20	1¼Cr–½Mo–Si	Smls. tube	SA–213	T11	K11597	...	...	415
21	1¼Cr–½Mo–Si	Smls. & wld. fittings	SA–234	WP11	...	1	...	415
22	1¼Cr–½Mo–Si	Smls. pipe	SA–335	P11	K11597	...	...	415
23	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11597	1	...	415
24	1¼Cr–½Mo–Si	Forged pipe	SA–369	FP11	K11597	...	...	415
25	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	1	...	415
26	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	415
27	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11572	2	...	485
28	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	2	...	485
(13) 29	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	$100 < t \le 250$	490
(13) 30	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	$60 < t \le 100$	500
(13) 31	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT	≤60	510
32	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	3	...	515
33	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	2	...	515
34	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...	...	515
35	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	$64 < t \le 100$	725
36	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...	≤64	795
37	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	$64 < t \le 150$	725
38	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...	≤64	795
39	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	1	...	415
40	2¼Cr–1Mo	Smls. tube	SA–213	T22	K21590	...	...	415
41	2¼Cr–1Mo	Smls. & wld. fittings	SA–234	WP22	K21590	1	...	415

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	448	439	431	431	431	431	431	431	431	431	431	431	424	407	385
2	450	440	436	433	433	432	432	432	432	432	432	431	424	411	386
3	450	440	436	433	433	432	432	432	432	432	432	431	424	411	386
4	483	472	464	464	464	464	464	464	464	464	464	464	456	438	415
5	483	472	464	464	464	464	464	464	464	464	464	464	456	438	415
6	689	689	689	689	689	689	688	676	657	637	614	589	561	532	502
7	758	758	758	758	758	758	756	744	723	701	675	647	617	586	552
8	793	793	793	793	793	793	792	780	754	732	704	676	642	611	580
9	827	827	827	827	827	827	827	813	786	764	735	705	670	638	605
10	862	862	862	862	862	862	862	862	862	862	862	862	726	665	631
11	931	931	931	931	931	931	931	931	926	857	825	793	753	718	681
12	1000	1000	1000	1000	1000	1000	999	983	950	923	888	852	809	771	732
13	1070	1070	1070	1070	1070	1070	1070	1050	1020	986	949	910	865	824	782
14	1140	1140	1140	1140	1140	1140	1140	1120	1080	1050	1010	969	921	878	833
15	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
16	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
17	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
18	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
19	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
20	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
21	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
22	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
23	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
24	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
25	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
26	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
27	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
28	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
29	490	490	485	485	485	485	485	485	485	485	479	464	447	426	401
30	500	500	495	495	495	495	495	495	495	495	489	474	456	434	410
31	510	510	505	505	505	505	505	505	505	505	499	483	465	443	418
32	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
33	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
34	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
35	724	724	724	724	724	724	724	724	720	707	693	677	659	639	618
36	793	793	793	793	793	793	793	793	789	775	760	741	722	700	677
37	724	724	724	724	724	724	724	724	720	707	693	677	659	639	618
38	793	793	793	793	793	793	793	793	789	775	760	741	722	700	677
39	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
40	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
41	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	2¼Cr–1Mo	Smls. pipe	SA–335	P22	K21590	...	...	415
	2	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	1	...	415
	3	2¼Cr–1Mo	Forged pipe	SA–369	FP22	K21590	...	...	415
	4	2¼Cr–1Mo	Plate	SA–387	22	K21590	1	...	415
	5	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	415
(13)	6	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	150 < t ≤ 250	450
(13)	7	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	100 < t ≤ 150	460
(13)	8	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	60 < t ≤ 100	470
(13)	9	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...	t ≤ 60	480
(13)	10	2¼Cr–1Mo	Smls. tube	SA/EN 10216–2	10CrMo9–10	...	...	t ≤ 60	480
	11	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...	...	485
	12	2¼Cr–1Mo	Cast pipe	SA–426	CP22	J21890	...	...	485
	13	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	3	...	515
	14	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	3	...	515
	15	2¼Cr–1Mo	Plate	SA–387	22	K21590	2	...	515
	16	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...	...	515
	17	2¼Cr–1Mo	Bar	SA–739	B22	K21390	...	...	515
	18	2¼Cr–1Mo	Castings	SA–487	8	J22091	A	...	585
	19	2¼Cr–1Mo	Forgings	SA–508	22	K21590	3	...	585
	20	2¼Cr–1Mo	Forgings	SA–541	22	K21390	3	...	585
	21	2¼Cr–1Mo	Plate	SA–542	B	K21590	4	...	585
	22	2¼Cr–1Mo	Forgings	SA–541	22	K21390	4	...	725
	23	2¼Cr–1Mo–V	Forgings	SA–182	F22V	K31835	...	...	585
	24	2¼Cr–1Mo–V	Forgings	SA–336	F22V	K31835	...	...	585
	25	2¼Cr–1Mo–V	Forgings	SA–541	22V	K31835	...	...	585
	26	2¼Cr–1Mo–V	Plate	SA–542	D	K31835	4a	...	585
	27	2¼Cr–1Mo–V	Plate	SA–832	22V	K31835	...	...	585
	28	3Cr–1Mo	Smls. tube	SA–213	T21	K31545	...	...	415
	29	3Cr–1Mo	Smls. pipe	SA–335	P21	K31545	...	...	415
	30	3Cr–1Mo	Forgings	SA–336	F21	K31545	1	...	415
	31	3Cr–1Mo	Forged pipe	SA–369	FP21	K31545	...	...	415
	32	3Cr–1Mo	Plate	SA–387	21	K31545	1	...	415
	33	3Cr–1Mo	Cast pipe	SA–426	CP21	J31545	...	...	415
	34	3Cr–1Mo	Forgings	SA–182	F21	K31545	...	...	515
	35	3Cr–1Mo	Forgings	SA–336	F21	K31545	3	...	515
	36	3Cr–1Mo	Plate	SA–387	21	K31545	2	...	515
	37	3Cr–1Mo–¼V–Ti–B	Forgings	SA–182	F3V	K31830	...	...	585
	38	3Cr–1Mo–¼V–Ti–B	Forgings	SA–336	F3V	K31830	...	...	585
	39	3Cr–1Mo–¼V–Ti–B	Forgings	SA–508	3V	K31830	...	...	585
	40	3Cr–1Mo–¼V–Ti–B	Forgings	SA–541	3V	K31830	...	...	585
	41	3Cr–1Mo–¼V–Ti–B	Plate	SA–542	C	K31830	4a	...	585
	42	3Cr–1Mo–¼V–Ti–B	Plate	SA–832	21V	K31830	...	...	585

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
2	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
3	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
4	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
5	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
6	450	449	442	434	432	429	427	424	420	414	406	396	382	366	345
7	460	459	452	443	441	439	437	433	429	423	415	404	391	374	353
8	470	469	462	453	451	448	446	443	438	432	424	413	399	382	360
9	480	479	472	463	461	458	456	452	448	441	433	422	408	390	368
10	480	480	473	466	464	462	460	457	451	443	431	416	396	373	345
11	483	482	476	468	466	465	463	460	454	445	433	418	399	375	347
12	483	482	476	468	466	465	463	460	454	445	433	418	399	375	347
13	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
14	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
15	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
16	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
17	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
18	586	585	572	567	566	565	562	558	550	540	526	507	483	455	420
19	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
20	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
21	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
22	724	724	724	724	720	713	708	702	694	685	673	658	641	620	595
23	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
24	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
25	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
26	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
27	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
28	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
29	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
30	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
31	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
32	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
33	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
34	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
35	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
36	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
37	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
38	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
39	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
40	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
41	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
42	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Ferrous Materials (Cont'd)							
1	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–182	F3VCb	...	...	...	585
2	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–336	F3VCb	...	...	...	585
3	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–508	3VCb	...	...	...	585
4	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–541	3VCb	...	...	...	585
5	3Cr–1Mo–$^1/_4$V–Cb–Ca	Plate	SA–542	E	...	4a	...	585
6	3Cr–1Mo–$^1/_4$V–Cb–Ca	Plate	SA–832	23V	...	...	...	585
7	5Cr–$^1/_2$Mo	Smls. tube	SA–213	T5	K41545	...	...	415
8	5Cr–$^1/_2$Mo	Smls. & wld. fittings	SA–234	WP5	K41545	...	...	415
9	5Cr–$^1/_2$Mo	Smls. pipe	SA–335	P5	K41545	...	...	415
10	5Cr–$^1/_2$Mo	Forged pipe	SA–369	FP5	K41545	...	...	415
11	5Cr–$^1/_2$Mo	Plate	SA–387	5	K41545	1	...	415
12	5Cr–$^1/_2$Mo	Wld. pipe	SA–691	5CR	K41545	...	...	415
13	5Cr–$^1/_2$Mo	Forgings	SA–336	F5	K41545	...	...	415
14	5Cr–$^1/_2$Mo	Forgings	SA–182	F5	K41545	...	...	485
15	5Cr–$^1/_2$Mo	Plate	SA–387	5	K41545	2	...	515
16	5Cr–$^1/_2$Mo	Forgings	SA–336	F5A	K42544	...	...	550
17	5Cr–$^1/_2$Mo	Castings	SA–217	C5	J42045	...	...	620
18	5Cr–$^1/_2$Mo	Cast pipe	SA–426	CP5	J42045	...	...	620
19	5Cr–$^1/_2$Mo	Forgings	SA–182	F5a	K42544	...	...	620
20	5Cr–$^1/_2$Mo	Bolting	SA–193	B5	K50100	...	≤100	690
21	5Cr–$^1/_2$Mo–Si	Smls. tube	SA–213	T5b	K51545	...	...	415
22	5Cr–$^1/_2$Mo–Si	Smls. pipe	SA–335	P5b	K51545	...	...	415
23	5Cr–$^1/_2$Mo–Ti	Smls. tube	SA–213	T5c	K41245	...	...	415
24	5Cr–$^1/_2$Mo–Ti	Smls. pipe	SA–335	P5c	K41245	...	...	415
25	9Cr–1Mo	Smls. tube	SA–213	T9	K90941	...	...	415
26	9Cr–1Mo	Fittings	SA–234	WP9	K90941	...	...	415
27	9Cr–1Mo	Smls. pipe	SA–335	P9	K90941	...	...	415
28	9Cr–1Mo	Forged pipe	SA–369	FP9	K90941	...	...	415
29	9Cr–1Mo	Forgings	SA–182	F9	K90941	...	...	585
30	9Cr–1Mo	Forgings	SA–336	F9	K90941	...	...	585
31	9Cr–1Mo	Castings	SA–217	C12	J82090	...	...	620
32	9Cr–1Mo	Cast pipe	SA–426	CP9	J82090	...	...	620
33	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...	≤75	585
34	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...	≤75	585
35	9Cr–1Mo–V	Fittings	SA–234	WP91	K90901	...	≤75	585
36	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...	≤75	585
37	9Cr–1Mo–V	Forgings	SA–336	F91	K90901	...	≤75	585
38	9Cr–1Mo–V	Forged pipe	SA–369	FP91	K90901	...	≤75	585
39	9Cr–1Mo–V	Plate	SA–387	91	K90901	2	≤75	585
40	11Cr–Ti	Plate	SA–240	...	S40910	...	...	380
41	11Cr–Ti	Plate	SA–240	...	S40920	...	...	380
42	11Cr–Ti	Plate	SA–240	...	S40930	...	...	380
43	11Cr–Ti	Smls. & wld. tube	SA–268	TP409	S40900	...	...	380

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
2	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
3	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
4	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
5	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
6	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
7	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
8	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
9	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
10	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
11	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
12	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
13	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
14	483	481	467	464	463	459	454	447	438	425	411	393	373	351	327
15	517	515	501	497	496	491	486	478	469	456	440	421	400	376	350
16	552	549	534	530	529	524	518	511	500	486	469	449	427	401	373
17	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
18	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
19	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
20	689	685	667	660	659	653	645	636	626	606	589	565	536	507	474
21	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
22	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
23	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
24	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
25	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
26	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
27	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
28	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
29	586	584	567	563	562	557	551	542	531	516	498	478	454	426	396
30	586	584	567	563	562	557	551	542	531	516	498	478	454	426	396
31	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
32	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
33	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
34	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
35	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
36	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
37	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
38	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
39	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
40	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
41	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
42	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
43	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	12Cr	Plate	SA–1010	40	S41003	...	≤19	455
2	12Cr	Bar	SA–479	403	S40300	A	...	485
3	12Cr	Bar	SA–479	403	S40300	1	...	485
4	12Cr	Plate	SA–1010	50	S41003	...	≤19	485
5	12Cr–Al	Bar	SA/JIS G4303	SUS405	...	...	...	410
6	12Cr–Al	Plate	SA–240	405	S40500	...	...	415
7	12Cr–Al	Smls. & wld. tube	SA–268	TP405	S40500	...	...	415
8	12Cr–Al	Bar	SA–479	405	S40500	...	...	415
9	12Cr–Ti	Smls. & wld. tube	SA–268	...	S40800	...	...	380
10	13Cr	Plate	SA–240	410S	S41008	...	...	415
11	13Cr	Smls. & wld. tube	SA–268	TP410	S41000	...	...	415
12	13Cr	Plate	SA–240	410	S41000	...	...	450
13	13Cr	Forgings	SA–182	F6a	S41000	1	...	485
14	13Cr	Bar	SA–479	410	S41000	...	...	485
15	13Cr	Bar	SA–479	410	S41000	A	...	485
16	13Cr	Bar	SA–479	410	S41000	1	...	485
17	13Cr	Forgings	SA–182	F6a	S41000	2	...	585
18	13Cr	Castings	SA–217	CA15	J91150	...	...	620
19	13Cr	Cast pipe	SA–426	CPCA15	J91150	...	...	620
20	13Cr	Bolting	SA–193	B6	S41000	...	≤100	760
21	13Cr–4Ni	Castings	SA–487	CA6NM	J91540	A	...	760
22	13Cr–4Ni	Forgings	SA–182	F6NM	S41500	...	...	795
(**13**) 23	13Cr–4Ni	Bar	SA–479	...	S41500	...	...	795
24	15Cr	Smls. & wld. tube	SA–268	TP429	S42900	...	...	415
25	15Cr	Plate	SA–240	429	S42900	...	...	450
26	17Cr	Smls. & wld. tube	SA–268	TP430	S43000	...	...	415
27	17Cr	Plate	SA–240	430	S43000	...	...	450
28	17Cr	Bar	SA–479	430	S43000	...	...	485
(**13**) 29	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1150M	...	795
(**13**) 30	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150M	...	795
31	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1150	...	930
32	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1150	...	930
33	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150	...	930
34	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1100	...	965
35	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1100	...	965
36	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1100	...	965
37	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1075	...	1000
38	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1075	...	1000
39	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1075	...	1000
40	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1025	...	1070
41	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H925	...	1170
42	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H900	...	1310

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	455	455	455	445	431	417	409	401	391	379	364	346	325	299	270
2	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
3	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
4	483	483	483	472	457	442	434	425	415	402	386	367	344	318	286
5	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
6	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
7	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
8	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
9	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
10	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
11	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
12	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
13	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
14	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
15	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
16	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
17	586	585	574	565	557	547	539	529	516	501	483	461	437	410	380
18	621	620	608	598	590	579	570	560	547	530	511	488	463	434	402
19	621	620	608	598	590	579	570	560	547	530	511	488	463	434	402
20	758	758	752	737	724	709	699	687	671	652	628	601	569	533	493
21	758	758	744	727	714	699	691	683	673	661	646	628	605	577	540
22	793	793	793	785	761	733	719	705	689	672	654	634	613	...	...
23	793	793	793	785	761	733	719	705	689	672	654	634	613	...	...
24	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
25	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
26	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
27	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
28	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
29	795	795	795	775	759	749	744	737	728	715	697	674	643	605	556
30	795	795	795	775	759	749	744	737	728	715	697	674	643	605	556
31	931	931	931	907	889	877	871	863	852	837	816	789	753	708	651
32	931	931	931	907	889	877	871	863	852	837	816	789	753	708	651
33	931	931	931	907	889	877	871	863	852	837	816	789	753	708	651
34	965	965	965	941	922	910	903	894	883	868	846	818	781	734	675
35	965	965	965	941	922	910	903	894	883	868	846	818	781	734	675
36	965	965	965	941	922	910	903	894	883	868	846	818	781	734	675
37	1000	1000	1000	974	955	943	936	927	915	899	877	847	809	761	699
38	1000	1000	1000	974	955	943	936	927	915	899	877	847	809	761	699
39	1000	1000	1000	974	955	943	936	927	915	899	877	847	809	761	699
40	1069	1069	1069	1041	1021	1007	991	981	978	...	...	...	...	...	...
41	1172	1172	1172	1142	1120	1105	1097	1086	1073	...	...	...	...	...	...
42	1310	1310	1310	1276	1252	1235	1226	1214	1199	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Ferrous Materials (Cont'd)							
1	18Cr–2Mo	Plate	SA–240	...	S44400	...	...	415
2	18Cr–2Mo	Smls. & wld. tube	SA–268	...	S44400	...	...	415
3	18Cr–Ti	Smls. & wld. tube	SA–268	TP439	S43035	...	...	415
4	18Cr–Ti	Wld. tube	SA–803	TP439	S43035	...	...	415
5	18Cr–Ti	Smls. & wld. pipe	SA–731	TP439	S43035	...	...	415
6	18Cr–Ti	Smls. & wld. tube	SA–268	TP430 Ti	S43036	...	...	415
7	18Cr–Ti	Bar	SA–479	439	S43035	...	...	485
8	26Cr–3Ni–3Mo	Plate	SA–240	26–3–3	S44660	...	≤5	585
9	26Cr–3Ni–3Mo	Smls. & wld. tube	SA–268	26–3–3	S44660	...	≤5	585
10	26Cr–3Ni–3Mo	Wld. tube	SA–803	26–3–3	S44660	...	≤5	585
11	27Cr	Smls. tube	SA–268	TP446–1	S44600	...	...	485
12	27Cr–1Mo	Forgings	SA–182	FXM–27Cb	S44627	...	...	415
13	27Cr–1Mo	Plate	SA–240	XM–27	S44627	...	...	450
14	27Cr–1Mo	Smls. & wld. tube	SA–268	TPXM–27	S44627	...	...	450
15	27Cr–1Mo	Bar	SA–479	XM–27	S44627	...	...	450
16	27Cr–1Mo	Smls. & wld. pipe	SA–731	TPXM–27	S44627	...	...	450
17	27Cr–1Mo–Ti	Smls. & wld. pipe	SA–731	TPXM–33	S44626	...	...	450
18	27Cr–1Mo–Ti	Plate	SA–240	XM–33	S44626	...	...	470
19	27Cr–1Mo–Ti	Smls. & wld. tube	SA–268	TPXM–33	S44626	...	...	470
20	29Cr–4Mo	Bar	SA–479	...	S44700	...	...	485
21	29Cr–4Mo	Plate	SA–240	...	S44700	...	...	550
22	29Cr–4Mo	Smls. & wld. tube	SA–268	29–4	S44700	...	...	550
23	29Cr–4Mo–2Ni	Bar	SA–479	...	S44800	...	...	485
24	29Cr–4Mo–2Ni	Plate	SA–240	...	S44800	...	...	550
25	29Cr–4Mo–2Ni	Smls. & wld. tube	SA–268	29–4–2	S44800	...	...	550
26	29Cr–4Mo–Ti	Smls. & wld. tube	SA–268	...	S44735	...	...	515
27	Mn–¼Mo	Forgings	SA–372	D	K14508	...	...	725
28	Mn–¼Mo–V	Castings	SA–487	2	J13005	A	...	585
29	Mn–¼Mo–V	Castings	SA–487	2	J13005	B	...	620
30	Mn–½Mo	Plate	SA–302	A	K12021	...	...	515
31	Mn–½Mo	Wld. pipe	SA–672	H75	K12021	...	...	515
32	Mn–½Mo	Plate	SA–302	B	K12022	...	...	550
33	Mn–½Mo	Plate	SA–533	A	K12521	1	...	550
34	Mn–½Mo	Plate	SA–533	A	K12521	2	...	620
35	Mn–½Mo	Plate	SA–533	A	K12521	3	...	690
36	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	1	...	550
37	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	2	...	620
38	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	3	...	690
39	Mn–½Mo–½Ni	Plate	SA–302	C	K12039	...	...	550
40	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	1	...	550
41	Mn–½Mo–½Ni	Wld. pipe	SA–672	H80	K12039	...	...	550
42	Mn–½Mo–½Ni	Wld. pipe	SA–672	J80	K12539	...	...	550

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	414	413	401	392	384	375	369	363	356	347	338	327	314	298	279
2	414	413	401	392	384	375	369	363	356	347	338	327	314	298	279
3	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
4	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
5	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
6	414	414	399	390	382	374	369	364	357	349	340	328	315	299	280
7	483	482	466	454	446	436	431	424	417	407	396	383	367	348	326
8	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
9	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
10	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
11	483	482	466	454	446	436	431	424	417	407	396	383	367	348	326
12	414	413	400	390	390	390	390	390	...	...	...	...	...	...	...
13	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
14	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
15	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
16	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
17	448	448	445	439	435	428	423	416	407	394	377	359	...	...	...
18	469	469	466	459	455	448	443	436	426	412	394	376	...	...	...
19	469	469	466	459	455	448	443	436	426	412	394	376	...	...	...
20	483	480	466	463	463	463	463	463	463	463	...	...	...	...	...
21	552	548	532	530	530	530	530	530	530	530	...	...	...	...	...
22	552	548	532	530	530	530	530	530	530	530	...	...	...	...	...
23	483	473	466	463	458	452	449	446	443	438	...	...	...	...	...
24	552	541	533	529	523	516	513	510	506	500	...	...	...	...	...
25	552	541	533	529	523	516	513	510	506	500	...	...	...	...	...
26	517	507	500	496	490	484	481	478	474	469	...	...	...	...	...
27	724	724	724	724	724	724	724	724	723	707	662	611	560	513	484
28	586	586	586	583	583	583	583	583	583	...	...	...	...	...	...
29	621	621	620	617	617	617	617	617	617	...	...	...	...	...	...
30	517	517	517	517	517	517	517	517	517	517	517	503	480	452	418
31	517	517	517	517	517	517	517	517	517	517	517	503	480	452	418
32	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
33	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
34	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
35	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
36	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
37	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
38	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
39	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
40	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
41	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
42	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	2	...	620
	2	Mn–½Mo–½Ni	Wld. pipe	SA–672	J90	K12539	...	...	620
	3	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	3	...	690
	4	Mn–½Mo–½Ni	Wld. pipe	SA–672	J100	K12539	...	...	690
	5	Mn–½Mo–¾Ni	Plate	SA–302	D	K12054	...	...	550
	6	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	1	...	550
(**13**)	7	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	1	...	550
	8	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	2	...	620
(**13**)	9	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	2	...	620
	10	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	3	...	690
(**13**)	11	Mn–½Ni–V	Plate	SA/NF A 36–215	P440NJ4	...	...	$8 \le t \le 20$	630
	12	Mn–½Ni–V	Plate	SA–225	C	K12524	...	...	725
	13	Mn–V	Castings	SA–487	1	J13002	A	...	585
	14	Mn–V	Castings	SA–487	1	J13002	B	...	620
	15	1½Si–½Mo	Smls. pipe	SA–335	P15	K11578	...	...	415
	16	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	A	...	620
	17	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	B	...	725
	18	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	E	...	795
	19	½Ni–½Mo–V	Forgings	SA–541	3	K12045	1	...	550
	20	½Ni–½Mo–V	Forgings	SA–541	3	K12045	2	...	620
	21	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	$64 < t \le 100$	725
	22	¾Ni–½Cr–½Mo–V	Plate	SA–517	F	K11576	...	≤64	795
	23	¾Ni–½Cr–½Mo–V	Forgings	SA–592	F	K11576	...	≤64	795
	24	¾Ni–½Cu–Mo	Smls. & wld. tube	SA–423	2	K11540	...	...	415
	25	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	1	...	550
	26	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	1	...	550
	27	¾Ni–½Mo–⅓Cr–V	Forgings	SA–508	2	K12766	2	...	620
	28	¾Ni–½Mo–⅓Cr–V	Forgings	SA–541	2	K12765	2	...	620
	29	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	1	...	550
	30	¾Ni–½Mo–Cr–V	Forgings	SA–508	3	K12042	2	...	620
	31	¾Ni–1Mo–¾Cr	Castings	SA–217	WC5	J22000	...	...	485
	32	1Ni–½Cr–½Mo	Castings	SA–217	WC4	J12082	...	...	485
	33	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	$64 < t \le 100$	725
	34	1¼Ni–1Cr–½Mo	Plate	SA–517	P	K21650	...	≤64	795
	35	1½Ni	Forgings	SA–350	LF5	K13050	1	...	415
	36	1½Ni	Forgings	SA–350	LF5	K13050	2	...	485
	37	1¾Ni–¾Cr–¼Mo	Forgings	SA–372	L	K24055	...	...	1070
	38	1¾Ni–¾Cr–¼Mo	Bolting	SA–574	4340	G43400	...	≥16	1170
	39	1¾Ni–¾Cr–¼Mo	Bolting	SA–574	4340	G43400	...	≤13	1240
	40	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	5	$150 < t \le 238$	795
	41	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	5	≤150	825
	42	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	4	≤238	930
	43	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	3	≤238	1000
	44	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	2	≤238	1070
	45	2Ni–¾Cr–¼Mo	Bolting	SA–540	B23	H43400	1	≤200	1140

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
2	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
3	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
4	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
5	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
6	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
7	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
8	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
9	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
10	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
11	630	630	...	...	...	...	...	...	...	...	...	...	...	...	...
12	724	724	724	724	724	724	724	724	723	718	667	616	...	...	...
13	586	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	621	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	414	414	414	414	414	414	414	414	414	414	414	402	384	362	334
16	621	621	621	621	621	621	621	621	621	...	...	...	...	...	...
17	724	724	724	724	724	724	724	724	724	...	...	...	...	...	...
18	793	793	793	793	793	793	793	793	793	...	...	...	...	...	...
19	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
20	621	621	621	621	621	621	621	621	620	611	596	576	550	518	479
21	724	724	724	724	724	724	723	721	706	689	669	645	617	585	550
22	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
23	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
24	414	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
26	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
27	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
28	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
29	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
30	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
31	483	483	483	483	483	483	483	483	483	483	483	470	448	422	390
32	483	483	483	483	483	483	483	483	483	483	483	470	448	422	390
33	724	724	724	724	724	724	723	721	706	689	669	645	617	585	550
34	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
35	414	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	483	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069	1058	1021	986	958	942
38	1170	1170	1170	1170	1170	1170	1170	1150	1120	1090	1060	1020	984	954	941
39	1240	1240	1240	1240	1240	1240	1240	1220	1190	1150	1120	1080	1040	1010	996
40	793	793	793	793	793	793	790	776	759	737	714	689	665	646	636
41	827	827	827	827	827	827	825	811	792	770	745	719	695	674	664
42	931	931	931	931	931	931	928	911	891	866	838	809	781	758	747
43	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	839	814	803
44	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	897	870	858
45	1140	1140	1140	1140	1140	1140	1140	1130	1090	1060	1020	989	955	927	913

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Ferrous Materials (Cont'd)							
1	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	5	...	795
2	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	5	...	825
3	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	4	...	930
4	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	3	...	1000
5	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	2	...	1070
6	2Ni–¾Cr–⅓Mo	Bolting	SA–540	B24	K24064	1	...	1140
7	2Ni–1Cu	Forgings	SA–182	FR	K22035	...	...	435
8	2Ni–1Cu	Fittings	SA–234	WPR	K22035	...	...	435
9	2Ni–1Cu	Smls. & wld. pipe	SA–333	9	K22035	...	...	435
10	2Ni–1Cu	Tube	SA–334	9	K22035	...	...	435
11	2Ni–1Cu	Forgings	SA–350	LF9	K22036	...	...	435
12	2Ni–1Cu	Smls. & wld. fittings	SA–420	WPL9	K22035	...	...	435
13	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	1	...	795
14	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2	...	930
15	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	3	...	1070
16	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	4	...	1205
17	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	5	...	1310
18	2½Ni	Pipe	SA–333	7	K21903	...	...	450
19	2½Ni	Tube	SA–334	7	K21903	...	...	450
20	2½Ni	Plate	SA–203	A	K21703	...	...	450
21	2½Ni	Plate	SA–203	B	K22103	...	...	485
22	2½Ni	Castings	SA–352	LC2	J22500	...	...	485
23	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	3	...	620
24	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	1	...	725
25	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	2	...	795
26	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	1	...	795
27	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2	...	930
28	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	3	...	1070
29	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	4	...	1205
30	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	5	...	1310
31	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	3	...	620
32	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	A	...	725
33	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	1	...	725
34	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	2	...	795
35	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	B	...	825
36	3½Ni	Pipe	SA–333	3	K31918	...	...	450
37	3½Ni	Tube	SA–334	3	K31918	...	...	450
38	3½Ni	Fittings	SA–420	WPL3	...	...	...	450
39	3½Ni	Plate	SA–203	D	K31718	...	...	450
40	3½Ni	Forgings	SA–350	LF3	K32025	...	...	485
41	3½Ni	Forgings	SA–765	III	K32026	...	...	485
42	3½Ni	Plate	SA–203	E	K32018	...	...	485
43	3½Ni	Castings	SA–352	LC3	J31550	...	...	485
44	3½Ni	Plate	SA–203	F	...	...	>50	515
45	3½Ni	Plate	SA–203	F	...	...	≤50	550

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	793	793	793	793	793	793	790	776	759	737	714	689	665	646	636
2	827	827	827	827	827	827	825	811	792	770	745	719	695	674	664
3	931	931	931	931	931	931	928	911	891	866	838	809	781	758	747
4	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	839	814	803
5	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	897	870	858
6	1140	1140	1140	1140	1140	1140	1140	1130	1090	1060	1020	989	955	927	913
7	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
14	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
15	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
16	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
17	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
18	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
19	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
20	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
21	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
22	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
23	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
24	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
25	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
26	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
27	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
28	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
29	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
30	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
31	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
32	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
33	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
34	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
35	827	827	827	819	815	807	800	790	776	758	736	709	677	639	595
36	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
37	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
38	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
39	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
40	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
41	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
42	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
43	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
44	517	517	517	517	517	517	517	514	486	457	429	404	378	350	311
45	552	552	552	552	552	552	552	547	519	487	458	430	403	373	332

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	3	...	620
2	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	1	...	725
3	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	2	...	795
4	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	1	...	795
5	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2	...	930
6	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	3	...	1070
7	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	4	...	1205
8	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	5	...	1310
9	5Ni–¼Mo	Plate	SA–645	A	K41583	...	...	655
10	8Ni	Forgings	SA–522	II	K71340	...	...	690
11	8Ni	Plate	SA–553	II	K71340	...	...	690
(**13**) 12	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	NNT640	≤50	640
(**13**) 13	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT640	≤50	640
(**13**) 14	9Ni	Plate	SA/EN 10028–4	X7Ni9	...	QT	≤50	680
(**13**) 15	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT680	≤50	680
16	9Ni	Smls. & wld. pipe	SA–333	8	K81340	...	...	690
17	9Ni	Smls. & wld. tube	SA–334	8	K81340	...	...	690
18	9Ni	Plate	SA–353	...	K81340	...	...	690
19	9Ni	Smls. & wld. fittings	SA–420	WPL8	K81340	...	...	690
20	9Ni	Forgings	SA–522	I	K81340	...	...	690
21	9Ni	Plate	SA–553	I	K81340	...	...	690
22	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	A	...	895
23	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	B	...	895
24	25Ni–15Cr–2Ti	Bar	SA–638	660	S66286	...	...	895
25	27Ni–22Cr–7Mo–Mn–Cu–N	Forgings	SA–182	...	S31277	...	...	772
26	27Ni–22Cr–7Mo–Mn–Cu–N	Smls. tube	SA–213	...	S31277	...	...	772
27	27Ni–22Cr–7Mo–Mn–Cu–N	Plate	SA–240	...	S31277	...	...	772
28	27Ni–22Cr–7Mo–Mn–Cu–N	Wld. tube	SA–249	...	S31277	...	...	772
29	29Ni–20Cr–3Cu–2Mo	Castings	SA–351	CN7M	J95150	...	...	425
30	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...	...	655
31	16Cr–9Mn–2Ni–N	Plate	SA–240	204	S20400	...	...	655
32	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	>125	450
33	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...	...	450
34	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316L	...	...	...	480
35	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...	≤125	485
36	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...	...	485
37	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...	...	485
38	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...	...	485
39	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316L	S31603	...	...	485
40	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	1	...	485
(**13**) 41	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	3	...	485
(**13**) 42	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	4	...	485
43	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316L	S31603	...	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
2	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
3	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
4	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
5	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
6	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
7	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
8	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
9	655	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
11	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
12	640	640	636	...	...	...	...	...	...	...	...	...	...	...	...
13	640	640	636	...	...	...	...	...	...	...	...	...	...	...	...
14	680	680	676	...	...	...	...	...	...	...	...	...	...	...	...
15	680	680	676	...	...	...	...	...	...	...	...	...	...	...	...
16	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
17	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
18	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
19	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
20	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
21	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
22	896	896	896	895	880	864	858	851	844	836	827	817	806	794	780
23	896	896	896	895	880	864	858	851	844	836	827	817	806	794	780
24	896	896	896	896	884	868	860	853	845	836	827	816	805	794	780
25	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
26	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
27	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
28	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
29	427	356	328	309	295	283	278	274	270	...	...	...	...	...	...
30	655	562	511	486	477	475	473	471	467	462	455	446	437	429	422
31	655	560	497	459	440	433	432	432	431	429	426	421	411	398	379
32	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
33	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
34	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
35	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
36	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
37	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
38	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
39	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
40	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
41	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
42	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
43	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316L	S31603	...	...	485
	2	16Cr–12Ni–2Mo	Bar	SA–479	316L	S31603	...	...	485
	3	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...	...	485
	4	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316L	S31603	...	...	485
	5	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316L	S31603	...	...	485
	6	16Cr–12Ni–2Mo	Castings	SA–351	CF3M	J92800	...	...	485
	7	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF3M	J92800	...	...	485
	8	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...	...	485
	9	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF8M	J92900	...	...	485
	10	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	>125	485
	11	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...	...	485
	12	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...	≤125	515
	13	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	1	...	515
(**13**)	14	16Cr–12Ni–2Mo	Bolting	SA–193	B8MA	S31600	1A	...	515
	15	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...	...	515
	16	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...	...	515
	17	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...	...	515
	18	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316	S31600	...	...	515
	19	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	1	...	515
	20	16Cr–12Ni–2Mo	Bolting	SA–320	B8MA	S31600	1A	...	515
	21	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	1	...	515
(**13**)	22	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	3	...	515
(**13**)	23	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	4	...	515
	24	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...	...	515
	25	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316	S31600	...	...	515
	26	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316	S31600	...	...	515
	27	16Cr–12Ni–2Mo	Bar	SA–479	316	S31600	...	...	515
	28	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...	...	515
	29	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316	S31600	...	...	515
	30	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316	S31600	...	...	515
	31	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316	...	...	...	520
	32	16Cr–12Ni–2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...	≤75	520
	33	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	64 < t ≤ 75	550
	34	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	32 < t ≤ 38	620
	35	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	32 < t ≤ 38	620
	36	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	50 < t ≤ 64	620
	37	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	25 < t ≤ 32	655
	38	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	25 < t ≤ 32	655
	39	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...	≤50	655
	40	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	19 < t ≤ 25	690
	41	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	19 < t ≤ 25	690
	42	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2	≤19	760
	43	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2	≤19	760

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
2	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
3	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
4	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
5	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
6	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
7	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
8	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
9	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
10	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
11	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
12	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
13	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
14	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
15	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
16	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
17	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
18	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
19	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
20	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
21	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
22	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
23	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
24	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
25	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
26	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
27	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
28	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
29	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
30	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
31	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
32	520	520	505	499	498	498	498	498	498	495	491	485	477	466	453
33	552	551	532	513	513	513	513	513	513	509	507	500	489	477	467
34	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
35	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
36	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
37	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
38	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
39	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
40	689	689	680	665	660	660	660	660	660	657	651	643	632	618	601
41	689	689	680	665	660	660	660	660	660	657	651	643	632	618	601
42	758	758	747	731	726	726	726	726	726	722	716	707	695	680	661
43	758	758	747	731	726	726	726	726	726	722	716	707	695	680	661

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	>125	485
	2	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...	...	485
	3	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...	≤125	515
	4	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...	...	515
	5	16Cr–12Ni–2Mo	Plate	SA–240	316H	S31609	...	...	515
	6	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...	...	515
	7	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316H	S31609	...	...	515
	8	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	1	...	515
(**13**)	9	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	3	...	515
(**13**)	10	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	4	...	515
	11	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...	...	515
	12	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316H	S31609	...	...	515
	13	16Cr–12Ni–2Mo	Bar	SA–479	316H	S31609	...	...	515
	14	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316H	S31609	...	...	515
	15	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316H	S31609	...	...	515
	16	16Cr–12Ni–2Mo–Cb	Plate	SA–240	316Cb	S31640	...	...	515
	17	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	>125	485
	18	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316LN	S31653	...	...	485
	19	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...	≤125	515
	20	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316LN	S31653	...	...	515
	21	16Cr–12Ni–2Mo–N	Plate	SA–240	316LN	S31653	...	...	515
	22	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316LN	S31653	...	...	515
	23	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316LN	S31653	...	...	515
	24	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	1	...	515
(**13**)	25	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	3	...	515
(**13**)	26	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	4	...	515
	27	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316LN	S31653	...	...	515
	28	16Cr–12Ni–2Mo–N	Fittings	SA–403	316LN	S31653	...	...	515
	29	16Cr–12Ni–2Mo–N	Bar	SA–479	316LN	S31653	...	...	515
	30	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316LN	S31653	...	...	515
	31	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316N	S31651	...	...	550
	32	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...	...	550
	33	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...	...	550
	34	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...	...	550
	35	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316N	S31651	...	...	550
	36	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	1	...	550
(**13**)	37	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	3	...	550
(**13**)	38	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	4	...	550
	39	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...	...	550
	40	16Cr–12Ni–2Mo–N	Smls. & wld. fittings	SA–403	316N	S31651	...	...	550
	41	16Cr–12Ni–2Mo–N	Bar	SA–479	316N	S31651	...	...	550

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
2	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
3	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
4	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
5	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
6	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
7	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
8	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
9	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
10	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
11	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
12	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
13	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
14	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
15	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
16	517	517	517	517	517	517	517	517	517	517	517	517	517	...	...
17	483	482	454	433	418	409	406	404	402	399	397	394	390	385	380
18	483	482	454	433	418	409	406	404	402	399	397	394	390	385	380
19	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
20	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
21	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
22	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
23	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
24	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
25	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
26	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
27	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
28	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
29	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
30	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
31	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
32	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
33	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
34	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
35	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
36	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
37	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
38	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
39	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
40	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
41	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316N	S31651	...	...	550
2	16Cr–12Ni–2Mo–N	Wld. pipe	SA–813	TP316N	S31651	...	...	550
3	16Cr–12Ni–2Mo–N	Wld. pipe	SA–814	TP316N	S31651	...	...	550
4	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...	...	550
5	16Cr–12Ni–2Mo–Ti	Plate	SA–240	316Ti	S31635	...	...	515
6	17Cr–4Ni–6Mn	Plate	SA–240	201–1	S20100	...	...	515
7	17Cr–4Ni–6Mn	Plate	SA–666	201–1	S20100	...	...	515
8	17Cr–4Ni–6Mn	Plate	SA–240	201–2	S20100	...	...	655
9	17Cr–4Ni–6Mn	Plate	SA–666	201–2	S20100	...	...	655
10	17Cr–7Ni	Plate, sheet, strip	SA–240	301	S30100	...	...	515
11	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...	...	690
12	18Cr–3Ni–12Mn	Wld. tube	SA–249	XM–29	S24000	...	...	690
13	18Cr–3Ni–12Mn	Wld. pipe	SA–312	XM–29	S24000	...	...	690
14	18Cr–3Ni–12Mn	Bar	SA–479	XM–29	S24000	...	...	690
15	18Cr–3Ni–12Mn	Wld. tube	SA–688	TPXM–29	S24000	...	...	690
16	18Cr–5Ni–3Mo	Smls. & wld. tube	SA–789	...	S31500	...	...	635
17	18Cr–5Ni–3Mo	Smls. & wld. pipe	SA–790	...	S31500	...	...	635
18	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	>125	450
19	18Cr–8Ni	Forgings	SA–965	F304L	S30403	...	...	450
20	18Cr–8Ni	Bar	SA/JIS G4303	SUS304L	...	...	...	480
21	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...	≤125	485
22	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...	...	485
23	18Cr–8Ni	Plate	SA–240	304L	S30403	...	...	485
24	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...	...	485
25	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304L	S30403	...	...	485
26	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	1	...	485
(**13**) 27	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	3	...	485
(**13**) 28	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	4	...	485
29	18Cr–8Ni	Smls. & wld. fittings	SA–403	304L	S30403	...	...	485
30	18Cr–8Ni	Wld. pipe	SA–409	TP304L	S30403	...	...	485
31	18Cr–8Ni	Bar	SA–479	304L	S30403	...	...	485
32	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...	...	485
33	18Cr–8Ni	Wld. pipe	SA–813	TP304L	S30403	...	...	485
34	18Cr–8Ni	Wld. pipe	SA–814	TP304L	S30403	...	...	485
35	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	>125	485
36	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	>125	485
37	18Cr–8Ni	Castings	SA–351	CF3	J92500	...	...	485
38	18Cr–8Ni	Castings	SA–351	CF8	J92600	...	...	485
39	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	485
40	18Cr–8Ni	Cast pipe	SA–451	CPF3	J92500	...	...	485
41	18Cr–8Ni	Cast pipe	SA–451	CPF8	J92600	...	...	485
42	18Cr–8Ni	Forgings	SA–965	F304	S30400	...	...	485
43	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
2	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
3	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
4	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
5	517	517	517	517	517	517	517	517	517	517	517	517	517	...	...
6	515	444	414	402	...	...	...	...	...	...	...	...	...	...	...
7	515	444	414	402	...	...	...	...	...	...	...	...	...	...	...
8	655	565	526	511	...	...	...	...	...	...	...	...	...	...	...
9	655	565	526	511	...	...	...	...	...	...	...	...	...	...	...
10	517	414	379	372	372	372	372	372	369	362	353	345	340	340	...
11	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
12	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
13	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
14	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
15	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
16	634	609	589	585	585	585	585	585	585	585	...	...	...	...	...
17	634	609	589	585	585	585	585	585	585	585	...	...	...	...	...
18	448	419	392	377	369	366	364	362	361	358	355	350	345	338	330
19	448	419	392	377	369	366	364	362	361	358	355	350	345	338	330
20	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
21	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
22	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
23	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
24	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
25	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
26	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
27	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
28	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
29	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
30	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
31	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
32	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
33	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
34	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
35	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
36	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
37	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
38	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
39	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
40	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
41	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
42	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
43	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	18Cr–8Ni	Forgings	SA–182	F304	S30400	...	≤125	515
	2	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...	≤125	515
	3	18Cr–8Ni	Bolting	SA–193	B8	S30400	1	...	515
(**13**)	4	18Cr–8Ni	Bolting	SA–193	B8A	S30400	1A	...	515
	5	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...	...	515
	6	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...	...	515
	7	18Cr–8Ni	Plate	SA–240	302	S30200	...	...	515
	8	18Cr–8Ni	Plate	SA–240	304	S30400	...	...	515
	9	18Cr–8Ni	Plate	SA–240	304H	S30409	...	...	515
	10	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...	...	515
	11	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...	...	515
	12	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304	S30400	...	...	515
	13	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304H	S30409	...	...	515
	14	18Cr–8Ni	Bolting	SA–320	B8	S30400	1	...	515
	15	18Cr–8Ni	Bolting	SA–320	B8A	S30400	1A	...	515
	16	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	1	...	515
(**13**)	17	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	3	...	515
(**13**)	18	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	4	...	515
	19	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	1	...	515
(**13**)	20	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	3	...	515
(**13**)	21	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	4	...	515
	22	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	1	...	515
(**13**)	23	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	3	...	515
(**13**)	24	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	4	...	515
	25	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...	...	515
	26	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...	...	515
	27	18Cr–8Ni	Smls. & wld. fittings	SA–403	304	S30400	...	...	515
	28	18Cr–8Ni	Smls. & wld. fittings	SA–403	304H	S30409	...	...	515
	29	18Cr–8Ni	Wld. pipe	SA–409	TP304	S30400	...	...	515
	30	18Cr–8Ni	Bar	SA–479	302	S30200	...	...	515
	31	18Cr–8Ni	Bar	SA–479	304	S30400	...	...	515
	32	18Cr–8Ni	Bar	SA–479	304H	S30409	...	...	515
	33	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...	...	515
	34	18Cr–8Ni	Wld. pipe	SA–813	TP304	S30400	...	...	515
	35	18Cr–8Ni	Wld. pipe	SA–813	TP304H	S30409	...	...	515
	36	18Cr–8Ni	Wld. pipe	SA–814	TP304	S30400	...	...	515
	37	18Cr–8Ni	Wld. pipe	SA–814	TP304H	S30409	...	...	515
	38	18Cr–8Ni	Bar	SA/JIS G4303	SUS302	...	...	...	520
	39	18Cr–8Ni	Bar	SA/JIS G4303	SUS304	...	...	...	520
	40	18Cr–8Ni	Plate	SA/EN 10028–7	X5CrNi18–10	...	...	≤75	520

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
2	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
3	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
4	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
5	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
6	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
7	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
8	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
9	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
10	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
11	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
12	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
13	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
14	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
15	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
16	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
17	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
18	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
19	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
20	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
21	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
22	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
23	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
24	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
25	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
26	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
27	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
28	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
29	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
30	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
31	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
32	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
33	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
34	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
35	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
36	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
37	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
38	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
39	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
40	520	487	459	444	440	439	439	439	439	439	436	431	424	415	404

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	18Cr–8Ni	Castings	SA–351	CF3A	J92500	...	...	530
2	18Cr–8Ni	Castings	SA–351	CF8A	J92600	...	...	530
3	18Cr–8Ni	Cast pipe	SA–451	CPF3A	J92500	...	...	530
4	18Cr–8Ni	Cast pipe	SA–451	CPF8A	J92600	...	...	530
5	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	>125	485
6	18Cr–8Ni–N	Forgings	SA–965	F304LN	S30453	...	...	485
7	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...	≤125	515
8	18Cr–8Ni–N	Bolting	SA–193	B8NA	S30451	1A	...	515
9	18Cr–8Ni–N	Smls. tube	SA–213	TP304LN	S30453	...	...	515
10	18Cr–8Ni–N	Plate	SA–240	304LN	S30453	...	...	515
11	18Cr–8Ni–N	Wld. tube	SA–249	TP304LN	S30453	...	...	515
12	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304LN	S30453	...	...	515
13	18Cr–8Ni–N	Smls. pipe	SA–376	TP304LN	S30453	...	...	515
14	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304LN	S30453	WP	...	515
15	18Cr–8Ni–N	Bar	SA–479	304LN	S30453	...	...	515
16	18Cr–8Ni–N	Wld. tube	SA–688	TP304LN	S30453	...	...	515
17	18Cr–8Ni–N	Wld. pipe	SA–813	TP304LN	S30453	...	...	515
18	18Cr–8Ni–N	Wld. pipe	SA–814	TP304LN	S30453	...	...	515
19	18Cr–8Ni–N	Forgings	SA–182	F304N	S30451	...	...	550
20	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...	...	550
21	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...	...	550
22	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...	...	550
23	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304N	S30451	...	...	550
24	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	1	...	550
(**13**) 25	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	3	...	550
(**13**) 26	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	4	...	550
27	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...	...	550
28	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304N	S30451	...	...	550
29	18Cr–8Ni–N	Bar	SA–479	304N	S30451	...	...	550
30	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...	...	550
31	18Cr–8Ni–N	Wld. pipe	SA–813	TP304N	S30451	...	...	550
32	18Cr–8Ni–N	Wld. pipe	SA–814	TP304N	S30451	...	...	550
33	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...	...	550
34	18Cr–8Ni–S	Bolting	SA–320	B8F	S30323	1	...	515
35	18Cr–8Ni–S	Bolting	SA–320	B8FA	S30323	1A	...	515
36	18Cr–8Ni–4Si–N	Bar	SA–479	...	S21800	...	...	655
37	18Cr–10Ni–Cb	Forgings	SA–965	F348H	S34809	...	...	450
38	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...	...	485
39	18Cr–10Ni–Cb	Cast pipe	SA–451	CPF8C	J92710	...	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
2	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
3	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
4	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
5	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
6	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
7	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
8	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
9	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
10	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
11	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
12	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
13	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
14	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
15	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
16	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
17	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
18	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
19	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
20	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
21	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
22	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
23	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
24	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
25	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
26	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
27	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
28	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
29	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
30	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
31	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
32	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
33	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
34	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
35	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
36	655	644	599	568	550	539	536	534	531	529	526	521	517	510	503
37	448	425	393	373	360	354	352	352	352	352	352	351	350	348	345
38	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
39	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	>125	485
2	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...	...	485
3	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	>125	485
4	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...	...	485
5	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	>125	485
6	18Cr–10Ni–Cb	Forgings	SA–965	F348	S34800	...	...	485
7	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	>125	485
8	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...	≤125	515
9	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	1	...	515
10	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...	...	515
11	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...	...	515
12	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...	...	515
13	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347	S34700	...	...	515
14	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	1	...	515
15	18Cr–10Ni–Cb	Bolting	SA–320	B8CA	S34700	1A	...	515
16	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	1	...	515
(**13**) 17	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	3	...	515
(**13**) 18	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	4	...	515
19	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...	...	515
20	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347	S34700	...	...	515
21	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP347	S34700	...	...	515
22	18Cr–10Ni–Cb	Bar	SA–479	347	S34700	...	...	515
23	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347	S34700	...	...	515
24	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...	≤125	515
25	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...	...	515
26	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...	...	515
27	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...	...	515
28	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347H	S34709	...	...	515
29	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...	...	515
30	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347H	S34709	...	...	515
31	18Cr–10Ni–Cb	Bar	SA–479	347H	S34709	...	...	515
32	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347H	S34709	...	...	515
33	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP347H	S34709	...	...	515
34	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347LN	S34751	...	...	515
35	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347LN	S34751	...	...	515
36	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...	≤125	515
37	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...	...	515
38	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...	...	515
39	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...	...	515
40	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348	S34800	...	...	515

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
2	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
3	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
4	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
5	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
6	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
7	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
8	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
9	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
10	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
11	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
12	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
13	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
14	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
15	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
16	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
17	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
18	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
19	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
20	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
21	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
22	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
23	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
24	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
25	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
26	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
27	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
28	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
29	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
30	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
31	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
32	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
33	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
34	517	498	461	432	412	400	397	395	394	394	393	392	391	389	385
35	517	498	461	432	412	400	397	395	394	394	393	392	391	389	385
36	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
37	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
38	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
39	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
40	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	1	...	515
(13)	2	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	3	...	515
(13)	3	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	4	...	515
	4	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...	...	515
	5	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348	S34800	...	...	515
	6	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP348	S34800	...	...	515
	7	18Cr–10Ni–Cb	Bar	SA–479	348	S34800	...	...	515
	8	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348	S34800	...	...	515
	9	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348	S34800	...	...	515
	10	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...	≤125	515
	11	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...	...	515
	12	18Cr–10Ni–Cb	Plate	SA–240	348H	S34809	...	...	515
	13	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...	...	515
	14	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348H	S34809	...	...	515
	15	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348H	S34809	...	...	515
	16	18Cr–10Ni–Cb	Bar	SA–479	348H	S34809	...	...	515
	17	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348H	S34809	...	...	515
	18	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348H	S34809	...	...	515
	19	18Cr–10Ni–Cb	Bar	SA/JIS G4303	SUS347	...	...	...	520
	20	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347HFG	S34710	...	...	550
	21	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321	S32100	...	>10	485
	22	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	>10	485
	23	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321H	S32109	...	>5	485
	24	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	>10	485
	25	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	>125	485
	26	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...	...	485
	27	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	>125	485
	28	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...	...	485
	29	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...	≤125	515
	30	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	1	...	515
	31	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...	...	515
	32	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...	...	515
	33	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...	...	515
	34	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321	S32100	...	≤10	515
	35	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	1	...	515
	36	18Cr–10Ni–Ti	Bolting	SA–320	B8TA	S32100	1A	...	515
	37	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	1	...	515
(13)	38	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	3	...	515
(13)	39	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	4	...	515
	40	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...	≤10	515
	41	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321	S32100	...	...	515
	42	18Cr–10Ni–Ti	Wld. pipe	SA–409	TP321	S32100	...	...	515

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
2	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
3	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
4	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
5	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
6	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
7	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
8	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
9	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
10	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
11	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
12	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
13	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
14	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
15	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
16	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
17	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
18	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
19	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
20	552	531	501	481	469	462	459	458	456	455	454	452	449	445	440
21	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
22	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
23	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
24	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
25	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
26	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
27	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
28	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
29	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
30	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
31	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
32	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
33	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
34	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
35	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
36	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
37	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
38	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
39	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
40	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
41	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
42	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...	...	515
2	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321	S32100	...	...	515
3	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321	S32100	...	...	515
4	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...	≤125	515
5	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...	...	515
6	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...	...	515
7	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...	...	515
8	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321H	S32109	...	≤5	515
9	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...	≤10	515
10	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321H	S32109	...	...	515
11	18Cr–10Ni–Ti	Bar	SA–479	321H	S32109	...	...	515
12	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321H	S32109	...	...	515
13	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321H	S32109	...	...	515
14	18Cr–10Ni–Ti	Bar	SA/JIS G4303	SUS321	...	...	...	520
15	18Cr–11Ni	Plate	SA–240	305	S30500	...	...	515
16	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	>125	450
17	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...	≤125	485
18	18Cr–13Ni–3Mo	Forgings	SA–182	F317	S31700	...	≤125	515
19	18Cr–13Ni–3Mo	Plate	SA–240	317	S31700	...	...	515
20	18Cr–13Ni–3Mo	Plate	SA–240	317L	S31703	...	...	515
21	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...	...	515
22	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317L	S31703	...	...	515
23	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317	S31700	...	...	515
24	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317L	S31703	...	...	515
25	18Cr–13Ni–3Mo	Smls. & wld. fittings	SA–403	317	S31700	...	...	515
26	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	...	...	515
27	18Cr–18Ni–2Si	Smls. tube	SA–213	XM–15	S38100	...	...	515
28	18Cr–18Ni–2Si	Plate	SA–240	XM–15	S38100	...	...	515
29	18Cr–18Ni–2Si	Wld. tube	SA–249	TPXM–15	S38100	...	...	515
30	18Cr–18Ni–2Si	Wld. pipe	SA–312	TPXM–15	S38100	...	...	515
31	19Cr–9Ni–½Mo	Castings	SA–351	CF10	J92590	...	...	485
32	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B	...	655
33	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A	...	690
34	19Cr–9Ni–2Mo	Castings	SA–351	CF10M	...	...	...	485
35	19Cr–10Ni–3Mo	Castings	SA–351	CG8M	J93000	...	...	515

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
2	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
3	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
4	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
5	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
6	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
7	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
8	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
9	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
10	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
11	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
12	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
13	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
14	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
15	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
16	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
17	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
18	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
19	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
20	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
21	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
22	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
23	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
24	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
25	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
26	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
27	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
28	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
29	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
30	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
31	483	454	428	415	410	409	409	408	407	405	403	399	393	387	378
32	655	643	609	588	576	568	566	563	560	556	551	545	536	525	511
33	689	676	641	619	606	598	595	593	590	585	580	573	564	553	538
34	483	481	470	467	465	461	458	454	449	444	440	434	428	423	417
35	517	499	474	461	456	455	455	455	455	454	452	449	443	436	426

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	19Cr–15Ni–4Mo	Smls. tube	SA–213	...	S31725	...	...	515
2	19Cr–15Ni–4Mo	Plate	SA–240	...	S31725	...	...	515
3	19Cr–15Ni–4Mo	Wld. tube	SA–249	...	S31725	...	...	515
4	19Cr–15Ni–4Mo	Smls. & wld. pipe	SA–312	...	S31725	...	...	515
5	19Cr–15Ni–4Mo	Wld. pipe	SA–358	...	S31725	...	...	515
6	19Cr–15Ni–4Mo	Smls. pipe	SA–376	...	S31725	...	...	515
7	19Cr–15Ni–4Mo	Wld. pipe	SA–409	...	S31725	...	...	515
8	19Cr–15Ni–4Mo	Bar	SA–479	...	S31725	...	...	515
9	20Cr–10Ni	Bar	SA–479	ER308	S30880	...	...	515
10	20Cr–18Ni–6Mo	Castings	SA–351	CK3MCuN	J93254	...	...	550
11	20Cr–18Ni–6Mo	Forgings	SA–182	F44	S31254	...	...	650
12	20Cr–18Ni–6Mo	Wld. tube	SA–249	...	S31254	...	...	650
13	20Cr–18Ni–6Mo	Smls. & wld. pipe	SA–312	...	S31254	...	...	650
14	20Cr–18Ni–6Mo	Wld. pipe	SA–358	...	S31254	...	...	650
15	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...	...	690
16	21Cr–6Ni–9Mn	Forgings	SA–182	FXM–11	S21904	...	...	620
17	21Cr–6Ni–9Mn	Smls. & wld. pipe	SA–312	TPXM–11	S21904	...	...	620
18	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...	...	620
19	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...	...	620
20	21Cr–11Ni–N	Forgings	SA–182	F45	S30815	...	...	600
21	21Cr–11Ni–N	Smls. tube	SA–213	...	S30815	...	...	600
22	21Cr–11Ni–N	Plate	SA–240	...	S30815	...	...	600
23	21Cr–11Ni–N	Wld. tube	SA–249	...	S30815	...	...	600
24	21Cr–11Ni–N	Smls. & wld. pipe	SA–312	...	S30815	...	...	600
25	21Cr–11Ni–N	Bar	SA–479	...	S30815	...	...	600
26	22Cr–5Ni–3Mo–N	Forgings	SA–182	F51	S31803	...	...	620
27	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S31803	...	...	620
28	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S31803	...	...	620
29	22Cr–5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S31803	...	...	620
30	22Cr–5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S31803	...	...	620
31	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S31803	...	...	620
(13) 32	22Cr–5Ni–3Mo–N	Forgings	SA–182	F60	S32205	...	...	655
(13) 33	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S32205	...	...	655
(13) 34	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S32205	...	...	655
(13) 35	22Cr–5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S32205	...	...	655
(13) 36	22Cr–5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S32205	...	...	655
(13) 37	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S32205	...	...	655

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
2	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
3	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
4	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
5	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
6	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
7	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
8	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
9	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
10	552	550	523	501	485	474	471	468	466	465	462	459	455	...	...
11	648	646	616	589	570	557	553	550	548	546	543	539	534	...	...
12	648	646	616	589	570	557	553	550	548	546	543	539	534	...	...
13	648	646	616	589	570	557	553	550	548	546	543	539	534	...	...
14	648	646	616	589	570	557	553	550	548	546	543	539	534	...	...
15	689	688	655	627	607	593	589	585	583	580	575	572	571	...	...
16	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
17	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
18	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
19	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
20	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
21	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
22	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
23	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
24	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
25	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
26	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
27	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
28	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
29	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
30	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
31	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
32	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
33	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
34	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
35	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
36	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
37	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	22Cr–13Ni–5Mn	Castings	SA–351	CG6MMN	J93790	...	...	585
	2	22Cr–13Ni–5Mn	Forgings	SA–182	FXM–19	S20910	...	...	690
	3	22Cr–13Ni–5Mn	Bolting	SA–193	B8R	S20910	Annealed	...	690
	4	22Cr–13Ni–5Mn	Bolting	SA–193	B8RA	S20910	Annealed	...	690
	5	22Cr–13Ni–5Mn	Smls. tube	SA–213	XM–19	S20910	...	...	690
	6	22Cr–13Ni–5Mn	Plate	SA–240	XM–19	S20910	...	...	690
	7	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...	...	690
	8	22Cr–13Ni–5Mn	Smls. & wld. pipe	SA–312	TPXM–19	S20910	...	...	690
	9	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	1	...	690
(**13**)	10	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	3	...	690
(**13**)	11	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	4	...	690
	12	22Cr–13Ni–5Mn	Smls. & wld. fittings	SA–403	XM–19	S20910	...	...	690
	13	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Annealed	...	690
	14	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled	75 < t ≤ 200	690
	15	22Cr–13Ni–5Mn	Wld. pipe	SA–813	TPXM–19	S20910	...	...	690
	16	22Cr–13Ni–5Mn	Wld. pipe	SA–814	TPXM–19	S20910	...	...	690
	17	22Cr–13Ni–5Mn	Forgings	SA–965	FXM–19	S20910	...	...	690
	18	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled	50 < t ≤ 75	795
	19	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled	≤50	930
	20	23Cr–4Ni–Mo–Cu–N	Plate	SA–240	...	S32304	...	...	600
	21	23Cr–4Ni–Mo–Cu–N	Smls. & wld. tube	SA–789	...	S32304	...	>25	600
	22	23Cr–4Ni–Mo–Cu–N	Smls. & wld. pipe	SA–790	...	S32304	...	...	600
	23	23Cr–4Ni–Mo–Cu–N	Smls. & wld. tube	SA–789	...	S32304	...	≤25	690
	24	23Cr–12Ni	Smls. & wld. fittings	SA–403	309	S30900	...	...	515
	25	23Cr–12Ni	Smls. tube	SA–213	TP309S	S30908	...	...	515
	26	23Cr–12Ni	Plate	SA–240	309S	S30908	...	...	515
	27	23Cr–12Ni	Wld. tube	SA–249	TP309S	S30908	...	...	515
	28	23Cr–12Ni	Smls. & wld. pipe	SA–312	TP309S	S30908	...	...	515
	29	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	1	...	515
(**13**)	30	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	3	...	515
(**13**)	31	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	4	...	515
	32	23Cr–12Ni	Bar	SA–479	309S	S30908	...	...	515
	33	23Cr–12Ni	Wld. pipe	SA–813	TP309S	S30908	...	...	515
	34	23Cr–12Ni	Wld. pipe	SA–814	TP309S	S30908	...	...	515
	35	23Cr–12Ni	Smls. tube	SA–213	TP309H	S30909	...	...	515
	36	23Cr–12Ni	Plate	SA–240	309H	S30909	...	...	515
	37	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...	...	515
	38	23Cr–12Ni	Smls. & wld. pipe	SA–312	TP309H	S30909	...	...	515
	39	23Cr–12Ni	Bar	SA–479	309H	S30909	...	...	515
	40	23Cr–12Ni	Bar	SA/JIS G4303	SUS309S	...	...	...	520

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
													Ferrous Materials (Cont'd)		
1	586	580	552	534	523	516	512	509	506	502	497	492	485	477	467
2	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
3	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
4	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
5	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
6	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
7	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
8	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
9	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
10	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
11	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
12	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
13	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
14	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
15	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
16	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
17	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
18	793	784	747	724	709	698	693	689	684	678	673	665	657	649	638
19	931	920	876	850	832	820	814	809	803	797	789	781	772	761	749
20	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
21	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
22	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
23	689	661	624	605	595	588	584	579	574	...	...	...	...	...	...
24	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
25	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
26	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
27	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
28	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
29	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
30	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
31	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
32	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
33	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
34	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
35	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
36	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
37	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
38	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
39	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
40	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Ferrous Materials (Cont'd)							
1	23Cr–12Ni–Cb	Smls. tube	SA–213	TP309Cb	S30940	...	...	515
2	23Cr–12Ni–Cb	Plate	SA–240	309Cb	S30940	...	...	515
3	23Cr–12Ni–Cb	Wld. tube	SA–249	TP309Cb	S30940	...	...	515
4	23Cr–12Ni–Cb	Smls. & wld. pipe	SA–312	TP309Cb	S30940	...	...	515
5	23Cr–12Ni–Cb	Bar	SA–479	309Cb	S30940	...	...	515
6	23Cr–12Ni–Cb	Wld. pipe	SA–813	TP309Cb	S30940	...	...	515
7	23Cr–12Ni–Cb	Wld. pipe	SA–814	TP309Cb	S30940	...	...	515
8	24Cr–10Ni–4Mo–N	Castings	SA–995	2A	J93345	...	...	655
9	25Cr–4Ni–4Mo–Ti	Plate	SA–240	...	S44635	...	...	620
10	25Cr–4Ni–4Mo–Ti	Wld. tube	SA–268	...	S44635	...	...	620
11	25Cr–5Ni–3Mo–2Cu	Castings	SA–995	1B	J93372	...	...	690
12	25Cr–5Ni–3Mo–2Cu	Plate	SA–240	...	S32550	...	...	760
13	25Cr–5Ni–3Mo–2Cu	Bar	SA–479	...	S32550	...	...	760
14	25Cr–5Ni–3Mo–2Cu	Smls. & wld. tube	SA–789	...	S32550	...	...	760
15	25Cr–5Ni–3Mo–2Cu	Smls. & wld. pipe	SA–790	...	S32550	...	...	760
16	25Cr–6Ni–Mo–N	Plate	SA–240	...	S31200	...	...	690
17	25Cr–6.5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S31260	...	...	690
18	25Cr–6.5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S31260	...	...	690
19	25Cr–6.5Ni–3Mo–N	Plate	SA–240	...	S31260	...	...	690
20	25Cr–7Ni–3Mo–W–Cu–N	Forgings	SA–182	F54	S39274	...	...	800
21	25Cr–7Ni–3Mo–W–Cu–N	Smls. & wld. tube	SA–789	...	S39274	...	...	800
22	25Cr–7Ni–3Mo–W–Cu–N	Smls. & wld. pipe	SA–790	...	S39274	...	...	800
23	25Cr–7Ni–4Mo–N	Forgings	SA–182	F53	S32750	...	...	800
24	25Cr–7Ni–4Mo–N	Plate	SA–240	...	S32750	...	...	800
25	25Cr–7Ni–4Mo–N	Smls. & wld. tube	SA–789	...	S32750	...	≤25	800
26	25Cr–7Ni–4Mo–N	Smls. & wld. pipe	SA–790	...	S32750	...	≤25	800
(13) 27	25Cr–7.5Ni–3.5Mo–N–Cu–W	Forgings	SA–182	F55	S32760	...	...	750
(13) 28	25Cr–7.5Ni–3.5Mo–N–Cu–W	Plate	SA–240	...	S32760	...	...	750
(13) 29	25Cr–7.5Ni–3.5Mo–N–Cu–W	Bar	SA–479	...	S32760	Annealed	...	750
(13) 30	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. tube	SA–789	...	S32760	...	...	750
(13) 31	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. pipe	SA–790	...	S32760	...	...	750
(13) 32	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. fittings	SA–815	...	S32760	...	...	750
33	25Cr–12Ni	Castings	SA–351	CH8	J93400	...	...	450
34	25Cr–12Ni	Cast pipe	SA–451	CPH8	J93400	...	...	450
35	25Cr–12Ni	Castings	SA–351	CH20	J93402	...	...	485
36	25Cr–12Ni	Cast pipe	SA–451	CPH20	J93402	...	...	485
37	25Cr–20Ni	Castings	SA–351	CK20	J94202	...	...	450
38	25Cr–20Ni	Cast pipe	SA–451	CPK20	J94202	...	...	450
39	25Cr–20Ni	Forgings	SA–182	F310	S31000	...	≤125	515
40	25Cr–20Ni	Forgings	SA–965	F310	S31000	...	...	515
41	25Cr–20Ni	Smls. tube	SA–213	TP310S	S31008	...	...	515
42	25Cr–20Ni	Plate	SA–240	310S	S31008	...	...	515
43	25Cr–20Ni	Wld. tube	SA–249	TP310S	S31008	...	...	515
44	25Cr–20Ni	Smls. & wld. pipe	SA–312	TP310S	S31008	...	...	515

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
2	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
3	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
4	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
5	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
6	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
7	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
8	655	652	604	583	583	583	583	580	557	...	...	...	...	...	...
9	621	597	565	545	532	528	525	521	...	...	...	...	...	...	...
10	621	597	565	545	532	528	525	521	...	...	...	...	...	...	...
11	689	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
13	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
14	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
15	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
16	689	687	653	635	631	631	631	...	...	...	...	...	...	...	...
17	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
18	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
19	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
20	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
21	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
22	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
23	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
24	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
25	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
26	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
27	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
28	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
29	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
30	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
31	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
32	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
33	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
34	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
35	483	437	411	401	399	399	399	398	395	391	384	375	364	350	334
36	483	437	411	401	399	399	399	398	395	391	384	375	364	350	334
37	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
38	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
39	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
40	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
41	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
42	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
43	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
44	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
		Ferrous Materials (Cont'd)							
	1	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	1	...	515
(**13**)	2	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	3	...	515
(**13**)	3	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	4	...	515
	4	25Cr–20Ni	Smls. & wld. fittings	SA–403	310S	S31008	...	...	515
	5	25Cr–20Ni	Bar	SA–479	310S	S31008	...	...	515
	6	25Cr–20Ni	Wld. pipe	SA–813	TP310S	S31008	...	...	515
	7	25Cr–20Ni	Wld. pipe	SA–814	TP310S	S31008	...	...	515
	8	25Cr–20Ni	Smls. tube	SA–213	TP310H	S31009	...	...	515
	9	25Cr–20Ni	Plate	SA–240	310H	S31009	...	...	515
	10	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...	...	515
	11	25Cr–20Ni	Smls. & wld. pipe	SA–312	TP310H	S31009	...	...	515
	12	25Cr–20Ni	Bar	SA–479	310H	S31009	...	...	515
	13	25Cr–20Ni	Bar	SA/JIS G4303	SUS310S	...	...	...	520
	14	25Cr–20Ni–Cb	Smls. tube	SA–213	TP310Cb	S31040	...	...	515
	15	25Cr–20Ni–Cb	Plate	SA–240	310Cb	S31040	...	...	515
	16	25Cr–20Ni–Cb	Wld. tube	SA–249	TP310Cb	S31040	...	...	515
	17	25Cr–20Ni–Cb	Smls. & wld. pipe	SA–312	TP310Cb	S31040	...	...	515
	18	25Cr–20Ni–Cb	Bar	SA–479	310Cb	S31040	...	...	515
	19	25Cr–20Ni–Cb	Wld. pipe	SA–813	TP310Cb	S31040	...	...	515
	20	25Cr–20Ni–Cb	Wld. pipe	SA–814	TP310Cb	S31040	...	...	515
	21	25Cr–20Ni–Cb–N	Smls. tube	SA–213	TP310HCbN	S31042	...	...	655
	22	25Cr–22Ni–2Mo–N	Forgings	SA–182	F310MoLN	S31050	...	...	540
	23	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	$6 < t \le 32$	540
(**13**)	24	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t > 6$	540
	25	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	$6 < t \le 32$	540
	26	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	$6 < t \le 32$	540
	27	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...	≤6, wall	580
(**13**)	28	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...	$t \le 6$	580
	29	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...	≤6, wall	580
	30	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...	≤6, wall	580
	31	26Cr–4Ni–Mo	Plate	SA–240	329	S32900	...	...	620
	32	26Cr–4Ni–Mo	Smls. & wld. tube	SA–789	...	S32900	...	...	620
	33	26Cr–4Ni–Mo	Smls. & wld. pipe	SA–790	...	S32900	...	...	620
	34	26Cr–4Ni–Mo–N	Plate	SA–240	...	S32950	...	...	690
	35	26Cr–4Ni–Mo–N	Smls. & wld. tube	SA–789	...	S32950	...	...	690
	36	26Cr–4Ni–Mo–N	Smls. & wld. pipe	SA–790	...	S32950	...	...	690
	37	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...	≥10	750
	38	29Cr–6.5Ni–2Mo–N	Bar	SA–479	...	S32906	...	...	750
	39	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...	≥10	750
	40	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...	≥10	750
	41	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...	<10	800
	42	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...	<10	800
	43	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...	<10	800

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Ferrous Materials (Cont'd)
1	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
2	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
3	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
4	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
5	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
6	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
7	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
8	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
9	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
10	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
11	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
12	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
13	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
14	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
15	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
16	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
17	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
18	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
19	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
20	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
21	655	643	613	594	584	579	577	576	574	572	570	568	561	555	547
22	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
23	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
24	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
25	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
26	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
27	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
28	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
29	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
30	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
31	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...
32	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...
33	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...
34	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
35	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
36	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
37	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
38	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
39	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
40	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
41	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...
42	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...
43	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Nonferrous Materials							
1	...	Rod	SB–187	...	C10200	O60	...	195
2	...	Smls. tube	SB–75	...	C10200	O60	...	205
3	...	Smls. pipe	SB–42	...	C10200	O61	6 < DN ≤ 50	205
4	...	Plate, sheet, strip	SB–152	...	C10200	H00	...	205
5	...	Plate, sheet, strip	SB–152	...	C10200	H01	...	205
6	...	Plate, sheet, strip	SB–152	...	C10200	H02	...	205
7	...	Plate, sheet, strip	SB–152	...	C10200	H03	...	205
8	...	Plate, sheet, strip	SB–152	...	C10200	H04	...	205
9	...	Plate, sheet, strip	SB–152	...	C10200	O25	...	205
10	...	Smls. pipe	SB–42	...	C10200	H55	50 < DN ≤ 300	250
11	...	Smls. tube	SB–75	...	C10200	H55	...	250
12	...	Smls. cond. tube	SB–111	...	C10200	H55	<75	250
13	...	Smls. U–bend tube	SB–395	...	C10200	H55	...	250
14	...	Smls. pipe	SB–42	...	C10200	H80	6 < DN ≤ 50	310
15	...	Smls. tube	SB–75	...	C10200	H80	<100	310
16	...	Smls. cond. tube	SB–111	...	C10200	H80	<75	310
17	...	Plate, sheet, strip	SB–152	...	C10400	H00	...	205
18	...	Plate, sheet, strip	SB–152	...	C10400	H01	...	205
19	...	Plate, sheet, strip	SB–152	...	C10400	H02	...	205
20	...	Plate, sheet, strip	SB–152	...	C10400	H03	...	205
21	...	Plate, sheet, strip	SB–152	...	C10400	H04	...	205
22	...	Plate, sheet, strip	SB–152	...	C10400	O25	...	205
23	...	Plate, sheet, strip	SB–152	...	C10500	H00	...	205
24	...	Plate, sheet, strip	SB–152	...	C10500	H01	...	205
25	...	Plate, sheet, strip	SB–152	...	C10500	H02	...	205
26	...	Plate, sheet, strip	SB–152	...	C10500	H03	...	205
27	...	Plate, sheet, strip	SB–152	...	C10500	H04	...	205
28	...	Plate, sheet, strip	SB–152	...	C10500	O25	...	205
29	...	Plate, sheet, strip	SB–152	...	C10700	H00	...	205
30	...	Plate, sheet, strip	SB–152	...	C10700	H01	...	205
31	...	Plate, sheet, strip	SB–152	...	C10700	H02	...	205
32	...	Plate, sheet, strip	SB–152	...	C10700	H03	...	205
33	...	Plate, sheet, strip	SB–152	...	C10700	H04	...	205
34	...	Plate, sheet, strip	SB–152	...	C10700	O25	...	205
35	...	Bar, rod	SB–187	...	C11000	H04	...	195
36	...	Bar, rod	SB–187	...	C11000	O60	...	195
37	...	Plate, sheet, strip, bar	SB–152	...	C11000	H00	≤50	205
38	...	Plate, sheet, strip, bar	SB–152	...	C11000	H01	≤50	205
39	...	Plate, sheet, strip, bar	SB–152	...	C11000	H02	≤50	205
40	...	Plate, sheet, strip, bar	SB–152	...	C11000	H03	≤50	205
41	...	Plate, sheet, strip, bar	SB–152	...	C11000	H04	≤50	205
42	...	Plate, sheet, strip, bar	SB–152	...	C11000	O25	≤50	205
43	...	Smls. tube	SB–75	...	C12000	O50	...	205
44	...	Smls. tube	SB–75	...	C12000	O60	...	205
45	...	Smls. pipe	SB–42	...	C12000	O61	6 < DN ≤ 50	205

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials
1	193	173	161	153	...	...	...	...	...	...	...	...	...	...	...
2	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
3	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
4	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
5	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
6	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
7	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
8	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
9	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
10	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
11	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
12	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
13	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
14	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
15	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
16	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
17	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
18	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
19	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
20	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
21	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
22	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
23	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
24	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
25	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
26	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
27	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
28	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
29	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
30	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
31	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
32	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
33	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
34	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
35	193	173	161	153	...	...	...	...	...	...	...	...	...	...	...
36	193	173	161	153	...	...	...	...	...	...	...	...	...	...	...
37	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
38	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
39	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
40	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
41	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
42	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
43	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
44	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
45	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	...	Smls. pipe	SB–42	...	C12000	H55	50 < DN ≤ 300	250
2	...	Smls. tube	SB–75	...	C12000	H55	...	250
3	...	Smls. cond. tube	SB–111	...	C12000	H55	<75	250
4	...	Smls. U–bend tube	SB–395	...	C12000	H55	<50	250
5	...	Smls. pipe	SB–42	...	C12000	H80	6 < DN ≤ 50	310
6	...	Smls. tube	SB–75	...	C12000	H80	...	310
7	...	Smls. cond. tube	SB–111	...	C12000	H80	<75	310
8	...	Smls. tube	SB–75	...	C12200	O50	...	205
9	...	Smls. tube	SB–75	...	C12200	O60	...	205
10	...	Smls. pipe	SB–42	...	C12200	O61	3 < t ≤ 75	205
11	...	Finned tube	SB–359	...	C12200	O61	...	205
12	...	Plate, sheet, strip	SB–152	...	C12200	H00	...	205
13	...	Plate, sheet, strip	SB–152	...	C12200	H01	...	205
14	...	Plate, sheet, strip	SB–152	...	C12200	H02	...	205
15	...	Plate, sheet, strip	SB–152	...	C12200	H03	...	205
16	...	Plate, sheet, strip	SB–152	...	C12200	H04	...	205
17	...	Plate, sheet, strip	SB–152	...	C12200	O25	...	205
18	...	Wld. cond. tube	SB–543	...	C12200	Light cold worked	...	220
19	...	Smls. pipe	SB–42	...	C12200	H55	50 < t ≤ 300	250
20	...	Smls. tube	SB–75	...	C12200	H55	...	250
21	...	Smls. cond. tube	SB–111	...	C12200	H55	<75	250
22	...	Finned tube	SB–359	...	C12200	H55	...	250
23	...	Smls. U–bend tube	SB–395	...	C12200	H55	<50	250
24	...	Smls. pipe	SB–42	...	C12200	H80	3 < t ≤ 50	310
25	...	Smls. cond. tube	SB–75	...	C12200	H80	<100	310
26	...	Smls. tube	SB–111	...	C12200	H80	<75	310
27	...	Plate, sheet, strip, bar	SB–152	...	C12300	H00	...	205
28	...	Plate, sheet, strip, bar	SB–152	...	C12300	H01	...	205
29	...	Plate, sheet, strip, bar	SB–152	...	C12300	H02	...	205
30	...	Plate, sheet, strip, bar	SB–152	...	C12300	H03	...	205
31	...	Plate, sheet, strip, bar	SB–152	...	C12300	H04	...	205
32	...	Plate, sheet, strip, bar	SB–152	...	C12300	O25	...	205
33	...	Plate, sheet, strip	SB–152	...	C14200	O25	...	205
34	...	Smls. cond. tube	SB–111	...	C14200	H55	<75	250
35	...	Smls. U–bend tube	SB–395	...	C14200	H55	...	250
36	...	Smls. cond. tube	SB–111	...	C14200	H80	<75	310
37	...	Smls. cond. tube	SB–111	...	C19200	O61	<75	260
38	...	Smls. U–bend tube	SB–395	...	C19200	O61	...	260
39	...	Wld. cond. tube	SB–543	...	C19400	Annealed	...	310
40	...	Wld. cond. tube	SB–543	...	C19400	Light cold worked	...	310
41	...	Smls. cond. tube	SB–111	...	C60800	O61	...	345
42	...	Smls. U–bend tube	SB–395	...	C60800	O61	...	345

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
2	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
3	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
4	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
5	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
6	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
7	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
8	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
9	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
10	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
11	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
12	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
13	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
14	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
15	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
16	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
17	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
18	221	220	214	203	...	...	...	...	...	...	...	...	...	...	...
19	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
20	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
21	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
22	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
23	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
24	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
25	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
26	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
27	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
28	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
29	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
30	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
31	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
32	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
33	207	185	173	164	...	...	...	...	...	...	...	...	...	...	...
34	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
35	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
36	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
37	262	245	224	206	...	...	...	...	...	...	...	...	...	...	...
38	262	245	224	206	...	...	...	...	...	...	...	...	...	...	...
39	310	309	287	268	...	...	...	...	...	...	...	...	...	...	...
40	310	309	287	268	...	...	...	...	...	...	...	...	...	...	...
41	345	345	345	329	277	...	...	...	...	...	...	...	...	...	...
42	345	345	345	329	277	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	...	Plate, sheet	SB–169	...	C61400	O25 or O60	50 < t ≤ 125	450
2	...	Plate	SB–171	...	C61400	O25	50 < t ≤ 125	450
3	...	Plate, sheet	SB–169	...	C61400	O25 or O60	13 < t ≤ 50	485
4	...	Plate	SB–171	...	C61400	O25	≤50	485
5	...	Plate, sheet	SB–169	...	C61400	O25 or O60	≤13	495
6	...	Plate	SB–171	...	C63000	O25	89 < t ≤ 125	550
7	...	Plate	SB–171	...	C63000	O25	50 < t ≤ 89	585
8	...	Plate	SB–171	...	C63000	O25	≤50	620
9	...	Forgings	SB–283	...	C64200	M10	>38	470
10	...	Forgings	SB–283	...	C64200	M10	≤38	485
11	...	Plate, sheet	SB–96	...	C65500	O61	≤50	345
12	...	Smls. pipe & tube	SB–466	...	C70600	O60	...	260
13	...	Wld. pipe	SB–467	...	C70600	WO61	>114	260
14	...	Bar, rod	SB–151	...	C70600	O60	...	260
15	...	Plate	SB–171	...	C70600	M20	...	275
16	...	Plate, sheet	SB–171	...	C70600	M20	≤64	275
17	...	Plate	SB–171	...	C70600	O25	...	275
18	...	Plate, sheet	SB–171	...	C70600	O25	≤64	275
19	...	Smls. cond. tube	SB–111	...	C70600	O61	...	275
20	...	Finned tube	SB–359	...	C70600	O61	...	275
21	...	Smls. U–bend tube	SB–395	...	C70600	O61	...	275
22	...	Wld. pipe	SB–467	...	C70600	WO61	≤114	275
23	...	Wld. tube	SB–543	...	C70600	WO61	...	275
24	...	Finned wld. tube	SB–956	...	C70600	WO61	...	275
25	...	Wld. pipe	SB–467	...	C70600	WO61	≤114	310
26	...	Smls. tube	SB–111	...	C70600	H55	...	310
(13) 27	...	Smls. pipe & tube	SB–466	...	C70600	H55	...	310
28	...	Wld. tube	SB–543	...	C70600	WC55	...	310
29	...	Finned wld. tube	SB–956	...	C70600	WC55	...	310
30	...	Wld. pipe	SB–467	...	C70600	Wld. fr. cold rld. strip	≤114	370
31	...	Plate, sheet	SB–171	...	C71500	O25	64 < t ≤ 125	310
32	...	Plate, sheet	SB–171	...	C71500	O25	≤64	345
33	...	Smls. cond. tube	SB–111	...	C71500	O61	...	360
34	...	Wld. tube	SB–543	...	C71500	WO61	...	360
35	...	Finned wld. tube	SB–956	...	C71500	WO61	...	360
36	...	Smls. cond. tube	SB–111	...	C71500	HR50	...	495
37	...	Castings	SB–148	...	C95200	M01	...	450
38	...	Castings	SB–271	...	C95200	M02	...	450
39	...	Castings	SB–505	...	C95200	M07	...	470
40	...	Castings	SB–148	...	C95400	M01	...	515
41	...	Castings	SB–271	...	C95400	M02	...	515
42	99Ni	Plate, sheet, strip	SB–162	...	N02200	As rolled	...	380
43	99Ni	Smls. pipe & tube	SB–161	...	N02200	Stress rel.	...	450
44	99Ni	Smls. tube	SB–163	...	N02200	Stress rel.	...	450

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	448	448	448	441	415	...	...	...	...	...	...	...	...	...	...
2	448	448	448	441	415	...	...	...	...	...	...	...	...	...	...
3	483	483	483	475	447	...	...	...	...	...	...	...	...	...	...
4	483	483	483	475	447	...	...	...	...	...	...	...	...	...	...
5	496	496	496	488	460	...	...	...	...	...	...	...	...	...	...
6	552	552	552	552	546	484	410	299	152	...	...	...	...	...	...
7	586	586	586	586	581	515	436	317	162	...	...	...	...	...	...
8	621	621	621	621	618	543	462	336	172	...	...	...	...	...	...
9	469	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	483	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	345	345	345	326	303	...	...	...	...	...	...	...	...	...	...
12	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
13	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
14	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
15	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
16	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
17	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
18	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
19	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
20	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
21	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
22	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
23	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
24	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
25	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
26	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
27	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
28	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
29	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
30	372	365	339	321	309	305	303	...	...	...	...	...	...	...	...
31	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
32	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
33	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
34	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
35	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
36	496	496	496	477	458	448	444	440	431	414	...	...	...	...	...
37	448	448	448	431	398	351	326	...	...	...	...	...	...	...	...
38	448	448	448	431	398	351	326	...	...	...	...	...	...	...	...
39	469	469	469	450	416	368	341	...	...	...	...	...	...	...	...
40	517	517	517	517	517	...	...	...	...	...	...	...	...	...	...
41	517	517	517	517	517	...	...	...	...	...	...	...	...	...	...
42	379	379	379	379	379	379	379	379	379	379	379	379	379	...	...
43	448	448	448	448	444	432	422	409	...	...	...	...	...	...	...
44	448	448	448	448	444	432	422	409	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed	>125 O.D.	345
2	99Ni–Low C	Smls. & wld. fittings	SB–366	...	N02201	Annealed	...	345
3	99Ni–Low C	Bar, rod	SB–160	...	N02201	Hot rolled/ann.	...	345
4	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed	≤125 O.D.	345
5	99Ni–Low C	Smls. tube	SB–163	...	N02201	Annealed	...	345
6	99Ni–Low C	Plate, sheet, strip	SB–162	...	N02201	Hot rolled/ann.	...	345
7	67Ni–30Cu	Bar	SB–164	...	N04400	Annealed	...	485
8	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed	>125 O.D.	485
9	67Ni–30Cu	Forgings	SB–564	...	N04400	Annealed	...	485
10	67Ni–30Cu	Plate	SB–127	...	N04400	Annealed	...	485
11	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Annealed	≤75	485
12	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed	≤125 O.D.	485
13	67Ni–30Cu	Smls. & wld. fittings	SB–366	...	N04400	Annealed	...	485
14	67Ni–30Cu	Bar	SB–164	...	N04400	Hot worked	...	515
15	67Ni–30Cu	Plate	SB–127	...	N04400	As rolled	...	515
16	67Ni–30Cu	Bar, rod	SB–164	...	N04400	Hot worked	...	515
(**13**) 17	67Ni–30Cu	Rounds	SB–164	...	N04400	Hot worked	300 < t ≤ 350	515
(**13**) 18	67Ni–30Cu	Rounds	SB–164	...	N04400	Hot worked	t ≤ 300	550
(**13**) 19	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR	t < 13	580
(**13**) 20	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR	89 < t ≤ 100	580
21	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Stress rel.	...	585
22	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Stress rel.	...	585
(**13**) 23	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR	13 ≤ t ≤ 89	600
(**13**) 24	67Ni–30Cu	Rounds	SB–164	...	N04400	Cold worked	t < 13	760
25	67Ni–30Cu–S	Bar	SB–164	...	N04405	Annealed	...	485
26	67Ni–30Cu–S	Bar	SB–164	...	N04405	Hot worked	...	515
27	67Ni–28Cu–3Al	Bolting	SF–468	...	N05500	Ann./aged	6–38	895
28	47Ni–22Cr–9Mo–18Fe	Plate	SB–435	...	N06002	Annealed	>5	655
29	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	...	N06002	Solution ann.	≤5	655
30	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	...	N06002	Annealed	...	655
31	47Ni–22Cr–9Mo–18Fe	Smls. & wld. fittings	SB–366	...	N06002	Annealed	...	690
32	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	...	N06002	Annealed	1.5 < t ≤ 5	690
33	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	...	N06002	Solution ann.	...	690
34	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	...	N06002	Solution ann.	...	690
35	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	...	N06002	Solution ann.	...	690
36	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.	>19	585
37	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.	>19	585
38	47Ni–22Cr–19Fe–6Mo	Smls. & wld. fittings	SB–366	...	N06007	Annealed	...	620
39	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.	≤19	620
40	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.	≤19	620
41	47Ni–22Cr–19Fe–6Mo	Wld. pipe	SB–619	...	N06007	Solution ann.	...	620
42	47Ni–22Cr–19Fe–6Mo	Smls. pipe & tube	SB–622	...	N06007	Solution ann.	...	620
43	47Ni–22Cr–19Fe–6Mo	Wld. tube	SB–626	...	N06007	Solution ann.	...	620

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
2	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
3	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
4	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
5	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
6	345	345	345	344	332	319	312	304	297	291	285	280	277	274	273
7	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
8	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
9	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
10	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
11	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
12	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
13	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
14	517	517	517	517	517	517	517	514	495	475	451	424	398	374	357
15	517	517	517	517	517	517	517	514	495	475	451	424	398	374	357
16	517	517	517	517	517	517	517	514	495	475	451	424	398	374	357
17	517	517	517	517	517	517	517	514	495	475	451	424	...	...	...
18	551	551	551	551	551	546	540	530	517	498	475	445	...	...	...
19	579	579	579	579	579	573	567	557	542	523	498	468	...	...	...
20	579	579	579	579	579	573	567	557	542	523	498	468	...	...	...
21	586	586	586	585	585	581	574	563	548	529	504	478	451	424	404
22	586	586	586	585	585	581	574	563	548	529	504	478	451	424	404
23	...	600	600	600	600	594	587	577	562	542	516	484	...	...	...
24	...	758	758	758	758	751	742	729	710	685	653	612	...	...	...
25	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
26	517	517	517	517	517	517	517	514	495	475	451	424	398	374	357
27	896	896	896	896	896	896	890	880	869	...	...	...	...	...	...
28	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
29	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
30	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
31	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
32	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
33	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
34	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
35	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
36	586	586	577	571	563	553	548	543	539	536	533	528	524	516	502
37	586	586	577	571	563	553	548	543	539	536	533	528	524	516	502
38	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
39	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
40	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
41	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
42	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
43	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	55Ni–21Cr–13.5Mo	Smls. & wld. fittings	SB–366	...	N06022	Solution ann.	...	690
2	55Ni–21Cr–13.5Mo	Forgings	SB–462	...	N06022	Solution ann.	...	690
3	55Ni–21Cr–13.5Mo	Forgings	SB–564	...	N06022	Solution ann.	...	690
4	55Ni–21Cr–13.5Mo	Rod	SB–574	...	N06022	Solution ann.	...	690
5	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	...	N06022	Solution ann.	...	690
6	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	...	N06022	Solution ann.	...	690
7	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	...	N06022	Solution ann.	...	690
8	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	...	N06022	Solution ann.	...	690
9	40Ni–29Cr–15Fe–5Mo	Smls. & wld. fittings	SB–366	...	N06030	Solution ann.	...	585
10	40Ni–29Cr–15Fe–5Mo	Forgings	SB–462	...	N06030	Solution ann.	...	585
11	40Ni–29Cr–15Fe–5Mo	Rod	SB–581	...	N06030	Solution ann.	...	585
12	40Ni–29Cr–15Fe–5Mo	Plate, sheet, strip	SB–582	...	N06030	Solution ann.	...	585
13	40Ni–29Cr–15Fe–5Mo	Wld. pipe	SB–619	...	N06030	Solution ann.	...	585
14	40Ni–29Cr–15Fe–5Mo	Smls. pipe & tube	SB–622	...	N06030	Solution ann.	...	585
15	40Ni–29Cr–15Fe–5Mo	Wld. tube	SB–626	...	N06030	Solution ann.	...	585
16	58Ni–33Cr–8Mo	Smls. & wld. fittings	SB–366	...	N06035	Solution ann.	...	586
17	58Ni–33Cr–8Mo	Forgings	SB–462	...	N06035	Solution ann.	...	586
18	58Ni–33Cr–8Mo	Forgings	SB–564	...	N06035	Solution ann.	...	586
19	58Ni–33Cr–8Mo	Rod	SB–574	...	N06035	Solution ann.	...	586
20	58Ni–33Cr–8Mo	Plate, sheet, strip	SB–575	...	N06035	Solution ann.	...	586
21	58Ni–33Cr–8Mo	Wld. pipe	SB–619	...	N06035	Solution ann.	...	586
22	58Ni–33Cr–8Mo	Smls. pipe & tube	SB–622	...	N06035	Solution ann.	...	586
23	58Ni–33Cr–8Mo	Wld. tube	SB–626	...	N06035	Solution ann.	...	586
24	46Ni–27Cr–23Fe–2.75Si	Rod	SB–166	...	N06045	...	...	620
25	46Ni–27Cr–23Fe–2.75Si	Smls. pipe & tube	SB–167	...	N06045	...	...	620
26	46Ni–27Cr–23Fe–2.75Si	Plate, sheet, strip	SB–168	...	N06045	...	...	620
27	46Ni–27Cr–23Fe–2.75Si	Smls. & wld. fittings	SB–366	...	N06045	...	...	620
28	46Ni–27Cr–23Fe–2.75Si	Wld. tube	SB–516	...	N06045	...	...	620
29	46Ni–27Cr–23Fe–2.75Si	Wld. pipe	SB–517	...	N06045	...	...	620
30	46Ni–27Cr–23Fe–2.75Si	Forgings	SB–564	...	N06045	...	...	620
31	59Ni–23Cr–16Mo	Fittings	SB–366	CR5923	N06059	Annealed	...	690
32	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923	N06059	Annealed	...	690
33	59Ni–23Cr–16Mo	Wld. fittings	SB–366	WP5923W	N06059	Annealed	...	690
34	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923WX	N06059	Annealed	...	690
35	59Ni–23Cr–16Mo	Forgings	SB–564	...	N06059	Solution ann.	...	690
36	59Ni–23Cr–16Mo	Rod	SB–574	...	N06059	Solution ann.	...	690
37	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	...	N06059	Solution ann.	...	690
38	59Ni–23Cr–16Mo	Wld. pipe	SB–619	...	N06059	Solution ann.	...	690
39	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	...	N06059	Solution ann.	...	690
40	59Ni–23Cr–16Mo	Wld. tube	SB–626	...	N06059	Solution ann.	...	690

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
2	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
3	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
4	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
5	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
6	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
7	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
8	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
9	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
10	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
11	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
12	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
13	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
14	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
15	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
16	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
17	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
18	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
19	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
20	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
21	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
22	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
23	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
24	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
25	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
26	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
27	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
28	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
29	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
30	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
31	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
32	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
33	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
34	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
35	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
36	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
37	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
38	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
39	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
40	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	59Ni–23Cr–16Mo–1.6Cu	Fittings	SB–366	...	N06200	Solution ann.	...	690
2	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–462	...	N06200	Solution ann.	...	690
3	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–564	...	N06200	Solution ann.	...	690
4	59Ni–23Cr–16Mo–1.6Cu	Rod	SB–574	...	N06200	Solution ann.	...	690
5	59Ni–23Cr–16Mo–1.6Cu	Plate, sheet, strip	SB–575	...	N06200	Solution ann.	...	690
6	59Ni–23Cr–16Mo–1.6Cu	Wld. pipe	SB–619	...	N06200	Solution ann.	...	690
7	59Ni–23Cr–16Mo–1.6Cu	Smls. pipe & tube	SB–622	...	N06200	Solution ann.	...	690
8	59Ni–23Cr–16Mo–1.6Cu	Wld. tube	SB–626	...	N06200	Solution ann.	...	690
9	60Ni–19Cr–19Mo–1.8Ta	Smls. & wld. fittings	SB–366	...	N06210	Solution ann.	...	690
10	60Ni–19Cr–19Mo–1.8Ta	Forgings	SB–564	...	N06210	Solution ann.	...	690
11	60Ni–19Cr–19Mo–1.8Ta	Rod	SB–574	...	N06210	Solution ann.	...	690
12	60Ni–19Cr–19Mo–1.8Ta	Plate, sheet, strip	SB–575	...	N06210	Solution ann.	...	690
13	60Ni–19Cr–19Mo–1.8Ta	Wld. pipe	SB–619	...	N06210	Solution ann.	...	690
14	60Ni–19Cr–19Mo–1.8Ta	Smls. pipe & tube	SB–622	...	N06210	Solution ann.	...	690
15	60Ni–19Cr–19Mo–1.8Ta	Wld. tube	SB–626	...	N06210	Solution ann.	...	690
16	57Ni–22Cr–14W–2Mo–La	Plate, sheet, strip	SB–435	...	N06230	Solution ann.	...	760
17	57Ni–22Cr–14W–2Mo–La	Forgings	SB–564	...	N06230	Solution ann.	...	760
18	57Ni–22Cr–14W–2Mo–La	Bar	SB–572	...	N06230	Solution ann.	...	760
19	57Ni–22Cr–14W–2Mo–La	Wld. pipe	SB–619	...	N06230	Solution ann.	...	760
20	57Ni–22Cr–14W–2Mo–La	Smls. pipe & tube	SB–622	...	N06230	Solution ann.	...	760
21	57Ni–22Cr–14W–2Mo–La	Wld. tube	SB–626	...	N06230	Solution ann.	...	760
22	61Ni–16Mo–16Cr	Smls. & wld. fittings	SB–366	...	N06455	Annealed	...	690
23	61Ni–16Mo–16Cr	Rod	SB–574	...	N06455	Solution ann.	...	690
24	61Ni–16Mo–16Cr	Plate, sheet, strip	SB–575	...	N06455	Solution ann.	...	690
25	61Ni–16Mo–16Cr	Wld. pipe	SB–619	...	N06455	Solution ann.	...	690
26	61Ni–16Mo–16Cr	Smls. pipe & tube	SB–622	...	N06455	Solution ann.	...	690
27	61Ni–16Mo–16Cr	Wld. tube	SB–626	...	N06455	Solution ann.	...	690
28	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.	>125	515
29	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.	>125	550
30	72Ni–15Cr–8Fe	Smls. & wld. fittings	SB–366	...	N06600	Annealed	...	550
31	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.	>125	550
32	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.	≤125	550
33	72Ni–15Cr–8Fe	Smls. tube	SB–163	...	N06600	Annealed	≤75	550
34	72Ni–15Cr–8Fe	Bar	SB–166	...	N06600	Annealed	...	550
35	72Ni–15Cr–8Fe	Plate	SB–168	...	N06600	Annealed	...	550
36	72Ni–15Cr–8Fe	Wld. tube	SB–516	...	N06600	Annealed	...	550
37	72Ni–15Cr–8Fe	Forgings	SB–564	...	N06600	...	...	550
38	72Ni–15Cr–8Fe	Pipe, tube	SB–167	...	N06600	Cold drawn/ann.	≤125	550
39	72Ni–15Cr–8Fe	Wld. pipe	SB–517	...	N06600	Cold drawn/ann.	...	550
40	72Ni–15Cr–8Fe	Bar, rod	SB–166	...	N06600	Hot fin.	...	585
41	72Ni–15Cr–8Fe	Plate, sheet, strip	SB–168	...	N06600	Hot rolled	...	585
(**13**) 42	72Ni–15Cr–8Fe	Rounds	SB–166	...	N06600	Hot worked	$t > 75$	585
(**13**) 43	72Ni–15Cr–8Fe	Rounds	SB–166	...	N06600	Hot worked	$13 < t \le 75$	620
(**13**) 44	72Ni–15Cr–8Fe	Rounds	SB–166	...	N06600	Hot worked	$6 \le t \le 13$	655

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
2	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
3	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
4	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
5	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
6	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
7	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
8	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
9	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
10	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
11	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
12	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
13	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
14	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
15	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
16	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
17	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
18	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
19	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
20	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
21	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
22	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
23	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
24	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
25	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
26	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
27	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
28	517	517	517	517	517	517	517	517	517	517	517	509	492	474	...
29	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
30	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
31	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
32	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
33	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
34	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
35	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
36	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
37	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
38	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
39	552	552	552	552	552	552	552	552	552	552	552	543	525	506	...
40	586	586	586	586	586	586	586	586	586	586	586	586	586	586	...
41	586	586	586	586	586	586	586	586	586	586	586	586	586	586	...
42	586	586	586	586	586	586	586	586	586	586	586	586	...	...	...
43	620	620	620	620	620	620	620	620	620	620	620	620	...	...	...
44	655	655	655	655	655	655	655	655	655	655	655	655	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	60Ni–23Cr–Fe	Smls. tube	SB–163	...	N06601	Annealed	≤75 O.D.	552
2	60Ni–23Cr–Fe	Bar	SB–166	...	N06601	Annealed	...	552
3	60Ni–23Cr–Fe	Smls. pipe & tube	SB–167	...	N06601	Annealed	...	552
4	60Ni–23Cr–Fe	Plate, sheet, strip	SB–168	...	N06601	Annealed	...	552
5	52Ni–22Cr–13Co–9Mo	Bar, rod	SB–166	...	N06617	Annealed	...	655
6	52Ni–22Cr–13Co–9Mo	Smls. pipe & tube	SB–167	...	N06617	Annealed	...	655
7	52Ni–22Cr–13Co–9Mo	Plate, sheet, strip	SB–168	...	N06617	Annealed	...	655
8	52Ni–22Cr–13Co–9Mo	Forgings	SB–564	...	N06617	Annealed	...	655
9	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	2	N06625	Solution ann.	...	690
10	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe & tube	SB–444	2	N06625	Solution ann.	...	690
11	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	2	N06625	Solution ann.	...	690
12	60Ni–22Cr–9Mo–3.5Cb	Smls. & wld. fittings	SB–366	...	N06625	Annealed	...	690
13	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed	100 < t ≤ 250	760
14	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed	100 < t ≤ 250	760
15	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed	...	760
16	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed	...	825
17	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe	SB–444	1	N06625	Annealed	...	825
18	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed	≤100	825
19	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed	≤100	825
20	60Ni–22Cr–9Mo–3.5Cb	Wld. tube	SB–704	...	N06625	Annealed	...	825
21	60Ni–22Cr–9Mo–3.5Cb	Wld. pipe	SB–705	...	N06625	Annealed	...	825
22	Ni–Cr–Mo–W	Forgings	SB–564	...	N06686	Solution ann.	...	689
23	Ni–Cr–Mo–W	Rod	SB–574	...	N06686	Solution ann.	...	689
24	Ni–Cr–Mo–W	Plate, sheet, strip	SB–575	...	N06686	Solution ann.	...	689
25	Ni–Cr–Mo–W	Wld. pipe	SB–619	...	N06686	Solution ann.	...	689
26	Ni–Cr–Mo–W	Smls. pipe & tube	SB–622	...	N06686	Solution ann.	...	689
27	Ni–Cr–Mo–W	Wld. tube	SB–626	...	N06686	Solution ann.	...	689
28	58Ni–29Cr–9Fe	Smls. tube	SB–163	...	N06690	Annealed	...	585
29	58Ni–29Cr–9Fe	Bar, rod	SB–166	...	N06690	Annealed	...	585
30	58Ni–29Cr–9Fe	Smls. pipe & tube	SB–167	...	N06690	Annealed	...	585
31	58Ni–29Cr–9Fe	Plate, sheet, strip	SB–168	...	N06690	Annealed	...	585
32	58Ni–29Cr–9Fe	Forgings	SB–564	...	N06690	Annealed	...	585
33	49Ni–25Cr–18Fe–6Mo	Plate, sheet, strip	SB–582	...	N06975	Solution ann.	...	585
34	49Ni–25Cr–18Fe–6Mo	Wld. pipe	SB–619	...	N06975	Solution ann.	...	585
35	49Ni–25Cr–18Fe–6Mo	Smls. pipe & tube	SB–622	...	N06975	Solution ann.	...	585
36	49Ni–25Cr–18Fe–6Mo	Wld. tube	SB–626	...	N06975	Solution ann.	...	585
37	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed	>19	585
38	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed	>19	585
39	47Ni–22Cr–20Fe–7Mo	Smls. & wld. fittings	SB–366	...	N06985	Annealed	...	620
40	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed	≤19	620
41	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed	≤19	620
42	47Ni–22Cr–20Fe–7Mo	Wld. pipe	SB–619	...	N06985	Annealed	...	620
43	47Ni–22Cr–20Fe–7Mo	Smls. pipe & tube	SB–622	...	N06985	Annealed	...	620
44	47Ni–22Cr–20Fe–7Mo	Wld. tube	SB–626	...	N06985	Annealed	...	620

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
2	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
3	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
4	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
5	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
6	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
7	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
8	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
9	690	690	690	690	690	679	675	673	671	670	668	667	664	661	655
10	690	690	690	690	690	679	675	673	671	670	668	667	664	661	655
11	690	690	690	690	690	679	675	673	671	670	668	667	664	661	655
12	758	758	758	744	730	719	714	708	702	696	691	685	679	672	665
13	758	758	758	744	730	719	714	708	702	696	691	685	679	672	665
14	758	758	758	744	730	719	714	708	702	696	691	685	679	672	665
15	758	758	758	744	730	719	714	708	702	696	691	685	679	672	665
16	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
17	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
18	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
19	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
20	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
21	827	827	827	811	797	785	778	772	766	760	753	747	740	733	726
22	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
23	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
24	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
25	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
26	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
27	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
28	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
29	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
30	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
31	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
32	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
33	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
34	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
35	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
36	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
37	586	586	577	556	540	528	524	520	517	513	509	504	499	492	484
38	586	586	577	556	540	528	524	520	517	513	509	504	499	492	484
39	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
40	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
41	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
42	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
43	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
44	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	35Ni–35Fe–20Cr–Cb	Forgings	SB–462	...	N08020	Annealed	...	550
2	35Ni–35Fe–20Cr–Cb	Plate	SB–463	...	N08020	Annealed	...	550
3	35Ni–35Fe–20Cr–Cb	Bar	SB–473	...	N08020	Annealed	...	550
4	35Ni–35Fe–20Cr–Cb	Smls. pipe & tube	SB–729	...	N08020	Annealed	...	550
5	35Ni–35Fe–20Cr–Cb	Wld. pipe	SB–464	...	N08020	Wld. ann.	...	550
6	35Ni–35Fe–20Cr–Cb	Wld. tube	SB–468	...	N08020	Wld. ann.	...	550
7	35Ni–35Fe–20Cr–Cb	Smls. & wld. fittings	SB–366	...	N08020	Annealed	...	585
8	37Ni–33Fe–23Cr–4Mo–Cu	Plate, sheet, strip	SB–463	...	N08024	Annealed	...	550
9	37Ni–33Fe–23Cr–4Mo–Cu	Wld. pipe	SB–464	...	N08024	Wld. ann.	...	550
10	37Ni–33Fe–23Cr–4Mo–Cu	Wld. tube	SB–468	...	N08024	Wld. ann.	...	550
11	35Ni–30Fe–24Cr–6Mo–Cu	Plate, sheet, strip	SB–463	...	N08026	Annealed	...	550
12	35Ni–30Fe–24Cr–6Mo–Cu	Wld. pipe	SB–464	...	N08026	Wld. ann.	...	550
13	35Ni–30Fe–24Cr–6Mo–Cu	Wld. tube	SB–468	...	N08026	Wld. ann.	...	550
14	31Ni–31Fe–29Cr–Mo	Smls. tube	SB–668	...	N08028	Annealed	...	505
15	31Ni–31Fe–29Cr–Mo	Plate, sheet, strip	SB–709	...	N08028	Annealed	...	505
16	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. & wld. fittings	SB–366	...	N08031	...	...	650
17	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forgings	SB–564	...	N08031	...	...	650
18	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Rod	SB–581	...	N08031	...	...	650
19	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. pipe	SB–619	...	N08031	...	...	650
20	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. pipe & tube	SB–622	...	N08031	...	...	650
21	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08031	...	...	650
22	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. tube	SB–626	...	N08031	...	...	650
23	37Ni–33Fe–25Cr	Condenser tubes	SB–163	...	N08120	Solution ann.	...	621
24	37Ni–33Fe–25Cr	Smls. & wld. fittings	SB–366	...	N08120	Solution ann.	...	621
25	37Ni–33Fe–25Cr	Smls. pipe & tube	SB–407	...	N08120	Solution ann.	...	621
26	37Ni–33Fe–25Cr	Bar, rod	SB–408	...	N08120	Solution ann.	...	621
27	37Ni–33Fe–25Cr	Plate, sheet, strip	SB–409	...	N08120	Solution ann.	...	621
28	37Ni–33Fe–25Cr	Wld. pipe	SB–514	...	N08120	Solution ann.	...	621
29	37Ni–33Fe–25Cr	Wld. tube	SB–515	...	N08120	Solution ann.	...	621
30	37Ni–33Fe–25Cr	Forgings	SB–564	...	N08120	Solution ann.	...	621
31	26Ni–43Fe–22Cr–5Mo	Wld. pipe	SB–619	...	N08320	Solution ann.	...	515
32	26Ni–43Fe–22Cr–5Mo	Plate, sheet, strip	SB–620	...	N08320	Solution ann.	...	515
33	26Ni–43Fe–22Cr–5Mo	Rod	SB–621	...	N08320	Solution ann.	...	515
34	26Ni–43Fe–22Cr–5Mo	Smls. pipe & tube	SB–622	...	N08320	Solution ann.	...	515
35	26Ni–43Fe–22Cr–5Mo	Wld. tube	SB–626	...	N08320	Solution ann.	...	515
36	35Ni–19Cr–1¼Si	Bar	SB–511	...	N08330	...	...	485
37	35Ni–19Cr–1¼Si	Pipe	SB–535	...	N08330	...	...	485
38	35Ni–19Cr–1¼Si	Plate	SB–536	...	N08330	...	...	485
39	35Ni–19Cr–1¼Si	Smls. & wld. fittings	SB–366	...	N08330	Annealed	...	485
40	35Ni–19Cr–1¼Si	Smls. & wld. pipe	SB–535	...	N08330	Annealed	...	485
41	35Ni–19Cr–1¼Si	Plate, sheet, strip	SB–536	...	N08330	Annealed	...	485
42	35Ni–19Cr–1¼Si	Wld. pipe	SB–710	...	N08330	Annealed	...	485

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
2	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
3	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
4	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
5	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
6	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
7	586	586	580	569	567	566	566	564	561	559	559	559	...	...	...
8	552	551	544	531	518	506	501	496	492	488	485	482	480	478	475
9	552	551	544	531	518	506	501	496	492	488	485	482	480	478	475
10	552	551	544	531	518	506	501	496	492	488	485	482	480	478	475
11	552	551	542	527	513	501	495	489	482	476	470	464	459	455	450
12	552	551	542	527	513	501	495	489	482	476	470	464	459	455	450
13	552	551	542	527	513	501	495	489	482	476	470	464	459	455	450
14	503	503	485	467	453	442	437	432	427	423	419	414	408	403	397
15	503	503	485	467	453	442	437	432	427	423	419	414	408	403	397
16	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
17	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
18	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
19	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
20	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
21	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
22	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
23	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
24	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
25	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
26	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
27	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
28	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
29	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
30	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
31	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
32	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
33	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
34	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
35	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
36	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
37	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
38	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
39	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
40	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
41	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
42	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–462	...	N08367	Solution ann.	...	655
2	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–564	...	N08367	Solution ann.	...	655
3	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.	>5	655
4	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.	>5	655
5	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.	>5	655
6	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.	>5	655
7	46Fe–24Ni–21Cr–6Mo–Cu–N	Bar, rod, wire	SB–691	...	N08367	Solution ann.	...	655
8	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.	>5	655
9	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.	≤5	690
10	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.	≤5	690
11	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.	≤5	690
12	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.	≤5	690
13	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.	≤5	690
14	46Fe–24Ni–21Cr–6Mo–Cu–N	Castings	SA–351	CN3MN	J94651	Solution ann.	...	550
15	25Ni–47Fe–21Cr–5Mo	Plate, sheet, strip	SB–599	...	N08700	Solution ann.	...	550
16	25Ni–47Fe–21Cr–5Mo	Bar, wire	SB–672	...	N08700	Solution ann.	...	550
17	32Ni–45Fe–20Cr–Cb	Castings	SA–351	CT15C	...	As cast	...	435
18	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Annealed	...	515
19	33Ni–42Fe–21Cr	Smls. & wld. fittings	SB–366	...	N08800	Annealed	...	515
20	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08800	Annealed	...	515
21	33Ni–42Fe–21Cr	Bar	SB–408	...	N08800	Annealed	...	515
22	33Ni–42Fe–21Cr	Plate	SB–409	...	N08800	Annealed	...	515
23	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08800	Annealed	...	515
24	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08800	Annealed	...	515
25	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08800	Annealed	...	515
26	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Cold worked	...	570
27	32Ni–44Fe–21Cr	Smls. tube	SB–163	...	N08801	Ann./stabilized	...	450
28	32Ni–44Fe–21Cr	Smls. pipe & tube	SB–407	...	N08801	Ann./stabilized	...	450
29	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08810	Annealed	...	450
30	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08810	Annealed	...	450
31	33Ni–42Fe–21Cr	Bar	SB–408	...	N08810	Annealed	...	450
32	33Ni–42Fe–21Cr	Plate	SB–409	...	N08810	Annealed	...	450
33	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08810	Annealed	...	450
34	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08810	Annealed	...	450
35	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08810	Annealed	...	450
36	42Ni–21.5Cr–3Mo–2.3Cu	Smls. tube	SB–163	...	N08825	Annealed	...	585
37	42Ni–21.5Cr–3Mo–2.3Cu	Smls. & wld. fittings	SB–366	...	N08825	Annealed	...	585
38	42Ni–21.5Cr–3Mo–2.3Cu	Smls. pipe & tube	SB–423	...	N08825	Cold worked/ann.	...	585
39	42Ni–21.5Cr–3Mo–2.3Cu	Plate	SB–424	...	N08825	Annealed	...	585
40	42Ni–21.5Cr–3Mo–2.3Cu	Bar, rod	SB–425	...	N08825	Annealed	...	585
41	42Ni–21.5Cr–3Mo–2.3Cu	Forgings	SB–564	...	N08825	Annealed	...	585
42	42Ni–21.5Cr–3Mo–2.3Cu	Wld. tube	SB–704	...	N08825	Annealed	...	585
43	42Ni–21.5Cr–3Mo–2.3Cu	Wld. pipe	SB–705	...	N08825	Annealed	...	585

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
2	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
3	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
4	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
5	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
6	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
7	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
8	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
9	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
10	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
11	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
12	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
13	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
14	552	516	479	455	437	423	417	411	405	400	395	390	386	383	379
15	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
16	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
17	434	434	434	434	434	434	434	434	434	434	434	434	434	...	...
18	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
19	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
20	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
21	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
22	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
23	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
24	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
25	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
26	572	572	572	570	558	552	551	551	...	...	...	...	...	...	...
27	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
28	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
29	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
30	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
31	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
32	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
33	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
34	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
35	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
36	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
37	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
38	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
39	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
40	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
41	585	585	585	585	585	585	...	582	579	576	572	568	563	557	549
42	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
43	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	44Fe–25Ni–21Cr–Mo	Fittings	SB–366	...	N08904	Annealed	...	490
2	44Fe–25Ni–21Cr–Mo	Plate, sheet, strip	SB–625	...	N08904	Annealed	...	490
3	44Fe–25Ni–21Cr–Mo	Bar, wire	SB–649	...	N08904	Annealed	...	490
4	44Fe–25Ni–21Cr–Mo	Wld. pipe	SB–673	...	N08904	Annealed	...	490
5	44Fe–25Ni–21Cr–Mo	Wld. tube	SB–674	...	N08904	Annealed	...	490
6	44Fe–25Ni–21Cr–Mo	Smls. pipe & tube	SB–677	...	N08904	Annealed	...	490
7	25Ni–20Cr–6Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08925	Annealed	...	600
8	25Ni–20Cr–6Mo–Cu–N	Bar, wire	SB–649	...	N08925	Annealed	...	600
9	25Ni–20Cr–6Mo–Cu–N	Wld. pipe	SB–673	...	N08925	Annealed	...	600
10	25Ni–20Cr–6Mo–Cu–N	Wld. tube	SB–674	...	N08925	Annealed	...	600
11	25Ni–20Cr–6Mo–Cu–N	Smls. pipe & tube	SB–677	...	N08925	Annealed	...	600
12	62Ni–28Mo–5Fe	Plate	SB–333	...	N10001	Annealed	...	690
13	62Ni–28Mo–5Fe	Smls. & wld. fittings	SB–366	...	N10001	Annealed	...	690
14	62Ni–28Mo–5Fe	Wld. pipe	SB–619	...	N10001	Solution ann.	...	690
15	62Ni–28Mo–5Fe	Smls. pipe & tube	SB–622	...	N10001	Solution ann.	...	690
16	62Ni–28Mo–5Fe	Wld. tube	SB–626	...	N10001	Solution ann.	...	690
17	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed	...	690
18	62Ni–28Mo–5Fe	Sheet, strip	SB–333	...	N10001	Annealed	...	795
19	70Ni–16Mo–7Cr–5Fe	Smls. & wld. fittings	SB–366	...	N10003	Annealed	...	690
20	70Ni–16Mo–7Cr–5Fe	Plate, sheet, strip	SB–434	...	N10003	Annealed	...	690
21	70Ni–16Mo–7Cr–5Fe	Rod	SB–573	...	N10003	Annealed	...	690
22	62Ni–25Mo–8Cr–2Fe	Smls. & wld. fittings	SB–366	...	N10242	Annealed	...	725
23	62Ni–25Mo–8Cr–2Fe	Plate, sheet, strip	SB–434	...	N10242	Annealed	...	725
24	62Ni–25Mo–8Cr–2Fe	Forgings	SB–564	...	N10242	Annealed	...	725
25	62Ni–25Mo–8Cr–2Fe	Rod	SB–573	...	N10242	Annealed	...	725
26	62Ni–25Mo–8Cr–2Fe	Wld. pipe	SB–619	...	N10242	Solution ann.	...	725
27	62Ni–25Mo–8Cr–2Fe	Smls. pipe & tube	SB–622	...	N10242	Solution ann.	...	725
28	62Ni–25Mo–8Cr–2Fe	Wld. tube	SB–626	...	N10242	Solution ann.	...	725
29	54Ni–16Mo–15Cr	Smls. & wld. fittings	SB–366	...	N10276	Solution ann.	...	690
30	54Ni–16Mo–15Cr	Forgings	SB–462	...	N10276	Solution ann.	...	690
31	54Ni–16Mo–15Cr	Forgings	SB–564	...	N10276	Solution ann.	...	690
32	54Ni–16Mo–15Cr	Rod	SB–574	...	N10276	Solution ann.	...	690
33	54Ni–16Mo–15Cr	Plate, sheet, strip	SB–575	...	N10276	Solution ann.	...	690
34	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.	...	690
35	54Ni–16Mo–15Cr	Smls. pipe & tube	SB–622	...	N10276	Solution ann.	...	690
36	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.	...	690
37	Ni–28Mo–3Fe–1.3Cr–0.25Al	Plate, sheet, strip	SB–333	...	N10629	...	...	760
38	Ni–28Mo–3Fe–1.3Cr–0.25Al	Rod	SB–335	...	N10629	...	...	760
39	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. & wld. fittings	SB–366	...	N10629	...	...	760
40	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forgings	SB–564	...	N10629	...	...	760
41	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. pipe	SB–619	...	N10629	...	...	760
42	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. pipe & tube	SB–622	...	N10629	...	...	760
43	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. tube	SB–626	...	N10629	...	...	760

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
2	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
3	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
4	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
5	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
6	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
7	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
8	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
9	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
10	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
11	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
12	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
13	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
14	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
15	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
16	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
17	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
18	793	793	793	781	773	769	767	764	761	758	755	753	...	...	...
19	689	689	689	689	689	689	689	689	689	689	689	689	...	...	...
20	689	689	689	689	689	689	689	689	689	689	689	689	...	...	...
21	689	689	689	689	689	689	689	689	689	689	689	689	...	...	...
22	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
23	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
24	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
25	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
26	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
27	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
28	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
29	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
30	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
31	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
32	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
33	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
34	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
35	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
36	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
37	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
38	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
39	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
40	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
41	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
42	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
43	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	65Ni–28Mo–2Fe	Smls. & wld. fittings	SB–366	...	N10665	Annealed	...	760
2	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Annealed	...	760
3	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Annealed	...	760
4	65Ni–28Mo–2Fe	Plate, sheet, strip	SB–333	...	N10665	Solution ann.	...	760
5	65Ni–28Mo–2Fe	Rod	SB–335	...	N10665	Solution ann.	...	760
6	65Ni–28Mo–2Fe	Forgings	SB–462	...	N10665	Solution ann.	...	760
7	65Ni–28Mo–2Fe	Forgings	SB–564	...	N10665	Solution ann.	...	760
8	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Solution ann.	...	760
9	65Ni–28Mo–2Fe	Smls. pipe & tube	SB–622	...	N10665	Solution ann.	...	760
10	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Solution ann.	...	760
11	65Ni–29.5Mo–2Fe–2Cr	Plate, sheet, strip	SB–333	...	N10675	Solution ann.	...	760
12	65Ni–29.5Mo–2Fe–2Cr	Rod	SB–335	...	N10675	Solution ann.	...	760
13	65Ni–29.5Mo–2Fe–2Cr	Smls. & wld. fittings	SB–366	...	N10675	Solution ann.	...	760
14	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–462	...	N10675	Solution ann.	...	760
15	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–564	...	N10675	Solution ann.	...	760
16	65Ni–29.5Mo–2Fe–2Cr	Wld. pipe	SB–619	...	N10675	Solution ann.	...	760
17	65Ni–29.5Mo–2Fe–2Cr	Smls. pipe & tube	SB–622	...	N10675	Solution ann.	...	760
18	65Ni–29.5Mo–2Fe–2Cr	Wld. tube	SB–626	...	N10675	Solution ann.	...	760
19	37Ni–30Co–28Cr–2.7Si	Plate, sheet, strip	SB–435	...	N12160	Solution ann.	...	620
20	37Ni–30Co–28Cr–2.7Si	Forgings	SB–564	...	N12160	Solution ann.	...	620
21	37Ni–30Co–28Cr–2.7Si	Rod	SB–572	...	N12160	Solution ann.	...	620
22	37Ni–30Co–28Cr–2.7Si	Wld. pipe	SB–619	...	N12160	Solution ann.	...	620
23	37Ni–30Co–28Cr–2.7Si	Smls. pipe & tube	SB–622	...	N12160	Solution ann.	...	620
24	37Ni–30Co–28Cr–2.7Si	Wld. tube	SB–626	...	N12160	Solution ann.	...	620
25	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. & wld. fittings	SB–366	...	R20033	...	...	750
26	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Forgings	SB–564	...	R20033	...	...	750
27	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. pipe	SB–619	...	R20033	...	...	750
28	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. pipe & tube	SB–622	...	R20033	...	...	750
29	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Plate, sheet, strip	SB–625	...	R20033	...	...	750
30	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. tube	SB–626	...	R20033	...	...	750
31	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Rod	SB–649	...	R20033	...	...	750
32	21Ni–30Fe–22Cr–18Co–3Mo–3W	Plate, sheet, strip	SB–435	...	R30556	Annealed	...	690
33	21Ni–30Fe–22Cr–18Co–3Mo–3W	Rod	SB–572	...	R30556	Annealed	...	690
34	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. pipe	SB–619	...	R30556	Annealed	...	690
35	21Ni–30Fe–22Cr–18Co–3Mo–3W	Smls. pipe & tube	SB–622	...	R30556	Annealed	...	690
36	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. tube	SB–626	...	R30556	Annealed	...	690
37	Co–26Cr–9Ni–5Mo–3Fe–2W	Rod	SB–815	...	R31233	Solution ann.	...	896
38	Co–26Cr–9Ni–5Mo–3Fe–2W	Plate, sheet, strip	SB–818	...	R31233	Solution ann.	...	896
39	Ti	Plate, sheet, strip	SB–265	1	R50250	Annealed	...	240
40	Ti	Smls. & wld. tube	SB–338	1	R50250	Annealed	...	240
41	Ti	Bar, billet	SB–348	1	R50250	Annealed	...	240
42	Ti	Smls. & wld. fittings	SB–363	WPT1	R50250	Annealed	...	240
43	Ti	Forgings	SB–381	F–1	R50250	Annealed	...	240
44	Ti	Smls. pipe	SB–861	1	R50250	Annealed	...	240
45	Ti	Wld. pipe	SB–862	1	R50250	Annealed	...	240

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
2	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
3	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
4	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
5	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
6	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
7	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
8	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
9	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
10	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
11	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
12	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
13	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
14	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
15	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
16	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
17	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
18	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
19	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
20	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
21	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
22	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
23	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
24	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
25	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
26	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
27	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
28	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
29	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
30	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
31	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
32	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
33	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
34	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
35	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
36	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
37	896	896	896	896	896	896	896	894	883	872	864	856	850	843	835
38	896	896	896	896	896	896	896	894	883	872	864	856	850	843	835
39	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
40	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
41	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
42	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
43	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
44	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
45	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Tensile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	Ti	Castings	SB–367	C–2	R50400	...	...	345
2	Ti	Forgings	SB–381	F–2	R50400	Annealed	...	345
3	Ti	Plate, sheet, strip	SB–265	2H	R50400	Annealed	...	400
4	Ti	Smls. & wld. tube	SB–338	2H	R50400	Annealed	...	400
5	Ti	Bar, billet	SB–348	2H	R50400	Annealed	...	400
6	Ti	Smls. fittings	SB–363	WPT2H	R50400	Annealed	...	400
7	Ti	Wld. fittings	SB–363	WPT2HW	R50400	Annealed	...	400
8	Ti	Forgings	SB–381	F–2H	R50400	Annealed	...	400
9	Ti	Smls. pipe	SB–861	2H	R50400	Annealed	...	400
10	Ti	Wld. pipe	SB–862	2H	R50400	Annealed	...	400
11	Ti	Castings	SB–367	C–3	R50550	...	...	450
12	Ti	Plate, sheet, strip	SB–265	3	R50550	Annealed	...	450
13	Ti	Smls. & wld. tube	SB–338	3	R50550	Annealed	...	450
14	Ti	Bar, billet	SB–348	3	R50550	Annealed	...	450
15	Ti	Smls. & wld. fittings	SB–363	WPT3	R50550	Annealed	...	450
16	Ti	Forgings	SB–381	F–3	R50550	Annealed	...	450
17	Ti	Smls. pipe	SB–861	3	R50550	Annealed	...	450
18	Ti	Wld. pipe	SB–862	3	R50550	Annealed	...	450
19	Ti–Pd	Plate, sheet, strip	SB–265	11	R52250	Annealed	...	240
20	Ti–Pd	Plate, sheet, strip	SB–265	17	R52252	Annealed	...	240
21	Ti–Ru	Plate, sheet, strip	SB–265	27	R52254	Annealed	...	240
22	Ti–Pd	Plate, sheet, strip	SB–265	7	R52400	Annealed	...	345
23	Ti–0.15Pd	Plate, sheet, strip	SB–265	7H	R52400	Annealed	...	400
24	Ti–0.15Pd	Smls. & wld. tube	SB–338	7H	R52400	Annealed	...	400
25	Ti–0.15Pd	Bar, billet	SB–348	7H	R52400	Annealed	...	400
26	Ti–0.15Pd	Smls. fittings	SB–363	WPT7H	R52400	Annealed	...	400
27	Ti–0.15Pd	Wld. fittings	SB–363	WPT7HW	R52400	Annealed	...	400
28	Ti–0.15Pd	Forgings	SB–381	F–7H	R52400	Annealed	...	400
29	Ti–0.15Pd	Smls. pipe	SB–861	7H	R52400	Annealed	...	400
30	Ti–0.15Pd	Wld. pipe	SB–862	7H	R52400	Annealed	...	400
31	Ti–Pd	Plate, sheet, strip	SB–265	16	R52402	Annealed	...	345
32	Ti–Pd	Bar, billet	SB–348	16	R52402	Annealed	...	345
33	Ti–Pd	Forgings	SB–381	F–16	R52402	Annealed	...	345
34	Ti–0.05Pd	Plate, sheet, strip	SB–265	16H	R52402	Annealed	...	400
35	Ti–0.05Pd	Smls. & wld. tube	SB–338	16H	R52402	Annealed	...	400
36	Ti–0.05Pd	Bar, billet	SB–348	16H	R52402	Annealed	...	400
37	Ti–0.05Pd	Smls. fittings	SB–363	WPT16H	R52402	Annealed	...	400
38	Ti–0.05Pd	Wld. fittings	SB–363	WPT16HW	R52402	Annealed	...	400
39	Ti–0.05Pd	Forgings	SB–381	F–16H	R52402	Annealed	...	400
40	Ti–0.05Pd	Smls. pipe	SB–861	16H	R52402	Annealed	...	400
41	Ti–0.05Pd	Wld. pipe	SB–862	16H	R52402	Annealed	...	400

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	345	278	234	199	170	...	...	...	...	...	...	...	...	...	...
2	345	295	249	216	188	164	153	...	...	...	...	...	...	...	...
3	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
4	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
5	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
6	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
7	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
8	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
9	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
10	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
11	448	372	306	254	212	...	...	...	...	...	...	...	...	...	...
12	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
13	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
14	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
15	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
16	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
17	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
18	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
19	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
20	241	196	159	134	117	93.6	80.7	...	...	...	...	...	...	...	...
21	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
22	345	295	249	216	188	164	153	...	...	...	...	...	...	...	...
23	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
24	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
25	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
26	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
27	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
28	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
29	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
30	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
31	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
32	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
33	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
34	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
35	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
36	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
37	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
38	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
39	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
40	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
41	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/Condition/ Temper	Size/Thick-ness, mm	Min. Ten-sile Strength, MPa
	Nonferrous Materials (Cont'd)							
1	Ti–Ru	Plate, sheet, strip	SB–265	26	R52404	Annealed	...	345
2	Ti–Ru	Smls. & wld. tube	SB–338	26	R52404	Annealed	...	345
3	Ti–Ru	Bar, billet	SB–348	26	R52404	Annealed	...	345
4	Ti–Ru	Smls. fittings	SB–363	WPT26	R52404	Annealed	...	345
5	Ti–Ru	Wld. fittings	SB–363	WPT26W	R52404	Annealed	...	345
6	Ti–Ru	Forgings	SB–381	F–26	R52404	Annealed	...	345
7	Ti–Ru	Smls. pipe	SB–861	26	R52404	Annealed	...	345
8	Ti–Ru	Wld. pipe	SB–862	26	R52404	Annealed	...	345
9	Ti–0.10Ru	Plate, sheet, strip	SB–265	26H	R52404	Annealed	...	400
10	Ti–0.10Ru	Smls. & wld. tube	SB–338	26H	R52404	Annealed	...	400
11	Ti–0.10Ru	Bar, billet	SB–348	26H	R52404	Annealed	...	400
12	Ti–0.10Ru	Smls. fittings	SB–363	WPT26H	R52404	Annealed	...	400
13	Ti–0.10Ru	Wld. fittings	SB–363	WPT26HW	R52404	Annealed	...	400
14	Ti–0.10Ru	Forgings	SB–381	F–26H	R52404	Annealed	...	400
15	Ti–0.10Ru	Smls. pipe	SB–861	26H	R52404	Annealed	...	400
16	Ti–0.10Ru	Wld. pipe	SB–862	26H	R52404	Annealed	...	400
17	Ti–0.3Mo–0.8Ni	Forgings	SB–381	F–12	R53400	Annealed	...	485
18	Ti–3Al–2.5V	Plate, sheet, strip	SB–265	9	R56320	Annealed	...	620
19	Ti–3Al–2.5V	Smls. & wld. tube	SB–338	9	R56320	Annealed	...	620
20	Ti–3Al–2.5V	Bar, billet	SB–348	9	R56320	Annealed	...	620
21	Ti–3Al–2.5V	Smls. fittings	SB–363	WPT9	R56320	Annealed	...	620
22	Ti–3Al–2.5V	Wld. fittings	SB–363	WPT9W	R56320	Annealed	...	620
23	Ti–3Al–2.5V	Forgings	SB–381	F–9	R56320	Annealed	...	620
24	Ti–3Al–2.5V	Smls. pipe	SB–861	9	R56320	Annealed	...	620
25	Ti–3Al–2.5V	Wld. pipe	SB–862	9	R56320	Annealed	...	620
26	Ti–3Al–2.5V–0.1Ru	Plate, sheet, strip	SB–265	28	R56323	Annealed	...	620
27	Ti–3Al–2.5V–0.1Ru	Smls. & wld. tube	SB–338	28	R56323	Annealed	...	620
28	Ti–3Al–2.5V–0.1Ru	Bar, billet	SB–348	28	R56323	Annealed	...	620
29	Ti–3Al–2.5V–0.1Ru	Smls. fittings	SB–363	WPT28	R56323	Annealed	...	620
30	Ti–3Al–2.5V–0.1Ru	Wld. fittings	SB–363	WPT28W	R56323	Annealed	...	620
31	Ti–3Al–2.5V–0.1Ru	Forgings	SB–381	F–28	R56323	Annealed	...	620
32	Ti–3Al–2.5V–0.1Ru	Smls. pipe	SB–861	28	R56323	Annealed	...	620
33	Ti–3Al–2.5V–0.1Ru	Wld. pipe	SB–862	28	R56323	Annealed	...	620
34	99.2Zr	Forgings	SB–493	...	R60702	Annealed	...	380
35	99.2Zr	Smls. & wld. tube	SB–523	...	R60702	Annealed	...	380
36	99.2Zr	Bar, wire	SB–550	...	R60702	Annealed	...	380
37	99.2Zr	Plate, sheet, strip	SB–551	...	R60702	Annealed	...	380
38	99.2Zr	Smls. fittings	SB–653	PZ–2	R60702	Annealed	...	380
39	99.2Zr	Wld. fittings	SB–653	PZ–2W	R60702	Annealed	...	380
40	99.2Zr	Smls. & wld. pipe	SB–658	...	R60702	Annealed	...	380

Table U (Cont'd)
Tensile Strength Values S_u for Ferrous and Nonferrous Materials

Line No.	Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
	−30 to 40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
															Nonferrous Materials (Cont'd)
1	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
2	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
3	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
4	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
5	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
6	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
7	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
8	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
9	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
10	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
11	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
12	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
13	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
14	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
15	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
16	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
17	483	445	390	348	319	302	295	...	...	...	...	...	...	...	...
18	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
19	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
20	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
21	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
22	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
23	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
24	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
25	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
26	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
27	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
28	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
29	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
30	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
31	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
32	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
33	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
34	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
35	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
36	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
37	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
38	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
39	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
40	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...

NOTES TO TABLE U
GENERAL NOTES

(**13**) (a) The following abbreviations are used: ann., annealed; cond., condenser; CW, cold worked; fin., finished; fr., from; rel., relieved; rld., rolled; Smls., Seamless; Sol., Solution; SR, stress relieved; Str., Strength; treat., treated; and Wld., Welded.

(b) The tabulated values of tensile strength are those which the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the values of tensile strength tend toward an average or expected value which may be as much as 10% above the tensile strength trend curve adjusted to the minimum specified room temperature tensile strength. The tensile strength values do not correspond exactly to "average" as this term is applied to a statistical treatment of a homogeneous set of data. Neither the ASME Material Specifications nor the rules of Sections I, III, or VIII require elevated temperature testing for tensile strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated tensile strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

(c) Notes limiting applications of these materials appear in Tables 1A, 1B, 2A, 2B, 3, 4, 5A, and 5B.

(d) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–516/SA–516M), the values listed in this Table shall be applicable to either the customary U.S. version of the material specification or the SI units version of the material specification. For example, the values listed for SA–516 Grade 70 shall be used when SA–516M Grade 485 is used in construction.

(e) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(**13**) (f) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

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Table U-2
Section VIII, Division 3 Tensile Strength Values S_u for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	UNS No.	Temper	Diameter, mm	Specified Min. Tensile, MPa	Notes
1	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	0.51	2070	(1)
2	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	0.51	2070	(1)
3	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	0.81	2000	(1)
4	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	0.81	2000	(1)
5	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	1.04	1930	(1)
6	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	1.04	1930	(1)
7	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	1.37	1860	(1)
8	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	1.37	1860	(1)
9	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	1.57	1830	(1)
10	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	1.57	1830	(1)
11	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	2.03	1760	(2)
12	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	2.03	1760	(2)
13	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	2.67	1690	(2)
14	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	2.67	1690	(2)
15	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	3.43	1620	(2)
16	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	3.43	1620	(2)
17	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	4.11	1550	(2)
18	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	4.11	1550	(2)
19	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	4.88	1520	(2)
20	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	4.88	1520	(2)
21	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	6.20	1450	(2)
22	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	6.20	1450	(2)
23	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	7.19	1410	(2)
24	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	7.19	1410	(2)
25	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	7.92	1400	(2)
26	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	7.92	1400	(2)
27	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	9.53	1380	(2)
28	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	9.53	1380	(2)
29	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	11.1	1340	(2)
30	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	11.1	1340	(2)
31	1Cr–¼Si–V	Wire	SA–231	...	...	Oil	12.7	1310	(2)
32	1Cr–¼Si–V	Wire	SA–232	...	...	Oil	12.7	1310	(2)

NOTES TO TABLE U-2

GENERAL NOTES

(a) These wire materials are suitable only for use in special closure parts designed in accordance with Article KD–6 of Section VIII, Division 3, for which it is impractical or impossible to obtain yield strength data. The materials shall not be used for fabrication of other pressure retaining components, such as bolting, wire wound vessels, or wire wound frames.

(b) The wire may be reshaped for final use from a round to some other cross section, provided the processing does not adversely affect the tensile strength of the material.

(c) Tensile strength values for intermediate diameters may be interpolated. The values at intermediate diameters shall be rounded to the same number of decimal places as the value at the lesser diameter between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(d) These materials are not intended for use over 40°C.

NOTES

(1) Material of this diameter shall have a maximum tensile strength not in excess of 170 MPa above the specified minimum.

(2) Material of this diameter shall have a maximum tensile strength not in excess of 140 MPa above the specified minimum.

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Table Y-1
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials					
1	Carbon steel	Sheet	SA–1008	CS–A	...	...
2	Carbon steel	Sheet	SA–1008	CS–B	...	...
3	Carbon steel	Bar	SA–675	45	...	...
4	Carbon steel	Wld. pipe	SA–134	A283A	...	...
5	Carbon steel	Plate	SA–283	A	...	...
6	Carbon steel	Plate	SA–285	A	K01700	...
7	Carbon steel	Wld. pipe	SA–672	A45	K01700	...
8	Carbon steel	Sheet	SA–414	A	K01501	...
9	Carbon steel	Wld. tube	SA–178	A	K01200	...
10	Carbon steel	Smls. tube	SA–179	...	K01200	...
11	Carbon steel	Smls. tube	SA–192	...	K01201	...
12	Carbon steel	Wld. tube	SA–214	...	K01807	...
13	Carbon steel	Smls. tube	SA–556	A2	K01807	...
14	Carbon steel	Wld. tube	SA–557	A2	K01807	...
15	Carbon steel	Wld. pipe	SA–53	E/A	K02504	...
16	Carbon steel	Smls. pipe	SA–53	S/A	K02504	...
17	Carbon steel	Smls. pipe	SA–106	A	K02501	...
18	Carbon steel	Wld. pipe	SA–135	A	...	...
19	Carbon steel	Forged pipe	SA–369	FPA	K02501	...
20	Carbon steel	Wld. pipe	SA–587	...	K11500	...
21	Carbon steel	Bar	SA–675	50	...	...
22	Carbon steel	Wld. pipe	SA–134	A283B	...	...
23	Carbon steel	Plate	SA–283	B	...	...
24	Carbon steel	Plate	SA–285	B	K02200	...
25	Carbon steel	Wld. pipe	SA–672	A50	K02200	...
26	Carbon steel	Sheet	SA–414	B	K02201	...
27	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
(**13**) 28	Carbon steel	Plate	SA/EN 10028–2	P235GH	...	...
(**13**) 29	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...
30	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
(**13**) 31	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...
(**13**) 32	Carbon steel	Smls. tube	SA/EN 10216–2	P235GH	...	...
(**13**) 33	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
34	Carbon steel	Bar	SA–675	55	...	...
35	Carbon steel	Wld. pipe	SA–134	A283C	K02401	...
36	Carbon steel	Plate	SA–283	C	K02401	...
37	Carbon steel	Plate	SA–285	C	K02801	...
38	Carbon steel	Smls. & wld. pipe	SA–333	1	K03008	...
39	Carbon steel	Smls. & wld. tube	SA–334	1	K03008	...
40	Carbon steel	Plate	SA–516	55	K01800	...
41	Carbon steel	Smls. pipe	SA–524	II	K02104	...
42	Carbon steel	Wld. pipe	SA–671	CA55	K02801	...
43	Carbon steel	Wld. pipe	SA–671	CE55	K02202	...

Table Y-1
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials
1	...	275	140	...
2	...	275	140	...
3	...	310	155	...
4	...	310	165	...
5	...	310	165	...
6	...	310	165	...
7	...	310	165	...
8	...	310	170	...
9	...	325	180	...
10	...	325	180	...
11	...	325	180	...
12	...	325	180	...
13	...	325	180	...
14	...	325	180	...
15	...	330	205	...
16	...	330	205	...
17	...	330	205	...
18	...	330	205	...
19	...	330	205	...
20	...	330	205	...
21	...	345	170	...
22	...	345	185	...
23	...	345	185	...
24	...	345	185	...
25	...	345	185	...
26	...	345	205	...
27	$150 < t \le 250$	350	215	...
28	≤60	360	215	...
29	$40 < t \le 60$	360	215	...
30	$100 < t \le 150$	360	225	...
31	$16 < t \le 40$	360	225	...
32	$t \le 16$	360	235	...
33	$60 < t \le 100$	370	235	...
34	...	380	190	...
35	...	380	205	...
36	...	380	205	...
37	...	380	205	...
38	...	380	205	...
39	...	380	205	...
40	...	380	205	...
41	...	380	205	...
42	...	380	205	...
43	...	380	205	...

Table Y-1
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials									
1	138	130	126	124	122	120	118	116	114	111
2	138	130	126	124	122	120	118	116	114	111
3	155	146	141	139	137	135	133	130	127	124
4	165	156	151	149	146	144	142	139	136	133
5	165	156	151	149	146	144	142	139	136	133
6	165	156	151	149	146	144	142	139	136	133
7	165	156	151	149	146	144	142	139	136	133
8	172	162	157	155	152	150	148	145	142	139
9	179	168	163	161	158	156	154	151	148	144
10	179	168	163	161	158	156	154	151	148	144
11	179	168	163	161	158	156	154	151	148	144
12	179	168	163	161	158	156	154	151	148	144
13	179	168	163	161	158	156	154	151	148	144
14	179	168	163	161	158	156	154	151	148	144
15	207	195	189	186	183	180	177	174	170	166
16	207	195	189	186	183	180	177	174	170	166
17	207	195	189	186	183	180	177	174	170	166
18	207	195	189	186	183	180	177	174	170	166
19	207	195	189	186	183	180	177	174	170	166
20	207	195	189	186	183	180	177	174	170	166
21	172	162	157	155	152	150	148	145	142	139
22	186	175	170	167	165	162	160	157	153	149
23	186	175	170	167	165	162	160	157	153	149
24	186	175	170	167	165	162	160	157	153	149
25	186	175	170	167	165	162	160	157	153	149
26	207	195	189	186	183	180	177	174	170	166
27	215	202	196	193	190	187	184	181	177	172
28	215	202	196	193	190	187	184	181	177	173
29	215	202	196	193	190	187	184	181	177	173
30	225	212	205	202	199	196	193	189	185	181
31	225	212	205	202	199	196	193	189	185	181
32	235	221	214	211	208	205	201	198	193	189
33	234	221	213	210	207	204	201	198	193	188
34	190	178	173	170	167	165	163	159	156	152
35	207	195	189	186	183	180	177	174	170	166
36	207	195	189	186	183	180	177	174	170	166
37	207	195	189	186	183	180	177	174	170	166
38	207	195	189	186	183	180	177	174	170	166
39	207	195	189	186	183	180	177	174	170	166
40	207	195	189	186	183	180	177	174	170	166
41	207	195	189	186	183	180	177	174	170	166
42	207	195	189	186	183	180	177	174	170	166
43	207	195	189	186	183	180	177	174	170	166

Table Y-1
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
									Ferrous Materials	
1	107	104	101	98.1	95.0	92.5	90.1	87.5	85.6	83.4
2	107	104	101	98.1	95.0	92.5	90.1	87.5	85.6	83.4
3	121	117	114	110	107	104	101	98.6	96.2	93.7
4	129	125	122	118	114	111	108	106	103	99.8
5	129	125	122	118	114	111	108	106	103	99.8
6	129	125	122	118	114	111	108	106	103	99.8
7	129	125	122	118	114	111	108	106	103	99.8
8	135	131	127	123	119	116	113	110	107	104
9	140	136	132	128	124	120	117	114	111	109
10	140	136	132	128	124	120	117	114	111	109
11	140	136	132	128	124	120	117	114	111	109
12	140	136	132	128	124	120	117	114	111	109
13	140	136	132	128	124	120	117	114	111	109
14	140	136	132	128	124	120	117	114	111	109
15	161	157	152	148	143	139	135	132	128	125
16	161	157	152	148	143	139	135	132	128	125
17	161	157	152	148	143	139	135	132	128	125
18	161	157	152	148	143	139	135	132	128	125
19	161	157	152	148	143	139	135	132	128	125
20	161	157	152	148	143	139	135	132	128	125
21	135	131	127	123	119	116	113	110	107	104
22	145	141	137	132	129	125	122	119	116	112
23	145	141	137	132	129	125	122	119	116	112
24	145	141	137	132	129	125	122	119	116	112
25	145	141	137	132	129	125	122	119	116	112
26	161	157	152	148	143	139	135	132	128	125
27	168	163	158	153	149	144	141	137	133	130
28	168	163	158	153	149	144	141	137	133	130 (**13**)
29	168	163	158	153	149	144	141	137	133	130 (**13**)
30	176	171	165	160	156	151	147	143	140	136
31	176	171	165	160	156	151	147	143	140	136 (**13**)
32	183	178	173	167	162	158	154	150	146	142 (**13**)
33	183	178	173	168	163	158	154	150	146	142 (**13**)
34	148	144	139	135	131	127	124	121	118	114
35	161	157	152	148	143	139	135	132	128	125
36	161	157	152	148	143	139	135	132	128	125
37	161	157	152	148	143	139	135	132	128	125
38	161	157	152	148	143	139	135	132	128	125
39	161	157	152	148	143	139	135	132	128	125
40	161	157	152	148	143	139	135	132	128	125
41	161	157	152	148	143	139	135	132	128	125
42	161	157	152	148	143	139	135	132	128	125
43	161	157	152	148	143	139	135	132	128	125

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	Carbon steel	Wld. pipe	SA–672	A55	K02801	...
	2	Carbon steel	Wld. pipe	SA–672	B55	K02001	...
	3	Carbon steel	Wld. pipe	SA–672	C55	K01800	...
	4	Carbon steel	Wld. pipe	SA–672	E55	K02202	...
	5	Carbon steel	Sheet	SA–414	C	K02503	...
(13)	6	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
(13)	7	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
(13)	8	Carbon steel	Plate	SA/EN 10028–3	P275NH	...	...
	9	Carbon steel	Plate, sheet, bar	SA–36	...	K02600	...
	10	Carbon steel	Plate, sheet	SA–662	A	K01701	...
(13)	11	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
(13)	12	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...
(13)	13	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
(13)	14	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
(13)	15	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...
(13)	16	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
(13)	17	Carbon steel	Plate	SA/EN 10028–2	P265GH	...	...
(13)	18	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...
(13)	19	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
(13)	20	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250B	...	...
(13)	21	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
(13)	22	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...
(13)	23	Carbon steel	Smls. tube	SA/EN 10216–2	P265GH	...	...
	24	Carbon steel	Forgings	SA–181	...	K03502	60
	25	Carbon steel	Castings	SA–216	WCA	J02502	...
	26	Carbon steel	Forgings	SA–266	1	K03506	...
	27	Carbon steel	Forgings	SA–350	LF1	K03009	1
	28	Carbon steel	Castings	SA–352	LCA	J02504	...
	29	Carbon steel	Cast pipe	SA–660	WCA	J02504	...
	30	Carbon steel	Bar	SA–675	60	...	...
	31	Carbon steel	Forgings	SA–765	I	K03046	...
	32	Carbon steel	Plate	SA–515	60	K02401	...
	33	Carbon steel	Plate	SA–516	60	K02100	...
	34	Carbon steel	Wld. pipe	SA–671	CB60	K02401	...
	35	Carbon steel	Wld. pipe	SA–671	CC60	K02100	...
	36	Carbon steel	Wld. pipe	SA–671	CE60	K02402	...
	37	Carbon steel	Wld. pipe	SA–672	B60	K02401	...
	38	Carbon steel	Wld. pipe	SA–672	C60	K02100	...
	39	Carbon steel	Wld. pipe	SA–672	E60	K02402	...
	40	Carbon steel	Wld. pipe	SA–134	A283D	K02702	...
	41	Carbon steel	Plate	SA–283	D	K02702	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	380	205	...
2	...	380	205	...
3	...	380	205	...
4	...	380	205	...
5	...	380	230	...
6	40 < t ≤ 60	390	255	...
7	16 < t ≤ 40	390	265	...
8	≤16	390	275	...
9	...	400	250	...
10	...	400	275	...
11	t > 40	410	230	...
12	t > 40	410	230	...
13	t > 40	410	230	...
14	20 < t ≤ 40	410	240	...
15	20 < t ≤ 40	410	240	...
16	20 < t ≤ 40	410	240	...
17	≤60	410	245	...
18	40 < t ≤ 60	410	245	...
19	t ≤ 20	410	250	...
20	t ≤ 20	410	250	...
21	t ≤ 20	410	250	...
22	16 < t ≤ 40	410	255	...
23	t ≤ 16	410	265	...
24	...	415	205	...
25	...	415	205	...
26	...	415	205	...
27	...	415	205	...
28	...	415	205	...
29	...	415	205	...
30	...	415	205	...
31	...	415	205	...
32	...	415	220	...
33	...	415	220	...
34	...	415	220	...
35	...	415	220	...
36	...	415	220	...
37	...	415	220	...
38	...	415	220	...
39	...	415	220	...
40	...	415	230	...
41	...	415	230	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	195	189	186	183	180	177	174	170	166
2	207	195	189	186	183	180	177	174	170	166
3	207	195	189	186	183	180	177	174	170	166
4	207	195	189	186	183	180	177	174	170	166
5	228	214	207	204	201	198	195	191	187	183
6	255	240	232	229	225	222	218	214	210	204
7	265	250	242	239	235	231	227	224	218	213
8	275	258	251	247	243	239	236	231	226	221
9	248	233	227	223	219	216	213	209	204	199
10	276	259	251	248	244	240	237	232	227	221
11	230	215	209	206	203	201	197	194	189	185
12	230	215	209	206	203	201	197	194	189	185
13	230	215	209	206	203	201	197	194	189	185
14	240	225	218	215	212	209	206	202	198	193
15	240	225	218	215	212	209	206	202	198	193
16	240	225	218	215	212	209	206	202	198	193
17	245	230	223	220	217	213	210	206	202	197
18	245	230	223	220	217	213	210	206	202	197
19	250	234	227	224	221	218	215	211	206	201
20	250	234	227	224	221	218	215	211	206	201
21	250	234	227	224	221	218	215	211	206	201
22	255	240	232	229	225	222	219	214	210	205
23	265	249	242	238	234	231	227	223	218	213
24	207	195	189	186	183	180	177	174	170	166
25	207	195	189	186	183	180	177	174	170	166
26	207	195	189	186	183	180	177	174	170	166
27	207	195	189	186	183	180	177	174	170	166
28	207	195	189	186	183	180	177	174	170	166
29	207	195	189	186	183	180	177	174	170	166
30	207	195	189	186	183	180	177	174	170	166
31	207	195	189	186	183	180	177	174	170	166
32	221	208	201	198	195	192	189	185	182	177
33	221	208	201	198	195	192	189	185	182	177
34	221	208	201	198	195	192	189	185	182	177
35	221	208	201	198	195	192	189	185	182	177
36	221	208	201	198	195	192	189	185	182	177
37	221	208	201	198	195	192	189	185	182	177
38	221	208	201	198	195	192	189	185	182	177
39	221	208	201	198	195	192	189	185	182	177
40	228	214	207	204	201	198	195	191	187	183
41	228	214	207	204	201	198	195	191	187	183

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	161	157	152	148	143	139	135	132	128	125	
2	161	157	152	148	143	139	135	132	128	125	
3	161	157	152	148	143	139	135	132	128	125	
4	161	157	152	148	143	139	135	132	128	125	
5	178	173	167	162	157	153	149	145	142	137	
6	199	193	187	182	176	171	167	162	158	154	(**13**)
7	207	201	195	189	183	178	173	169	164	160	(**13**)
8	215	208	202	196	190	185	180	175	171	166	(**13**)
9	194	188	183	177	171	166	162	158	154	150	
10	216	209	202	196	191	185	180	176	171	167	
11	180	174	169	...	...	...	...	...	...	...	(**13**)
12	180	174	169	...	...	...	...	...	...	...	(**13**)
13	180	174	169	...	...	...	...	...	...	...	(**13**)
14	187	182	176	...	...	...	...	...	...	...	(**13**)
15	187	182	176	...	...	...	...	...	...	...	(**13**)
16	187	182	176	...	...	...	...	...	...	...	(**13**)
17	191	186	180	175	169	165	160	156	152	148	(**13**)
18	191	186	180	175	169	165	160	156	152	148	(**13**)
19	195	189	183	...	...	...	...	...	...	...	(**13**)
20	195	189	183	...	...	...	...	...	...	...	(**13**)
21	195	189	183	...	...	...	...	...	...	...	(**13**)
22	199	193	187	182	176	171	167	162	158	154	(**13**)
23	207	201	195	189	183	178	173	169	164	160	(**13**)
24	161	157	152	148	143	139	135	132	128	125	
25	161	157	152	148	143	139	135	132	128	125	
26	161	157	152	148	143	139	135	132	128	125	
27	161	157	152	148	143	139	135	132	128	125	
28	161	157	152	148	143	139	135	132	128	125	
29	161	157	152	148	143	139	135	132	128	125	
30	161	157	152	148	143	139	135	132	128	125	
31	161	157	152	148	143	139	135	132	128	125	
32	172	167	162	157	153	149	144	140	137	133	
33	172	167	162	157	153	149	144	140	137	133	
34	172	167	162	157	153	149	144	140	137	133	
35	172	167	162	157	153	149	144	140	137	133	
36	172	167	162	157	153	149	144	140	137	133	
37	172	167	162	157	153	149	144	140	137	133	
38	172	167	162	157	153	149	144	140	137	133	
39	172	167	162	157	153	149	144	140	137	133	
40	178	173	167	162	157	153	149	145	142	137	
41	178	173	167	162	157	153	149	145	142	137	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	Carbon steel	Wld. pipe	SA–53	E/B	K03005	...
	2	Carbon steel	Smls. pipe	SA–53	S/B	K03005	...
	3	Carbon steel	Smls. pipe	SA–106	B	K03006	...
	4	Carbon steel	Wld. pipe	SA–135	B	...	...
	5	Carbon steel	Smls. & wld. fittings	SA–234	WPB	K03006	...
	6	Carbon steel	Smls. & wld. pipe	SA–333	6	K03006	...
	7	Carbon steel	Smls. & wld. tube	SA–334	6	K03006	...
	8	Carbon steel	Forged pipe	SA–369	FPB	K03006	...
	9	Carbon steel	Forgings	SA–372	A	K03002	...
	10	Carbon steel	Sheet	SA–414	D	K02505	...
	11	Carbon steel	Smls. & wld. fittings	SA–420	WPL6	...	...
	12	Carbon steel	Smls. pipe	SA–524	I	K02104	...
(13)	13	...	...	...	...	...	...
	14	Carbon steel	Bar	SA–696	B	K03200	...
(13)	15	Carbon steel	Bolting	SA–307	B	...	...
	16	Carbon steel	Forgings	SA–727	...	K02506	...
	17	Carbon steel	Wld. tube	SA–178	C	K03503	...
	18	Carbon steel	Smls. tube	SA–210	A–1	K02707	...
	19	Carbon steel	Smls. tube	SA–556	B2	K02707	...
	20	Carbon steel	Wld. tube	SA–557	B2	K03007	...
	21	Carbon steel	Plate, bar	SA/CSA–G40.21	38W	...	...
	22	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
	23	Carbon steel	Plate	SA/AS 1548	PT430	...	...
	24	Carbon steel	Plate	SA/AS 1548	PT430	...	...
	25	Carbon steel	Plate	SA/AS 1548	PT430	...	...
	26	Carbon steel	Plate	SA/AS 1548	PT430	...	...
	27	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
	28	Carbon steel	Bar	SA–675	65	...	...
	29	Carbon steel	Castings	SA–352	LCB	J03003	...
	30	Carbon steel	Plate	SA–515	65	K02800	...
	31	Carbon steel	Plate	SA–516	65	K02403	...
	32	Carbon steel	Wld. pipe	SA–671	CB65	K02800	...
	33	Carbon steel	Wld. pipe	SA–671	CC65	K02403	...
	34	Carbon steel	Wld. pipe	SA–672	B65	K02800	...
	35	Carbon steel	Wld. pipe	SA–672	C65	K02403	...
	36	Carbon steel	Sheet	SA–414	E	K02704	...
	37	Carbon steel	Plate	SA–662	B	K02203	...
(13)	38	Carbon steel	Plate, bar	SA/CSA–G40.21	44W	...	...
(13)	39	...	...	...	...	...	...
(13)	40	Carbon steel	Plate, bar	SA/CSA–G40.21	44W	...	...
	41	Carbon steel	Plate	SA–537	...	K12437	1
	42	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...
(13)	43	Carbon steel	Plate, bar	SA/CSA–G40.21	50W	...	...
(13)	44	Carbon steel	Plate, bar	SA/CSA–G40.21	50W	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	415	240	...
2	...	415	240	...
3	...	415	240	...
4	...	415	240	...
5	...	415	240	...
6	...	415	240	...
7	...	415	240	...
8	...	415	240	...
9	...	415	240	...
10	...	415	240	...
11	...	415	240	...
12	...	415	240	...
13	...	...	...	...
14	...	415	240	...
15	...	415	250	...
16	...	415	250	...
17	...	415	255	...
18	...	415	255	...
19	...	415	255	...
20	...	415	255	...
21	...	415	260	...
22	$150 < t \le 250$	430	220	...
23	$80 < t \le 150$	430	250	...
24	$40 < t \le 80$	430	270	...
25	$16 < t \le 40$	430	280	...
26	≤16	430	300	...
27	$100 < t \le 150$	440	235	...
28	...	450	225	...
29	...	450	240	...
30	...	450	240	...
31	...	450	240	...
32	...	450	240	...
33	...	450	240	...
34	...	450	240	...
35	...	450	240	...
36	...	450	260	...
37	...	450	275	...
38	$64 < t \le 200$	450	275	...
39	...	...	...	...
40	$t \le 64$	450	305	...
41	$64 < t \le 100$	450	310	...
42	$64 < t \le 100$	450	310	...
43	$64 < t \le 150$	450	315	...
44	$t \le 64$	450	345	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	241	227	220	217	214	210	207	203	198	194
2	241	227	220	217	214	210	207	203	198	194
3	241	227	220	217	214	210	207	203	198	194
4	241	227	220	217	214	210	207	203	198	194
5	241	227	220	217	214	210	207	203	198	194
6	241	227	220	217	214	210	207	203	198	194
7	241	227	220	217	214	210	207	203	198	194
8	241	227	220	217	214	210	207	203	198	194
9	241	227	220	217	214	210	207	203	198	194
10	241	227	220	217	214	210	207	203	198	194
11	241	227	220	217	214	210	207	203	198	194
12	241	227	220	217	214	210	207	203	198	194
13	...	...	...	...	...	...	...	...	...	...
14	241	227	220	217	214	210	207	203	198	194
15	248	233	227	223	219	216	213	209	204	199
16	248	233	227	223	219	216	213	209	204	199
17	255	240	233	229	225	222	219	215	210	205
18	255	240	233	229	225	222	219	215	210	205
19	255	240	233	229	225	222	219	215	210	205
20	255	240	233	229	225	222	219	215	210	205
21	262	246	239	235	232	228	225	221	216	210
22	220	220	201	197	195	192	189	185	181	177
23	252	240	229	225	223	220	216	212	207	202
24	269	256	244	240	238	234	230	226	221	216
25	279	266	254	250	247	243	239	235	230	224
26	300	286	273	268	265	262	257	252	247	240
27	234	221	214	211	207	204	201	197	193	188
28	224	210	205	201	198	196	192	189	184	180
29	241	227	220	217	214	210	207	203	198	194
30	241	227	220	217	214	210	207	203	198	194
31	241	227	220	217	214	210	207	203	198	194
32	241	227	220	217	214	210	207	203	198	194
33	241	227	220	217	214	210	207	203	198	194
34	241	227	220	217	214	210	207	203	198	194
35	241	227	220	217	214	210	207	203	198	194
36	262	246	239	235	232	228	225	221	216	210
37	276	259	251	248	244	240	237	232	227	221
38	276	261	253	248	244	240	236	231	226	221
39	...	...	...	...	...	...	...	...	...	...
40	303	287	278	273	268	264	259	254	249	243
41	310	292	283	279	274	270	266	261	255	249
42	310	292	283	279	274	270	266	261	255	249
43	317	300	291	285	281	276	271	266	260	254
44	345	326	316	310	305	300	295	289	283	276

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	188	183	177	172	167	162	158	154	150	146	
2	188	183	177	172	167	162	158	154	150	146	
3	188	183	177	172	167	162	158	154	150	146	
4	188	183	177	172	167	162	158	154	150	146	
5	188	183	177	172	167	162	158	154	150	146	
6	188	183	177	172	167	162	158	154	150	146	
7	188	183	177	172	167	162	158	154	150	146	
8	188	183	177	172	167	162	158	154	150	146	
9	188	183	177	172	167	162	158	154	150	146	
10	188	183	177	172	167	162	158	154	150	146	
11	188	183	177	172	167	162	158	154	150	146	
12	188	183	177	172	167	162	158	154	150	146	
13	...	...	...	...	...	...	...	...	...	...	(**13**)
14	188	183	177	172	167	162	158	154	150	146	
15	194	188	183	177	171	...	...	...	...	...	(**13**)
16	194	188	183	177	171	166	162	158	154	150	
17	200	193	187	182	176	171	167	163	158	154	
18	200	193	187	182	176	171	167	163	158	154	
19	200	193	187	182	176	171	167	163	158	154	
20	200	193	187	182	176	171	167	163	158	154	
21	204	199	193	187	181	176	171	167	163	154	
22	172	167	162	157	152	148	144	140	137	133	
23	196	191	185	179	174	169	164	160	156	152	
24	210	204	198	191	186	180	176	172	167	163	
25	218	211	205	199	193	187	182	178	173	169	
26	234	227	220	213	207	202	196	191	186	181	
27	183	178	172	167	162	157	153	149	146	142	
28	175	170	165	160	155	151	146	142	139	135	
29	188	183	177	172	167	162	158	154	150	146	
30	188	183	177	172	167	162	158	154	150	146	
31	188	183	177	172	167	162	158	154	150	146	
32	188	183	177	172	167	162	158	154	150	146	
33	188	183	177	172	167	162	158	154	150	146	
34	188	183	177	172	167	162	158	154	150	146	
35	188	183	177	172	167	162	158	154	150	146	
36	204	199	193	187	181	176	171	167	162	158	
37	216	209	202	196	191	185	180	176	171	167	
38	215	209	203	197	191	185	180	175	171	166	(**13**)
39	...	...	...	...	...	...	...	...	...	...	(**13**)
40	237	230	223	217	210	204	198	193	188	183	(**13**)
41	242	235	228	221	215	209	203	197	192	187	
42	242	235	228	221	215	209	203	197	192	187	
43	247	241	234	227	220	213	207	201	196	191	(**13**)
44	269	261	254	246	239	232	225	219	213	208	(**13**)

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
	2	Carbon steel	Plate	SA/AS 1548	PT460	...	...
	3	Carbon steel	Plate	SA/AS 1548	PT460	...	...
	4	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
(**13**)	5	...	...	...	...	...	...
	6	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
	7	Carbon steel	Plate	SA/AS 1548	PT460	...	...
	8	Carbon steel	Plate	SA/EN 10028–2	P295GH	...	...
	9	Carbon steel	Plate	SA/AS 1548	PT460	...	...
(**13**)	10	Carbon steel	Plate	SA/GB 713	Q345R	...	...
(**13**)	11	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
(**13**)	12	...	...	...	...	...	...
(**13**)	13	Carbon steel	Plate	SA/GB 713	Q345R	...	...
(**13**)	14	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
	15	Carbon steel	Plate	SA–455	...	K03300	...
	16	Carbon steel	Bar	SA–675	70	...	...
	17	Carbon steel	Forgings	SA–105	...	K03504	...
	18	Carbon steel	Forgings	SA–181	...	K03502	70
	19	Carbon steel	Castings	SA–216	WCB	J03002	...
	20	Carbon steel	Forgings	SA–266	2	K03506	...
	21	Carbon steel	Forgings	SA–266	4	K03017	...
	22	Carbon steel	Forgings	SA–350	LF2	K03011	...
	23	Carbon steel	Forgings	SA–508	1	K13502	...
	24	Carbon steel	Forgings	SA–508	1A	K13502	...
	25	Carbon steel	Forgings	SA–541	1	K03506	...
	26	Carbon steel	Forgings	SA–541	1A	K03020	...
	27	Carbon steel	Cast pipe	SA–660	WCB	J03003	...
	28	Carbon steel	Forgings	SA–765	II	K03047	...
	29	Carbon steel	Plate	SA–515	70	K03101	...
	30	Carbon steel	Plate	SA–516	70	K02700	...
	31	Carbon steel	Wld. pipe	SA–671	CB70	K03101	...
	32	Carbon steel	Wld. pipe	SA–671	CC70	K02700	...
	33	Carbon steel	Wld. pipe	SA–672	B70	K03101	...
	34	Carbon steel	Wld. pipe	SA–672	C70	K02700	...
	35	Carbon steel	Smls. pipe	SA–106	C	K03501	...
	36	Carbon steel	Wld. tube	SA–178	D	...	...
	37	Carbon steel	Smls. tube	SA–210	C	K03501	...
	38	Carbon steel	Castings	SA–216	WCC	J02503	...
	39	Carbon steel	Smls. & wld. fittings	SA–234	WPC	K03501	...
	40	Carbon steel	Castings	SA–352	LCC	J02505	...
	41	Carbon steel	Castings	SA–487	16	...	A

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	60 < t ≤ 100	460	260	...
2	80 < t ≤ 150	460	265	...
3	40 < t ≤ 80	460	275	...
4	40 < t ≤ 60	460	285	...
5	...	...	...	...
6	16 < t ≤ 40	460	290	...
7	16 < t ≤ 40	460	295	...
8	≤16	460	295	...
9	≤16	460	305	...
10	150 < t ≤ 200	470	265	...
11	150 < t ≤ 250	470	280	...
12	...	...	...	...
13	100 < t ≤ 150	480	285	...
14	100 < t ≤ 150	480	295	...
15	15 < t ≤ 19	485	240	...
16	...	485	240	...
17	...	485	250	...
18	...	485	250	...
19	...	485	250	...
20	...	485	250	...
21	...	485	250	...
22	...	485	250	...
23	...	485	250	...
24	...	485	250	...
25	...	485	250	...
26	...	485	250	...
27	...	485	250	...
28	...	485	250	...
29	...	485	260	...
30	...	485	260	...
31	...	485	260	...
32	...	485	260	...
33	...	485	260	...
34	...	485	260	...
35	...	485	275	...
36	...	485	275	...
37	...	485	275	...
38	...	485	275	...
39	...	485	275	...
40	...	485	275	...
41	...	485	275	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	259	243	236	232	229	225	221	217	213	208
2	265	253	242	238	235	232	228	223	219	213
3	276	263	251	247	244	241	237	232	227	221
4	286	269	261	257	253	249	246	241	235	229
5	...	...	...	...	...	...	...	...	...	...
6	290	273	264	260	256	253	248	243	238	232
7	296	283	270	265	262	258	254	249	244	238
8	296	279	271	266	262	258	254	249	244	238
9	303	289	276	271	268	264	260	255	250	244
10	265	249	242	238	235	231	227	223	218	213
11	280	262	255	251	248	244	240	236	231	225
12	...	...	...	...	...	...	...	...	...	...
13	285	268	260	256	252	249	245	240	235	229
14	295	276	268	264	261	257	253	248	243	237
15	241	227	220	217	214	210	207	203	198	194
16	241	227	220	217	214	210	207	203	198	194
17	248	233	227	223	219	216	213	209	204	199
18	248	233	227	223	219	216	213	209	204	199
19	248	233	227	223	219	216	213	209	204	199
20	248	233	227	223	219	216	213	209	204	199
21	248	233	227	223	219	216	213	209	204	199
22	248	233	227	223	219	216	213	209	204	199
23	248	233	227	223	219	216	213	209	204	199
24	248	233	227	223	219	216	213	209	204	199
25	248	233	227	223	219	216	213	209	204	199
26	248	233	227	223	219	216	213	209	204	199
27	248	233	227	223	219	216	213	209	204	199
28	248	233	227	223	219	216	213	209	204	199
29	262	246	239	235	232	228	225	221	216	210
30	262	246	239	235	232	228	225	221	216	210
31	262	246	239	235	232	228	225	221	216	210
32	262	246	239	235	232	228	225	221	216	210
33	262	246	239	235	232	228	225	221	216	210
34	262	246	239	235	232	228	225	221	216	210
35	276	259	251	248	244	240	237	232	227	221
36	276	259	251	248	244	240	237	232	227	221
37	276	259	251	248	244	240	237	232	227	221
38	276	259	251	248	244	240	237	232	227	221
39	276	259	251	248	244	240	237	232	227	221
40	276	259	251	248	244	240	237	232	227	221
41	276	257	244	236	230	225	220	216	212	208

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	202	196	190	185	179	173	169	165	160	156	
2	207	201	195	189	184	178	173	169	164	160	
3	216	209	202	196	191	185	180	176	171	167	
4	223	217	211	204	198	192	187	182	178	173	
5	...	...	...	...	...	...	...	...	...	...	(**13**)
6	226	219	213	207	200	195	189	184	180	175	
7	232	225	218	211	205	199	194	189	184	179	
8	232	225	218	211	205	199	194	189	184	179	
9	237	230	223	216	210	204	198	193	188	183	
10	207	201	195	189	183	178	173	169	164	160	(**13**)
11	219	212	205	199	193	188	183	178	174	169	(**13**)
12	...	...	...	...	...	...	...	...	...	...	(**13**)
13	223	216	210	203	197	191	186	181	177	172	(**13**)
14	230	223	216	210	204	198	193	188	183	178	(**13**)
15	188	183	177	172	167	162	158	154	150	146	
16	188	183	177	172	167	162	158	154	150	146	
17	194	188	183	177	171	166	162	158	154	150	
18	194	188	183	177	171	166	162	158	154	150	
19	194	188	183	177	171	166	162	158	154	150	
20	194	188	183	177	171	166	162	158	154	150	
21	194	188	183	177	171	166	162	158	154	150	
22	194	188	183	177	171	166	162	158	154	150	
23	194	188	183	177	171	166	162	158	154	150	
24	194	188	183	177	171	166	162	158	154	150	
25	194	188	183	177	171	166	162	158	154	150	
26	194	188	183	177	171	166	162	158	154	150	
27	194	188	183	177	171	166	162	158	154	150	
28	194	188	183	177	171	166	162	158	154	150	
29	204	199	193	187	181	176	171	167	162	158	
30	204	199	193	187	181	176	171	167	162	158	
31	204	199	193	187	181	176	171	167	162	158	
32	204	199	193	187	181	176	171	167	162	158	
33	204	199	193	187	181	176	171	167	162	158	
34	204	199	193	187	181	176	171	167	162	158	
35	216	209	202	196	191	185	180	176	171	167	
36	216	209	202	196	191	185	180	176	171	167	
37	216	209	202	196	191	185	180	176	171	167	
38	216	209	202	196	191	185	180	176	171	167	
39	216	209	202	196	191	185	180	176	171	167	
40	216	209	202	196	191	185	180	176	171	167	
41	204	201	197	192	187	181	175	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	Carbon steel	Plate	SA–537	...	K12437	3
	2	Carbon steel	Smls. tube	SA–556	C2	K03006	...
	3	Carbon steel	Tube	SA–557	C2	K03505	...
	4	Carbon steel	Cast pipe	SA–660	WCC	J02505	...
(13)	5	...	...	...	...	...	...
	6	Carbon steel	Bar	SA–696	C	K03200	...
	7	Carbon steel	Sheet	SA–414	F	K03102	...
	8	Carbon steel	Plate	SA–662	C	K02007	...
	9	Carbon steel	Plate	SA–537	...	K12437	2
	10	Carbon steel	Plate	SA–738	C	K02008	...
	11	Carbon steel	Plate	SA–537	...	K12437	1
	12	Carbon steel	Wld. pipe	SA–671	CD70	K12437	...
	13	Carbon steel	Wld. pipe	SA–672	D70	K12437	...
	14	Carbon steel	Wld. pipe	SA–691	CMSH–70	K12437	...
	15	Carbon steel	Plate	SA–841	A	...	1
(13)	16	Carbon steel	Plate	SA/GB 713	Q345R	...	...
(13)	17	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
(13)	18	Carbon steel	Plate	SA/GB 713	Q345R	...	...
(13)	19	...	...	...	...	...	...
(13)	20	Carbon steel	Plate	SA/GB 713	Q345R	...	...
	21	Carbon steel	Plate	SA–455	...	K03300	...
(13)	22	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
(13)	23	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
(13)	24	Carbon steel	Plate	SA/GB 713	Q345R	...	...
(13)	25	...	...	...	...	...	...
(13)	26	Carbon steel	Plate	SA/EN 10028–2	P355GH	...	...
	27	Carbon steel	Forgings	SA–266	3	K05001	...
	28	Carbon steel	Plate	SA–455	...	K03300	...
	29	Carbon steel	Plate	SA–299	A	K02803	...
	30	Carbon steel	Wld. pipe	SA–671	CK75	K02803	...
	31	Carbon steel	Wld. pipe	SA–672	N75	K02803	...
	32	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...
	33	Carbon steel	Plate	SA–299	A	K02803	...
	34	Carbon steel	Wld. pipe	SA–691	CMS–75	K02803	...
	35	Carbon steel	Forgings	SA–372	B	K04001	...
	36	Carbon steel	Sheet	SA–414	G	K03103	...
	37	Carbon steel	Plate	SA–738	A	K12447	...
	38	Carbon steel	Plate	SA–537	...	K12437	3
	39	Carbon steel	Plate	SA–537	...	K12437	2
	40	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...
	41	Carbon steel	Plate	SA–738	C	K02008	...
	42	Carbon steel	Plate	SA–299	B	K02803	...
	43	Carbon steel	Plate	SA–299	B	K02803	...
	44	Carbon steel	Forgings	SA–765	IV	K02009	...
	45	Carbon steel	Plate	SA–537	...	K12437	3

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	100 < t ≤ 150	485	275	...
2	...	485	275	...
3	...	485	275	...
4	...	485	275	...
5	...	...	...	...
6	...	485	275	...
7	...	485	290	...
8	...	485	295	...
9	100 < t ≤ 150	485	315	...
10	100 < t ≤ 150	485	315	...
11	≤64	485	345	...
12	≤64	485	345	...
13	≤64	485	345	...
14	≤64	485	345	...
15	≤64	485	345	...
16	60 < t ≤ 100	490	305	...
17	60 < t ≤ 100	490	315	...
18	36 < t ≤ 60	490	315	...
19	...	...	...	...
20	16 < t ≤ 36	500	325	...
21	10 < t ≤ 16	505	255	...
22	40 < t ≤ 60	510	335	...
23	16 < t ≤ 40	510	345	...
24	3 ≤ t ≤ 16	510	345	...
25	...	...	...	...
26	≤16	510	355	...
27	...	515	260	...
28	≤10	515	260	...
29	>25	515	275	...
30	>25	515	275	...
31	>25	515	275	...
32	>25	515	275	...
33	≤25	515	290	...
34	≤25	515	290	...
35	...	515	310	...
36	...	515	310	...
37	...	515	310	...
38	64 < t ≤ 100	515	345	...
39	64 < t ≤ 100	515	380	...
40	64 < t ≤ 100	515	380	...
41	64 < t ≤ 100	515	380	...
42	>25	550	310	...
43	≤25	550	325	...
44	...	550	345	...
45	≤64	550	380	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	276	256	241	232	223	215	208	202	197	193
2	276	259	251	248	244	240	237	232	227	221
3	276	259	251	248	244	240	237	232	227	221
4	276	259	251	248	244	240	237	232	227	221
5	...	...	...	...	...	...	...	...	...	...
6	276	259	251	248	244	240	237	232	227	221
7	290	273	264	260	256	253	248	243	238	232
8	296	279	271	266	262	258	254	249	244	238
9	317	294	277	266	256	248	240	233	226	221
10	317	294	277	266	256	248	240	233	226	221
11	345	320	302	289	279	269	261	253	247	241
12	345	320	302	289	279	269	261	253	247	241
13	345	320	302	289	279	269	261	253	247	241
14	345	320	302	289	279	269	261	253	247	241
15	345	328	316	308	301	296	292	289	286	283
16	305	287	278	274	270	266	262	257	251	245
17	315	295	286	282	279	275	270	265	259	253
18	315	296	287	283	279	275	270	265	259	253
19	...	...	...	...	...	...	...	...	...	...
20	325	305	297	292	288	284	279	274	268	261
21	255	240	233	229	225	222	219	215	210	205
22	335	314	305	300	296	292	288	282	276	269
23	345	323	314	309	305	301	296	291	284	277
24	345	324	315	310	306	301	296	291	284	277
25	...	...	...	...	...	...	...	...	...	...
26	355	332	323	318	314	310	305	299	292	285
27	259	243	236	232	229	225	221	217	213	208
28	262	246	239	235	232	228	225	221	216	210
29	276	259	251	248	244	240	237	232	227	221
30	276	259	251	248	244	240	237	232	227	221
31	276	259	251	248	244	240	237	232	227	221
32	276	259	251	248	244	240	237	232	227	221
33	290	273	264	260	256	253	248	243	238	232
34	290	273	264	260	256	253	248	243	238	232
35	310	292	283	279	274	270	266	261	255	249
36	310	292	283	279	274	270	266	261	255	249
37	310	292	283	279	274	270	266	261	255	249
38	345	320	302	289	279	269	261	253	247	241
39	379	352	331	318	306	296	286	278	271	265
40	379	352	331	318	306	296	286	278	271	265
41	379	352	331	318	306	296	286	278	271	265
42	310	292	283	278	274	270	266	261	255	249
43	324	305	295	291	287	282	278	273	267	260
44	345	328	313	306	300	293	287	281	276	271
45	379	352	331	318	306	296	286	278	271	265

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	189	185	181	177	174	169	164	...	...	...	
2	216	209	202	196	191	185	180	176	171	167	
3	216	209	202	196	191	185	180	176	171	167	
4	216	209	202	196	191	185	180	176	171	167	
5	...	...	...	...	...	...	...	...	...	...	(**13**)
6	216	209	202	196	191	185	180	176	171	167	
7	226	219	213	207	200	195	189	184	180	175	
8	232	225	218	211	205	199	194	189	184	179	
9	216	212	208	204	199	194	189	...	...	...	
10	216	212	208	204	199	194	189	...	...	...	
11	235	231	226	222	217	211	204	...	...	...	
12	235	231	226	222	217	211	204	...	...	...	
13	235	231	226	222	217	211	204	...	...	...	
14	235	231	226	222	217	211	204	...	...	...	
15	279	275	269	261	252	...	...	...	...	...	
16	238	231	224	217	211	205	199	194	189	184	(**13**)
17	246	239	231	224	217	211	206	201	196	190	(**13**)
18	246	239	232	225	218	212	206	200	195	190	(**13**)
19	...	...	...	...	...	...	...	...	...	...	(**13**)
20	254	247	239	232	225	218	212	207	201	196	(**13**)
21	200	193	187	182	176	171	167	163	158	154	
22	261	254	246	238	231	225	219	213	208	203	(**13**)
23	269	261	253	245	238	231	225	220	214	209	(**13**)
24	270	262	254	246	239	232	225	219	214	208	(**13**)
25	...	...	...	...	...	...	...	...	...	...	(**13**)
26	277	269	261	252	245	238	232	226	220	215	(**13**)
27	202	196	190	185	179	173	169	165	160	156	
28	204	199	193	187	181	176	171	167	162	158	
29	216	209	202	196	191	185	180	176	171	167	
30	216	209	202	196	191	185	180	176	171	167	
31	216	209	202	196	191	185	180	176	171	167	
32	216	209	202	196	191	185	180	176	171	167	
33	226	219	213	207	200	195	189	184	180	175	
34	226	219	213	207	200	195	189	184	180	175	
35	242	235	228	221	215	209	203	197	192	187	
36	242	235	228	221	215	209	203	197	192	187	
37	242	235	228	221	215	209	203	197	192	187	
38	235	231	226	222	217	211	204	...	...	...	
39	259	254	249	244	238	231	225	...	...	...	
40	259	254	249	244	238	231	225	...	...	...	
41	259	254	249	244	238	231	225	...	...	...	
42	242	235	228	221	215	208	203	198	193	187	
43	253	246	238	231	224	218	212	206	201	196	
44	266	262	259	255	...	...	...	...	...	...	
45	259	254	249	244	238	231	225	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	Carbon steel	Plate	SA–537	...	K12437	2
	2	Carbon steel	Wld. pipe	SA–671	CD80	K12437	...
	3	Carbon steel	Wld. pipe	SA–672	D80	K12437	...
	4	Carbon steel	Wld. pipe	SA–691	CMSH–80	K12437	...
	5	Carbon steel	Plate	SA–738	C	K02008	...
	6	Carbon steel	Plate	SA–841	B	...	2
	7	Carbon steel	Plate	SA–612	...	K02900	...
(13)	8	Carbon steel	Plate	SA–841	F	...	6
	9	Carbon steel	Plate	SA–612	...	K02900	...
	10	Carbon steel	Plate	SA–738	B	K12007	...
(13)	11	Carbon steel	Plate	SA–841	F	...	7
	12	Carbon steel	Forgings	SA–372	C	K04801	...
	13	Carbon steel	Bolting	SA–449	...	K04200	...
	14	Carbon steel	Plate	SA–724	A	K11831	...
	15	Carbon steel	Plate	SA–724	C	K12037	...
	16	Carbon steel	Plate	SA–724	B	K12031	...
	17	Carbon steel	Bolting	SA–325	...	...	...
	18	Carbon steel	Bolting	SA–325	1	K02706	...
	19	Carbon steel	Bolting	SA–449	...	K04200	...
	20	Carbon steel	Bolting	SA–354	BC	K04100	...
	21	Carbon steel	Bolting	SA–325	1	K02706	...
	22	Carbon steel	Bolting	SA–449	...	K04200	...
	23	Carbon steel	Bolting	SA–354	BC	K04100	...
	24	Carbon steel	Bolting	SA–354	BD	K04100	...
	25	Carbon steel	Bolting	SA–354	BD	K04100	...
	26	Carbon steel	Flat wire	SA–905	...	...	2
	27	Carbon steel	Flat wire	SA–905	...	...	2
	28	Carbon steel	Flat wire	SA–905	...	...	2
	29	Carbon steel	Flat wire	SA–905	...	...	2
	30	Carbon steel	Flat wire	SA–905	...	...	2
	31	Carbon steel	Flat wire	SA–905	...	...	1
	32	Carbon steel	Flat wire	SA–905	...	...	1
	33	Carbon steel	Flat wire	SA–905	...	...	1
	34	Carbon steel	Flat wire	SA–905	...	...	1
	35	Carbon steel	Flat wire	SA–905	...	...	1
(13)	36	Ductile cast iron	Castings	SA–874	...	...	...
(13)	37	Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT	...	...
	38	C–Mn–Si–Cb	Plate	SA–737	B	K12001	...
	39	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490	...	...
	40	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490	...	...
	41	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490	...	...
	42	C–Mn–Si–Cb	Plate	SA/AS 1548	PT490	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	≤64	550	415	...
2	≤64	550	415	...
3	≤64	550	415	...
4	≤64	550	415	...
5	≤64	550	415	...
6	≤64	550	415	...
7	13 < t ≤ 25	560	345	...
8	t ≤ 32	565	485	...
9	≤13	570	345	...
10	...	585	415	...
11	t ≤ 25	590	515	...
12	...	620	380	...
13	38 < t ≤ 75	620	400	...
14	...	620	485	...
15	...	620	485	...
16	...	655	515	...
17	...	725	560	...
18	32 < t ≤ 38	725	560	...
19	25 < t ≤ 38	725	560	...
20	64 < t ≤ 100	795	685	...
21	13 < t ≤ 25	825	635	...
22	≤25	825	635	...
23	6 < t ≤ 64	860	750	...
24	64 < t ≤ 100	965	795	...
25	6 < t ≤ 64	1035	895	...
26	1.5	1695	1450	(1), (2)
27	1.3	1725	1475	(1), (2)
28	1.02	1765	1525	(1), (2)
29	0.76	1805	1560	(1), (2)
30	0.51	1850	1600	(1), (2)
31	1.5	1895	1650	(1), (2)
32	1.3	1930	1675	(1), (2)
33	1.02	1965	1725	(1), (2)
34	0.76	2000	1760	(1), (2)
35	0.51	2040	1795	(1), (2)
36	300 < t < 530	300	200	...
37	300 < t < 530	300	200	...
38	...	485	345	...
39	80 < t ≤ 150	490	320	...
40	40 < t ≤ 80	490	330	...
41	16 < t ≤ 40	490	340	...
42	≤16	490	360	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	414	384	362	347	335	323	313	303	295	288
2	414	384	362	347	335	323	313	303	295	288
3	414	384	362	347	335	323	313	303	295	288
4	414	384	362	347	335	323	313	303	295	288
5	414	384	362	347	335	323	313	303	295	288
6	414	394	379	369	362	355	351	347	343	339
7	345	323	300	289	279	270	260	252	245	241
8	483	463	443	431	422	415	410	406	402	397
9	345	323	300	289	279	270	260	252	245	241
10	414	393	378	368	360	353	345	339	333	328
11	517	496	475	462	452	444	439	435	430	425
12	379	357	346	340	336	331	325	319	312	304
13	400	381	364	357	354	349	343	337	329	321
14	483	448	422	405	390	377	365	354	345	337
15	483	448	422	405	390	377	365	354	345	337
16	517	480	452	434	418	403	390	379	370	361
17	558	525	488	468	452	436	422	409	399	390
18	558	525	488	468	452	436	422	409	399	390
19	558	525	488	468	452	436	422	409	399	390
20	683	651	621	611	604	595	585	574	562	548
21	634	596	554	531	513	495	479	465	453	443
22	634	596	554	531	513	495	479	465	453	443
23	752	717	684	672	664	655	644	632	618	603
24	793	757	722	709	701	691	680	667	652	636
25	896	855	816	802	792	781	768	753	737	719
26	1450	...	...	...	...	...	...	...	...	...
27	1480	...	...	...	...	...	...	...	...	...
28	1520	...	...	...	...	...	...	...	...	...
29	1560	...	...	...	...	...	...	...	...	...
30	1600	...	...	...	...	...	...	...	...	...
31	1650	1600	1530	...	...	...	...	...	...	...
32	1680	1620	1560	...	...	...	...	...	...	...
33	1720	1670	1600	...	...	...	...	...	...	...
34	1760	1700	1630	...	...	...	...	...	...	...
35	1790	1740	1670	...	...	...	...	...	...	...
36	200	182	174	...	166	...	162	...	160	...
37	200	182	174	...	166	...	162	...	160	...
38	345	331	312	298	285	272	262	253	246	240
39	321	308	290	278	265	253	243	235	228	223
40	331	318	300	286	273	261	251	243	236	231
41	341	328	309	296	282	270	259	250	243	238
42	359	344	325	310	296	283	272	263	256	250

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	283	277	272	266	260	253	246	...	...	...	
2	283	277	272	266	260	253	246	...	...	...	
3	283	277	272	266	260	253	246	...	...	...	
4	283	277	272	266	260	253	246	...	...	...	
5	283	277	272	266	260	253	246	...	...	...	
6	335	330	323	314	303	...	...	...	...	...	
7	237	232	226	220	...	...	...	...	...	...	
8	391	384	378	...	...	...	...	...	...	...	(**13**)
9	237	232	226	220	...	...	...	...	...	...	
10	323	317	312	306	300	293	286	...	...	...	
11	419	411	405	...	...	...	...	...	...	...	(**13**)
12	296	288	279	270	262	255	248	242	236	229	
13	312	303	294	285	277	269	261	255	249	...	
14	330	323	317	311	303	295	287	...	...	...	
15	330	323	317	311	303	295	287	...	...	...	
16	353	346	339	333	325	316	306	...	...	...	
17	381	374	366	359	351	341	329	314	295	269	
18	381	374	366	359	351	341	329	314	295	269	
19	381	374	366	359	351	341	329	314	295	269	
20	533	517	502	486	472	459	446	435	424	412	
21	433	424	416	408	399	388	374	357	335	306	
22	433	424	416	408	399	388	374	357	335	306	
23	587	570	553	536	520	505	491	479	466	453	
24	619	601	583	565	548	533	518	505	492	479	
25	700	679	658	638	618	601	584	569	554	539	
26	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	
36	157	154	151	...	...	...	...	...	...	...	(**13**)
37	157	154	151	...	...	...	...	...	...	...	(**13**)
38	236	233	230	226	222	216	208	198	182	179	
39	220	217	214	210	206	200	193	183	171	157	
40	227	224	221	217	213	207	199	190	177	162	
41	234	230	227	224	220	214	206	195	183	164	
42	246	242	239	235	231	225	216	205	192	175	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
(**13**)	1	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized
(**13**)	2	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized
(**13**)	3	C–Mn–Si–Cb	Plate	SA/GB 713	Q370R	...	Normalized
	4	C–Mn–Si–V	Plate	SA–737	C	K12202	...
	5	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...
	6	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...
	7	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...
	8	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...
	9	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...
	10	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...
	11	C–Mn–Si–V–Cb	Plate	SA–656	T3	...	...
	12	C–Mn–Si–V–Cb	Plate	SA–656	T7	...	...
	13	C–Mn–Ti	Plate, sheet	SA–562	...	K11224	...
	14	C–Si–Ti	Forgings	SA–836	...	...	1
	15	C–¼Mo	Bolting	SA–320	L7A	G40370	...
	16	C–¼Mo	Bolting	SA–574	4037	G40370	...
	17	C–¼Mo	Bolting	SA–574	4042	G40420	...
	18	C–¼Mo	Bolting	SA–574	4140	G41400	...
	19	C–¼Mo	Bolting	SA–574	4037	G40370	...
	20	C–¼Mo	Bolting	SA–574	4042	G40420	...
(**13**)	21	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...
(**13**)	22	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...
(**13**)	23	C–0.3Mo	Smls. tube	SA/EN 10216–2	16Mo3	...	...
	24	C–½Mo	Smls. tube	SA–209	T1b	K11422	...
	25	C–½Mo	Wld. tube	SA–250	T1b	K11422	...
	26	C–½Mo	Smls. tube	SA–209	T1	K11522	...
	27	C–½Mo	Smls. & wld. fittings	SA–234	WP1	K12821	...
	28	C–½Mo	Wld. tube	SA–250	T1	K11522	...
	29	C–½Mo	Smls. pipe	SA–335	P1	K11522	...
	30	C–½Mo	Forged pipe	SA–369	FP1	K11522	...
	31	C–½Mo	Smls. tube	SA–209	T1a	K12023	...
	32	C–½Mo	Wld. tube	SA–250	T1a	K12023	...
	33	C–½Mo	Castings	SA–217	WC1	J12524	...
	34	C–½Mo	Castings	SA–352	LC1	J12522	...
	35	C–½Mo	Cast pipe	SA–426	CP1	J12521	...
	36	C–½Mo	Plate	SA–204	A	K11820	...
	37	C–½Mo	Wld. pipe	SA–672	L65	K11820	...
	38	C–½Mo	Wld. pipe	SA–691	CM–65	K11820	...
	39	C–½Mo	Forgings	SA–182	F1	K12822	...
	40	C–½Mo	Plate	SA–204	B	K12020	...
	41	C–½Mo	Forgings	SA–336	F1	K12520	...
	42	C–½Mo	Wld. pipe	SA–672	L70	K12020	...
	43	C–½Mo	Wld. pipe	SA–691	CM–70	K12020	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	36 < t ≤ 60	520	340	...
2	16 < t ≤ 36	530	360	...
3	10 ≤ t ≤ 16	530	370	...
4	...	550	415	...
5	≤50	414	345	...
6	≤50	414	345	...
7	≤40	483	414	...
8	≤40	483	414	...
9	≤25	552	483	...
10	≤25	552	483	...
11	≤20	621	552	...
12	≤20	621	552	...
13	...	380	205	...
14	...	380	170	...
15	≤64	860	725	...
16	≥16	1170	930	...
17	≥16	1170	930	...
18	≥16	1170	930	...
19	≤13	1240	965	...
20	≤13	1240	965	...
21	40 < t ≤ 60	450	260	...
22	16 < t ≤ 40	450	270	...
23	t ≤ 16	450	280	...
24	...	365	195	...
25	...	365	195	...
26	...	380	205	...
27	...	380	205	...
28	...	380	205	...
29	...	380	205	...
30	...	380	205	...
31	...	415	220	...
32	...	415	220	...
33	...	450	240	...
34	...	450	240	...
35	...	450	240	...
36	...	450	255	...
37	...	450	255	...
38	...	450	255	...
39	...	485	275	...
40	...	485	275	...
41	...	485	275	...
42	...	485	275	...
43	...	485	275	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	340	327	309	294	280	268	257	249	242	237
2	360	346	327	311	297	284	272	263	257	251
3	370	356	336	320	305	291	280	271	264	258
4	414	397	375	358	342	327	314	303	294	288
5	345	324	314	309	305	300	295	290	284	277
6	345	324	314	309	305	300	295	290	284	277
7	414	389	377	371	366	360	355	348	340	332
8	414	389	377	371	366	360	355	348	340	332
9	483	454	440	433	427	421	414	406	397	387
10	483	454	440	433	427	421	414	406	397	387
11	552	519	503	495	488	481	473	464	454	443
12	552	519	503	495	488	481	473	464	454	443
13	207	189	176	169	165	163	161	161	161	161
14	172	157	147	141	138	136	134	134	134	134
15	724	690	659	648	640	631	620	609	596	581
16	931	902	870	853	838	825	813	801	790	779
17	931	902	870	853	838	825	813	801	790	779
18	931	902	870	853	838	825	813	801	790	779
19	965	935	902	884	869	856	843	831	819	808
20	965	935	902	884	869	856	843	831	819	808
21	260	250	243	238	234	230	227	224	221	218
22	270	260	252	248	243	239	236	232	229	226
23	280	270	262	257	252	248	244	241	238	234
24	193	186	181	177	174	171	169	166	164	161
25	193	186	181	177	174	171	169	166	164	161
26	207	199	193	190	187	184	180	178	175	173
27	207	199	193	190	187	184	180	178	175	173
28	207	199	193	190	187	184	180	178	175	173
29	207	199	193	190	187	184	180	178	175	173
30	207	199	193	190	187	184	180	178	175	173
31	221	212	206	202	199	196	193	190	187	185
32	221	212	206	202	199	196	193	190	187	185
33	241	232	226	221	218	214	211	208	205	202
34	241	232	226	221	218	214	211	208	205	202
35	241	232	226	221	218	214	211	208	205	202
36	255	246	239	234	230	226	223	219	216	213
37	255	246	239	234	230	226	223	219	216	213
38	255	246	239	234	230	226	223	219	216	213
39	276	266	258	253	249	245	241	237	234	231
40	276	266	258	253	249	245	241	237	234	231
41	276	266	258	253	249	245	241	237	234	231
42	276	266	258	253	249	245	241	237	234	231
43	276	266	258	253	249	245	241	237	234	231

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	234	230	227	223	218	212	204	194	184	174	(**13**)
2	247	244	240	236	231	224	216	206	195	184	(**13**)
3	254	251	247	243	237	230	222	212	200	189	(**13**)
4	283	279	276	272	266	259	249	237	218	214	
5	269	261	253	...	...	...	...	...	...	...	
6	269	261	253	...	...	...	...	...	...	...	
7	323	314	304	...	...	...	...	...	...	...	
8	323	314	304	...	...	...	...	...	...	...	
9	377	366	355	...	...	...	...	...	...	...	
10	377	366	355	...	...	...	...	...	...	...	
11	431	418	405	...	...	...	...	...	...	...	
12	431	418	405	...	...	...	...	...	...	...	
13	161	161	161	160	158	...	...	...	...	...	
14	134	134	134	134	132	...	...	...	...	...	
15	565	549	532	516	501	486	473	461	450	437	
16	768	757	744	730	714	697	677	656	631	604	
17	768	757	744	730	714	697	677	656	631	604	
18	768	757	744	730	714	697	677	656	631	604	
19	797	785	771	757	741	722	702	679	654	626	
20	797	785	771	757	741	722	702	679	654	626	
21	215	211	208	204	200	195	189	183	176	169	(**13**)
22	223	219	216	212	207	202	196	190	183	175	(**13**)
23	231	228	224	220	215	210	204	197	190	182	(**13**)
24	159	157	154	151	148	144	141	136	131	125	
25	159	157	154	151	148	144	141	136	131	125	
26	170	168	165	162	159	155	150	146	140	134	
27	170	168	165	162	159	155	150	146	140	134	
28	170	168	165	162	159	155	150	146	140	134	
29	170	168	165	162	159	155	150	146	140	134	
30	170	168	165	162	159	155	150	146	140	134	
31	182	180	176	173	169	165	161	155	149	143	
32	182	180	176	173	169	165	161	155	149	143	
33	199	196	193	189	185	181	175	170	163	157	
34	199	196	193	189	185	181	175	170	163	157	
35	199	196	193	189	185	181	175	170	163	157	
36	210	207	204	200	196	191	186	180	173	166	
37	210	207	204	200	196	191	186	180	173	166	
38	210	207	204	200	196	191	186	180	173	166	
39	228	224	220	216	211	207	200	194	187	179	
40	228	224	220	216	211	207	200	194	187	179	
41	228	224	220	216	211	207	200	194	187	179	
42	228	224	220	216	211	207	200	194	187	179	
43	228	224	220	216	211	207	200	194	187	179	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	C–½Mo	Plate	SA–204	C	K12320	...
2	C–½Mo	Wld. pipe	SA–672	L75	K12320	...
3	C–½Mo	Wld. pipe	SA–691	CM–75	K12320	...
4	½Cr–⅕Mo	Forgings	SA–372	G	K13049	70
5	½Cr–⅕Mo	Forgings	SA–372	H	K13547	70
6	½Cr–⅕Mo–V	Plate	SA–517	B	K11630	...
7	½Cr–¼Mo–Si	Plate	SA–517	A	K11856	...
8	½Cr–¼Mo–Si	Forgings	SA–592	A	K11856	...
9	½Cr–½Mo	Smls. pipe	SA–335	P2	K11547	...
10	½Cr–½Mo	Forged pipe	SA–369	FP2	K11547	...
11	½Cr–½Mo	Plate	SA–387	2	K12143	1
12	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...
13	½Cr–½Mo	Smls. tube	SA–213	T2	K11547	...
14	½Cr–½Mo	Cast pipe	SA–426	CP2	J11547	...
15	½Cr–½Mo	Forgings	SA–182	F2	K12122	...
16	½Cr–½Mo	Plate	SA–387	2	K12143	2
17	½Cr–½Mo	Wld. pipe	SA–691	½CR	K12143	...
18	½Cr–1¼Mn–Si	Plate	SA–202	A	K11742	...
19	½Cr–1¼Mn–Si	Plate	SA–202	B	K12542	...
20	¾Cr–½Ni–Cu	Wld. tube	SA–423	1	K11535	...
21	¾Cr–¾Ni–Cu–Al	Pipe	SA–333	4	K11267	...
22	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...
23	1Cr–⅕Mo	Bolting	SA–193	B7M	G41400	...
24	1Cr–⅕Mo	Bolting	SA–320	L7M	G41400	...
25	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...
26	1Cr–⅕Mo	Forgings	SA–372	E	K13047	70
27	1Cr–⅕Mo	Forgings	SA–372	F	G41350	70
28	1Cr–⅕Mo	Forgings	SA–372	J	K13548	70
29	1Cr–⅕Mo	Bolting	SA–193	B7	G41400	...
30	1Cr–⅕Mo	Bolting	SA–320	L7	G41400	...
31	1Cr–⅕Mo	Forgings	SA–372	J	G41370	110
(**13**) 32	1Cr–⅕Mo	Bolting	SA–574	4137	G41370	...
(**13**) 33	1Cr–⅕Mo	Bolting	SA–574	4137	G41370	...
34	1Cr–½Mo	Plate	SA–387	12	K11757	1
35	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...
36	1Cr–½Mo	Cast pipe	SA–426	CP12	J11562	...
37	1Cr–½Mo	Forgings	SA–182	F12	K11562	1
38	1Cr–½Mo	Smls. tube	SA–213	T12	K11562	...
39	1Cr–½Mo	Smls. & wld. fittings	SA–234	WP12	K12062	1
40	1Cr–½Mo	Smls. pipe	SA–335	P12	K11562	...
41	1Cr–½Mo	Forged pipe	SA–369	FP12	K11562	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	295	...
2	...	515	295	...
3	...	515	295	...
4	...	825	485	...
5	...	825	485	...
6	≤32	795	690	...
7	≤32	795	690	...
8	≤64	795	690	...
9	...	380	205	...
10	...	380	205	...
11	...	380	230	...
12	...	380	230	...
13	...	415	205	...
14	...	415	205	...
15	...	485	275	...
16	...	485	310	...
17	...	485	310	...
18	...	515	310	...
19	...	585	325	...
20	...	415	255	...
21	...	415	240	...
22	$100 < t \le 175$	690	515	...
23	≤64	690	550	...
24	≤64	690	550	...
25	$64 < t \le 100$	795	655	...
26	...	825	485	...
27	...	825	485	...
28	...	825	485	...
29	≤64	860	725	...
30	≤64	860	725	...
31	...	930	760	...
32	≥16	1170	930	...
33	≤13	1240	1035	...
34	...	380	230	...
35	...	380	230	...
36	...	415	205	...
37	...	415	220	...
38	...	415	220	...
39	...	415	220	...
40	...	415	220	...
41	...	415	220	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	296	286	277	272	267	263	259	255	252	248
2	296	286	277	272	267	263	259	255	252	248
3	296	286	277	272	267	263	259	255	252	248
4	483	462	447	439	433	427	421	415	410	404
5	483	462	447	439	433	427	421	415	410	404
6	689	670	656	646	637	629	621	614	607	600
7	689	670	656	646	637	629	621	614	607	600
8	689	670	656	646	637	629	621	614	607	600
9	207	199	193	190	187	184	180	178	175	173
10	207	199	193	190	187	184	180	178	175	173
11	228	219	213	209	205	202	198	196	193	191
12	228	219	213	209	205	202	198	196	193	191
13	207	199	193	190	187	184	180	178	175	173
14	207	199	193	190	187	184	180	178	175	173
15	276	266	258	253	249	245	241	237	234	231
16	310	299	290	285	280	275	271	267	263	260
17	310	299	290	285	280	275	271	267	263	260
18	310	292	283	278	274	270	266	260	254	247
19	324	305	295	290	287	282	277	272	266	258
20	255	242	234	230	227	225	223	221	219	217
21	241	228	222	218	216	214	211	209	207	205
22	517	498	479	470	463	457	451	445	438	432
23	552	532	511	501	494	488	482	475	467	461
24	552	532	511	501	494	488	482	475	467	461
25	655	631	606	595	586	579	572	564	556	547
26	483	462	447	439	433	427	421	415	410	404
27	483	462	447	439	433	427	421	415	410	404
28	483	462	447	439	433	427	421	415	410	404
29	724	698	671	658	648	640	632	623	614	605
30	724	698	671	658	648	640	632	623	614	605
31	758	725	703	690	679	670	661	652	644	634
32	930	890	863	847	833	822	811	800	790	778
33	1035	990	960	942	927	915	903	890	879	866
34	228	214	204	198	194	189	185	182	180	177
35	228	214	204	198	194	189	185	182	180	177
36	207	194	185	180	176	172	169	166	163	161
37	221	207	198	192	187	183	180	177	174	172
38	221	207	198	192	187	183	180	177	174	172
39	221	207	198	192	187	183	180	177	174	172
40	221	207	198	192	187	183	180	177	174	172
41	221	207	198	192	187	183	180	177	174	172

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	245	241	237	232	227	222	216	209	201	192
2	245	241	237	232	227	222	216	209	201	192
3	245	241	237	232	227	222	216	209	201	192
4	396	389	379	368	356	340	323	302	278	249
5	396	389	379	368	356	340	323	302	278	249
6	594	587	579	571	561	549	534	517	496	470
7	594	587	579	571	561	549	534	517	496	470
8	594	587	579	571	561	549	534	517	496	470
9	170	168	165	162	159	155	150	146	140	134
10	170	168	165	162	159	155	150	146	140	134
11	188	185	182	179	175	171	166	160	154	148
12	188	185	182	179	175	171	166	160	154	148
13	170	168	165	162	159	155	150	146	140	134
14	170	168	165	162	159	155	150	146	140	134
15	228	224	220	216	211	207	200	194	187	179
16	256	252	248	243	238	232	226	219	210	201
17	256	252	248	243	238	232	226	219	210	201
18	239	229	218	207	195	183	170	158	146	135
19	249	240	229	217	204	191	178	165	153	141
20	214	212	209	206	203	199	194	188	180	170
21	203	200	198	195	192	189	184	178	170	160
22	425	416	406	395	381	365	346	323	297	268
23	454	444	433	421	407	389	369	344	317	285
24	454	444	433	421	407	389	369	344	317	285
25	538	527	514	501	483	463	439	409	376	339
26	396	389	379	368	356	340	323	302	278	249
27	396	389	379	368	356	340	323	302	278	249
28	396	389	379	368	356	340	323	302	278	249
29	595	583	568	553	534	511	485	452	416	374
30	595	583	568	553	534	511	485	452	416	374
31	623	611	596	579	559	535	507	474	436	392
32	764	750	731	710	686	656	622	582	535	481 (**13**)
33	851	834	814	791	763	731	692	647	595	535 (**13**)
34	174	172	170	168	165	163	160	156	152	147
35	174	172	170	168	165	163	160	156	152	147
36	159	157	155	153	151	148	145	142	138	134
37	170	167	165	163	161	158	155	151	147	142
38	170	167	165	163	161	158	155	151	147	142
39	170	167	165	163	161	158	155	151	147	142
40	170	167	165	163	161	158	155	151	147	142
41	170	167	165	163	161	158	155	151	147	142

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
(13)	1	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...
(13)	2	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...
(13)	3	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	Norm. & temp.
(13)	4	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...
(13)	5	1Cr–½Mo	Smls. tube	SA/EN 10216–2	13CrMo4–5	...	...
(13)	6	1Cr–½Mo	Smls. tube	SA/EN 10216–2	13CrMo4–5	...	...
	7	1Cr–½Mo	Plate	SA–387	12	K11757	2
	8	1Cr–½Mo	Wld. pipe	SA–691	1CR	K11757	...
(13)	9	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	Norm. & temp.
(13)	10	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...
(13)	11	1Cr–½Mo	Plate	SA/GB 713	15CrMoR	...	Norm. & temp.
(13)	12	1Cr–½Mo	Plate	SA/EN 10028–2	13CrMo4–5	...	...
	13	1Cr–½Mo	Forgings	SA–182	F12	K11564	2
	14	1Cr–½Mo	Forgings	SA–336	F12	K11564	...
	15	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...
	16	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...
	17	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	5
	18	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	5
	19	1Cr–½Mo–V	Bolting	SA–193	B16	K14072	...
	20	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	4
	21	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	3
	22	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	2
	23	1Cr–½Mo–V	Bolting	SA–540	B21	K14073	1
	24	1Cr–V	Smls. tube	SA–213	T17	K12047	...
	25	1¼Cr–½Mo	Castings	SA–217	WC6	J12072	...
	26	1¼Cr–½Mo	Cast pipe	SA–426	CP11	J12072	...
	27	1¼Cr–½Mo	Bar	SA–739	B11	K11797	...
	28	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11597	1
	29	1¼Cr–½Mo–Si	Smls. tube	SA–213	T11	K11597	...
	30	1¼Cr–½Mo–Si	Smls. & wld. fittings	SA–234	WP11	...	1
	31	1¼Cr–½Mo–Si	Smls. pipe	SA–335	P11	K11597	...
	32	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11597	1
	33	1¼Cr–½Mo–Si	Forged pipe	SA–369	FP11	K11597	...
	34	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	1
	35	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...
	36	1¼Cr–½Mo–Si	Forgings	SA–182	F11	K11572	2
	37	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	2
(13)	38	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT
(13)	39	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT
(13)	40	1¼Cr–½Mo–Si	Plate	SA/EN 10028–2	13CrMoSi5–5	...	QT
	41	1¼Cr–½Mo–Si	Forgings	SA–336	F11	K11572	3
	42	1¼Cr–½Mo–Si	Plate	SA–387	11	K11789	2
	43	1¼Cr–½Mo–Si	Wld. pipe	SA–691	1¼CR	K11789	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	150 < t ≤ 250	420	245	...
2	100 < t ≤ 150	430	255	...
3	100 < t ≤ 150	440	225	...
4	60 < t ≤ 100	440	270	...
5	40 < t ≤ 60	440	280	...
6	t ≤ 40	440	290	...
7	...	450	275	...
8	...	450	275	...
9	60 < t ≤ 100	450	275	...
10	16 < t ≤ 60	450	290	...
11	6 ≤ t ≤ 60	450	295	...
12	t ≤ 16	450	300	...
13	...	485	275	...
14	...	485	275	...
15	100 < t ≤ 175	690	585	...
16	64 < t ≤ 100	760	655	...
17	50 < t ≤ 200	795	690	...
18	≤50	825	725	...
19	≤64	860	725	...
20	≤150	930	825	...
21	≤150	1000	895	...
22	≤100	1070	965	...
23	≤100	1140	1035	...
24	...	415	205	...
25	...	485	275	...
26	...	485	275	...
27	...	485	310	...
28	...	415	205	...
29	...	415	205	...
30	...	415	205	...
31	...	415	205	...
32	...	415	205	...
33	...	415	205	...
34	...	415	240	...
35	...	415	240	...
36	...	485	275	...
37	...	485	275	...
38	100 < t ≤ 250	490	380	...
39	60 < t ≤ 100	500	390	...
40	≤60	510	400	...
41	...	515	310	...
42	...	515	310	...
43	...	515	310	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	245	230	220	214	208	204	200	196	193	191
2	255	239	229	222	217	212	208	204	201	198
3	225	211	202	196	191	187	183	180	177	175
4	270	253	242	235	230	224	220	216	213	210
5	280	266	257	251	246	241	236	233	229	225
6	290	276	266	260	254	249	245	241	237	233
7	276	259	248	240	234	229	225	221	218	215
8	276	259	248	240	234	229	225	221	218	215
9	275	258	247	240	234	229	224	220	217	214
10	290	272	260	253	247	241	236	232	229	226
11	295	277	265	257	251	245	240	236	233	229
12	300	282	269	262	255	249	244	240	237	233
13	276	259	248	240	234	229	225	221	218	215
14	276	259	248	240	234	229	225	221	218	215
15	586	575	563	557	551	544	538	531	525	518
16	655	643	630	622	615	608	600	593	586	579
17	689	678	664	655	646	639	632	625	617	609
18	724	711	696	688	680	672	664	656	648	640
19	724	711	696	688	680	672	664	656	648	640
20	827	814	797	786	776	767	759	750	740	731
21	896	882	863	851	840	831	822	812	802	792
22	965	950	930	917	905	895	885	875	864	852
23	1030	1020	996	982	970	959	949	937	925	913
24	207	197	190	185	181	178	175	172	169	166
25	276	262	253	247	242	237	233	229	225	222
26	276	262	253	247	242	237	233	229	225	222
27	310	295	284	278	272	267	262	258	253	249
28	207	197	190	185	181	178	175	172	169	166
29	207	197	190	185	181	178	175	172	169	166
30	207	197	190	185	181	178	175	172	169	166
31	207	197	190	185	181	178	175	172	169	166
32	207	197	190	185	181	178	175	172	169	166
33	207	197	190	185	181	178	175	172	169	166
34	241	230	221	216	211	207	204	201	197	194
35	241	230	221	216	211	207	204	201	197	194
36	276	262	253	247	242	237	233	229	225	222
37	276	262	253	247	242	237	233	229	225	222
38	380	372	365	360	355	349	343	338	332	327
39	390	382	375	369	364	358	353	347	341	335
40	400	391	384	379	373	367	362	356	350	344
41	310	295	284	278	272	267	262	258	253	249
42	310	295	284	278	272	267	262	258	253	249
43	310	295	284	278	272	267	262	258	253	249

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
									Ferrous Materials (Cont'd)		
1	188	186	184	181	178	175	172	168	163	158	(13)
2	196	193	191	188	186	182	179	175	170	165	(13)
3	173	171	169	166	164	161	158	154	150	145	(13)
4	207	205	202	200	197	193	189	185	180	174	(13)
5	222	218	215	211	207	202	197	192	186	179	(13)
6	230	226	222	218	214	209	204	199	192	185	(13)
7	212	209	207	204	201	197	194	189	184	178	
8	212	209	207	204	201	197	194	189	184	178	
9	211	209	206	203	200	197	193	188	183	177	(13)
10	223	220	217	214	211	208	203	199	193	187	(13)
11	227	224	221	218	215	211	207	202	197	190	(13)
12	230	228	225	222	218	215	210	206	200	194	(13)
13	212	209	207	204	201	197	194	189	184	178	
14	212	209	207	204	201	197	194	189	184	178	
15	511	504	496	488	479	469	457	443	427	407	
16	571	563	555	546	535	524	511	495	477	455	
17	601	594	585	575	564	551	536	520	502	480	
18	631	623	613	603	592	579	565	547	528	503	
19	631	623	613	603	592	579	565	547	528	503	
20	721	712	702	690	677	662	644	624	602	576	
21	782	772	761	747	734	716	697	676	653	624	
22	842	831	819	805	790	771	751	728	702	672	
23	902	891	877	862	847	827	805	780	753	720	
24	164	161	158	155	153	149	145	142	137	132	
25	219	215	211	208	204	199	195	189	183	176	
26	219	215	211	208	204	199	195	189	183	176	
27	246	242	238	234	229	224	219	213	206	198	
28	164	161	158	155	153	149	145	142	137	132	
29	164	161	158	155	153	149	145	142	137	132	
30	164	161	158	155	153	149	145	142	137	132	
31	164	161	158	155	153	149	145	142	137	132	
32	164	161	158	155	153	149	145	142	137	132	
33	164	161	158	155	153	149	145	142	137	132	
34	191	188	185	182	178	174	170	165	160	154	
35	191	188	185	182	178	174	170	165	160	154	
36	219	215	211	208	204	199	195	189	183	176	
37	219	215	211	208	204	199	195	189	183	176	
38	321	315	309	303	297	291	283	276	267	258	(13)
39	329	324	318	311	305	298	291	283	274	265	(13)
40	338	332	326	319	313	306	298	290	281	272	(13)
41	246	242	238	234	229	224	219	213	206	198	
42	246	242	238	234	229	224	219	213	206	198	
43	246	242	238	234	229	224	219	213	206	198	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...
	2	1¾Cr–½Mo–Cu	Forgings	SA–592	E	K11695	...
	3	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...
	4	1¾Cr–½Mo–Ti	Plate	SA–517	E	K21604	...
	5	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	1
	6	2¼Cr–1Mo	Smls. tube	SA–213	T22	K21590	...
	7	2¼Cr–1Mo	Smls. & wld. fittings	SA–234	WP22	K21590	1
	8	2¼Cr–1Mo	Smls. pipe	SA–335	P22	K21590	...
	9	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	1
	10	2¼Cr–1Mo	Forged pipe	SA–369	FP22	K21590	...
	11	2¼Cr–1Mo	Plate	SA–387	22	K21590	1
	12	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...
(**13**)	13	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
(**13**)	14	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
(**13**)	15	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
(**13**)	16	2¼Cr–1Mo	Smls. tube	SA/EN 10216–2	10CrMo9–10	...	...
(**13**)	17	2¼Cr–1Mo	Smls. tube	SA/EN 10216–2	10CrMo9–10	...	...
(**13**)	18	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
(**13**)	19	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
(**13**)	20	2¼Cr–1Mo	Plate	SA/EN 10028–2	10CrMo9–10	...	...
	21	2¼Cr–1Mo	Castings	SA–217	WC9	J21890	...
	22	2¼Cr–1Mo	Cast pipe	SA–426	CP22	J21890	...
	23	2¼Cr–1Mo	Forgings	SA–182	F22	K21590	3
	24	2¼Cr–1Mo	Forgings	SA–336	F22	K21590	3
	25	2¼Cr–1Mo	Plate	SA–387	22	K21590	2
	26	2¼Cr–1Mo	Wld. pipe	SA–691	2¼CR	K21590	...
	27	2¼Cr–1Mo	Bar	SA–739	B22	K21390	...
	28	2¼Cr–1Mo	Castings	SA–487	8	J22091	A
	29	2¼Cr–1Mo	Forgings	SA–508	22	K21590	3
	30	2¼Cr–1Mo	Forgings	SA–541	22	K21390	3
	31	2¼Cr–1Mo	Plate	SA–542	B	K21590	4
	32	2¼Cr–1Mo	Forgings	SA–541	22	K21390	4
	33	2¼Cr–1Mo–V	Forgings	SA–182	F22V	K31835	...
	34	2¼Cr–1Mo–V	Forgings	SA–336	F22V	K31835	...
	35	2¼Cr–1Mo–V	Forgings	SA–541	22V	K31835	...
	36	2¼Cr–1Mo–V	Plate	SA–542	D	K31835	4a
	37	2¼Cr–1Mo–V	Plate	SA–832	22V	K31835	...
	38	3Cr–1Mo	Smls. tube	SA–213	T21	K31545	...
	39	3Cr–1Mo	Smls. pipe	SA–335	P21	K31545	...
	40	3Cr–1Mo	Forgings	SA–336	F21	K31545	1
	41	3Cr–1Mo	Forged pipe	SA–369	FP21	K31545	...
	42	3Cr–1Mo	Plate	SA–387	21	K31545	1
	43	3Cr–1Mo	Cast pipe	SA–426	CP21	J31545	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	64 < t ≤ 100	725	620	...
2	≤64	795	690	...
3	64 < t ≤ 150	725	620	...
4	≤64	795	690	...
5	...	415	205	...
6	...	415	205	...
7	...	415	205	...
8	...	415	205	...
9	...	415	205	...
10	...	415	205	...
11	...	415	205	...
12	...	415	205	...
13	150 < t ≤ 250	450	250	...
14	100 < t ≤ 150	460	260	...
15	60 < t ≤ 100	470	280	...
16	40 < t ≤ 60	480	270	...
17	t ≤ 40	480	280	...
18	40 < t ≤ 60	480	290	...
19	16 < t ≤ 40	480	300	...
20	t ≤ 16	480	310	...
21	...	485	275	...
22	...	485	275	...
23	...	515	310	...
24	...	515	310	...
25	...	515	310	...
26	...	515	310	...
27	...	515	310	...
28	...	585	380	...
29	...	585	380	...
30	...	585	380	...
31	...	585	380	...
32	...	725	585	...
33	...	585	415	...
34	...	585	415	...
35	...	585	415	...
36	...	585	415	...
37	...	585	415	...
38	...	415	205	...
39	...	415	205	...
40	...	415	205	...
41	...	415	205	...
42	...	415	205	...
43	...	415	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	621	604	591	581	573	566	560	554	548	543
2	689	670	656	646	637	629	622	615	609	603
3	621	604	591	581	573	566	560	554	548	543
4	689	670	656	646	637	629	622	615	609	603
5	207	197	192	190	187	186	185	185	185	185
6	207	197	192	190	187	186	185	185	185	185
7	207	197	192	190	187	186	185	185	185	185
8	207	197	192	190	187	186	185	185	185	185
9	207	197	192	190	187	186	185	185	185	185
10	207	197	192	190	187	186	185	185	185	185
11	207	197	192	190	187	186	185	185	185	185
12	207	197	192	190	187	186	185	185	185	185
13	250	236	227	223	218	215	212	210	208	206
14	260	246	237	231	227	224	221	218	216	214
15	280	264	255	249	245	241	238	235	233	231
16	270	256	248	245	242	239	237	235	233	231
17	280	266	258	254	251	248	246	244	242	240
18	290	274	264	258	253	249	246	244	241	239
19	300	283	273	267	262	258	255	252	249	247
20	310	293	282	276	271	267	263	260	258	255
21	276	262	254	250	247	244	242	240	238	236
22	276	262	254	250	247	244	242	240	238	236
23	310	293	282	276	271	267	263	260	258	256
24	310	293	282	276	271	267	263	260	258	256
25	310	293	282	276	271	267	263	260	258	256
26	310	293	282	276	271	267	263	260	258	256
27	310	293	282	276	271	267	263	260	258	256
28	379	360	349	343	339	336	333	330	328	325
29	379	372	365	361	357	353	350	346	343	339
30	379	372	365	361	357	353	350	346	343	339
31	379	372	365	361	357	353	350	346	343	339
32	586	574	560	554	549	543	539	534	530	526
33	414	412	410	407	404	400	396	392	388	383
34	414	412	410	407	404	400	396	392	388	383
35	414	412	410	407	404	400	396	392	388	383
36	414	412	410	407	404	400	396	392	388	383
37	414	412	410	407	404	400	396	392	388	383
38	207	197	192	190	187	186	185	185	185	185
39	207	197	192	190	187	186	185	185	185	185
40	207	197	192	190	187	186	185	185	185	185
41	207	197	192	190	187	186	185	185	185	185
42	207	197	192	190	187	186	185	185	185	185
43	207	197	192	190	187	186	185	185	185	185

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	538	534	530	525	521	515	509	502	494	483
2	598	593	589	584	579	573	566	558	548	536
3	538	534	530	525	521	515	509	502	494	483
4	598	593	589	584	579	573	566	558	548	536
5	185	185	185	185	185	184	181	178	173	167
6	185	185	185	185	185	184	181	178	173	167
7	185	185	185	185	185	184	181	178	173	167
8	185	185	185	185	185	184	181	178	173	167
9	185	185	185	185	185	184	181	178	173	167
10	185	185	185	185	185	184	181	178	173	167
11	185	185	185	185	185	184	181	178	173	167
12	185	185	185	185	185	184	181	178	173	167
13	204	202	200	198	195	191	187	182	176	169 (**13**)
14	212	210	208	205	202	199	194	189	183	176 (**13**)
15	229	227	224	221	218	214	209	204	197	190 (**13**)
16	229	227	224	222	219	215	211	206	199	191 (**13**)
17	238	235	233	230	227	223	219	213	207	198 (**13**)
18	237	235	232	229	226	222	217	211	204	196 (**13**)
19	245	243	240	237	233	229	224	218	211	203 (**13**)
20	253	251	248	245	241	237	232	225	218	210 (**13**)
21	234	231	229	226	223	220	215	210	204	195
22	234	231	229	226	223	220	215	210	204	195
23	253	251	248	245	241	237	232	225	218	210
24	253	251	248	245	241	237	232	225	218	210
25	253	251	248	245	241	237	232	225	218	210
26	253	251	248	245	241	237	232	225	218	210
27	253	251	248	245	241	237	232	225	218	210
28	322	319	316	312	307	302	296	289	280	269
29	335	331	326	322	317	312	306	300	...	...
30	335	331	326	322	317	312	306	300	...	...
31	335	331	326	322	317	312	306	300	...	...
32	521	517	511	505	498	490	480	470	457	442
33	377	372	366	360	353	346	339	332	324	...
34	377	372	366	360	353	346	339	332	324	...
35	377	372	366	360	353	346	339	332	324	...
36	377	372	366	360	353	346	339	332	324	...
37	377	372	366	360	353	346	339	332	324	...
38	185	185	185	185	185	184	181	178	173	167
39	185	185	185	185	185	184	181	178	173	167
40	185	185	185	185	185	184	181	178	173	167
41	185	185	185	185	185	184	181	178	173	167
42	185	185	185	185	185	184	181	178	173	167
43	185	185	185	185	185	184	181	178	173	167

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	3Cr–1Mo	Forgings	SA–182	F21	K31545	...
2	3Cr–1Mo	Forgings	SA–336	F21	K31545	3
3	3Cr–1Mo	Plate	SA–387	21	K31545	2
4	3Cr–1Mo–$^1/_4$V–Ti–B	Forgings	SA–182	F3V	K31830	...
5	3Cr–1Mo–$^1/_4$V–Ti–B	Forgings	SA–336	F3V	K31830	...
6	3Cr–1Mo–$^1/_4$V–Ti–B	Forgings	SA–508	3V	K31830	...
7	3Cr–1Mo–$^1/_4$V–Ti–B	Forgings	SA–541	3V	K31830	...
8	3Cr–1Mo–$^1/_4$V–Ti–B	Plate	SA–542	C	K31830	4a
9	3Cr–1Mo–$^1/_4$V–Ti–B	Plate	SA–832	21V	K31830	...
10	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–182	F3VCb	...	...
11	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–336	F3VCb	...	...
12	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–508	3VCb	...	...
13	3Cr–1Mo–$^1/_4$V–Cb–Ca	Forgings	SA–541	3VCb	...	...
14	3Cr–1Mo–$^1/_4$V–Cb–Ca	Plate	SA–542	E	...	4a
15	3Cr–1Mo–$^1/_4$V–Cb–Ca	Plate	SA–832	23V	...	...
16	5Cr–$^1/_2$Mo	Smls. tube	SA–213	T5	K41545	...
17	5Cr–$^1/_2$Mo	Smls. & wld. fittings	SA–234	WP5	K41545	...
18	5Cr–$^1/_2$Mo	Smls. pipe	SA–335	P5	K41545	...
19	5Cr–$^1/_2$Mo	Forged pipe	SA–369	FP5	K41545	...
20	5Cr–$^1/_2$Mo	Plate	SA–387	5	K41545	1
21	5Cr–$^1/_2$Mo	Wld. pipe	SA–691	5CR	K41545	...
22	5Cr–$^1/_2$Mo	Forgings	SA–336	F5	K41545	...
23	5Cr–$^1/_2$Mo	Forgings	SA–182	F5	K41545	...
24	5Cr–$^1/_2$Mo	Plate	SA–387	5	K41545	2
25	5Cr–$^1/_2$Mo	Forgings	SA–336	F5A	K42544	...
26	5Cr–$^1/_2$Mo	Castings	SA–217	C5	J42045	...
27	5Cr–$^1/_2$Mo	Cast pipe	SA–426	CP5	J42045	...
28	5Cr–$^1/_2$Mo	Forgings	SA–182	F5a	K42544	...
29	5Cr–$^1/_2$Mo	Bolting	SA–193	B5	K50100	...
30	5Cr–$^1/_2$Mo–Si	Smls. tube	SA–213	T5b	K51545	...
31	5Cr–$^1/_2$Mo–Si	Smls. pipe	SA–335	P5b	K51545	...
32	5Cr–$^1/_2$Mo–Ti	Smls. tube	SA–213	T5c	K41245	...
33	5Cr–$^1/_2$Mo–Ti	Smls. pipe	SA–335	P5c	K41245	...
34	9Cr–1Mo	Smls. tube	SA–213	T9	K90941	...
35	9Cr–1Mo	Fittings	SA–234	WP9	K90941	...
36	9Cr–1Mo	Smls. pipe	SA–335	P9	K90941	...
37	9Cr–1Mo	Forged pipe	SA–369	FP9	K90941	...
38	9Cr–1Mo	Forgings	SA–182	F9	K90941	...
39	9Cr–1Mo	Forgings	SA–336	F9	K90941	...
40	9Cr–1Mo	Castings	SA–217	C12	J82090	...
41	9Cr–1Mo	Cast pipe	SA–426	CP9	J82090	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	310	...
2	...	515	310	...
3	...	515	310	...
4	...	585	415	...
5	...	585	415	...
6	...	585	415	...
7	...	585	415	...
8	...	585	415	...
9	...	585	415	...
10	...	585	415	...
11	...	585	415	...
12	...	585	415	...
13	...	585	415	...
14	...	585	415	...
15	...	585	415	...
16	...	415	205	...
17	...	415	205	...
18	...	415	205	...
19	...	415	205	...
20	...	415	205	...
21	...	415	205	...
22	...	415	250	...
23	...	485	275	...
24	...	515	310	...
25	...	550	345	...
26	...	620	415	...
27	...	620	415	...
28	...	620	450	...
29	≤100	690	550	...
30	...	415	205	...
31	...	415	205	...
32	...	415	205	...
33	...	415	205	...
34	...	415	205	...
35	...	415	205	...
36	...	415	205	...
37	...	415	205	...
38	...	585	380	...
39	...	585	380	...
40	...	620	415	...
41	...	620	415	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	310	293	282	276	271	267	263	260	258	256
2	310	293	282	276	271	267	263	260	258	256
3	310	293	282	276	271	267	263	260	258	256
4	414	396	384	377	371	366	363	361	359	358
5	414	396	384	377	371	366	363	361	359	358
6	414	396	384	377	371	366	363	361	359	358
7	414	396	384	377	371	366	363	361	359	358
8	414	396	384	377	371	366	363	361	359	358
9	414	396	384	377	371	366	363	361	359	358
10	414	396	384	377	371	366	363	361	359	358
11	414	396	384	377	371	366	363	361	359	358
12	414	396	384	377	371	366	363	361	359	358
13	414	396	384	377	371	366	363	361	359	358
14	414	396	384	377	371	366	363	361	359	358
15	414	396	384	377	371	366	363	361	359	358
16	207	193	186	182	180	179	178	177	177	176
17	207	193	186	182	180	179	178	177	177	176
18	207	193	186	182	180	179	178	177	177	176
19	207	193	186	182	180	179	178	177	177	176
20	207	193	186	182	180	179	178	177	177	176
21	207	193	186	182	180	179	178	177	177	176
22	248	232	223	219	216	215	213	212	212	211
23	276	257	248	243	240	238	237	237	236	234
24	310	290	279	274	270	268	267	266	265	264
25	345	322	310	304	300	298	296	295	294	293
26	414	387	372	365	360	357	355	354	353	352
27	414	387	372	365	360	357	355	354	353	352
28	448	419	403	395	390	387	385	384	382	381
29	552	517	486	477	475	474	474	474	474	473
30	207	193	186	182	180	179	178	177	177	176
31	207	193	186	182	180	179	178	177	177	176
32	207	193	186	182	180	179	178	177	177	176
33	207	193	186	182	180	179	178	177	177	176
34	207	193	186	182	180	179	178	177	177	176
35	207	193	186	182	180	179	178	177	177	176
36	207	193	186	182	180	179	178	177	177	176
37	207	193	186	182	180	179	178	177	177	176
38	379	354	341	334	330	327	326	325	324	322
39	379	354	341	334	330	327	326	325	324	322
40	414	387	372	365	360	357	355	354	353	352
41	414	387	372	365	360	357	355	354	353	352

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	253	251	248	245	241	237	232	225	218	210
2	253	251	248	245	241	237	232	225	218	210
3	253	251	248	245	241	237	232	225	218	210
4	357	356	354	353	350	347	342	336	330	...
5	357	356	354	353	350	347	342	336	330	...
6	357	356	354	353	350	347	342	336	330	...
7	357	356	354	353	350	347	342	336	330	...
8	357	356	354	353	350	347	342	336	330	...
9	357	356	354	353	350	347	342	336	330	...
10	357	356	354	353	350	347	342	336	330	...
11	357	356	354	353	350	347	342	336	330	...
12	357	356	354	353	350	347	342	336	330	...
13	357	356	354	353	350	347	342	336	330	...
14	357	356	354	353	350	347	342	336	330	...
15	357	356	354	353	350	347	342	336	330	...
16	175	173	171	168	165	160	154	148	140	132
17	175	173	171	168	165	160	154	148	140	132
18	175	173	171	168	165	160	154	148	140	132
19	175	173	171	168	165	160	154	148	140	132
20	175	173	171	168	165	160	154	148	140	132
21	175	173	171	168	165	160	154	148	140	132
22	210	208	205	201	197	191	185	177	168	158
23	233	231	228	224	219	213	206	197	187	176
24	262	260	257	252	247	239	231	221	210	198
25	291	289	285	280	274	266	256	245	233	220
26	350	347	342	336	329	319	308	295	280	263
27	350	347	342	336	329	319	308	295	280	263
28	379	376	371	364	356	346	333	319	303	285
29	473	472	466	459	448	435	419	400	379	355
30	175	173	171	168	165	160	154	148	140	132
31	175	173	171	168	165	160	154	148	140	132
32	175	173	171	168	165	160	154	148	140	132
33	175	173	171	168	165	160	154	148	140	132
34	175	173	171	168	165	160	154	148	140	132
35	175	173	171	168	165	160	154	148	140	132
36	175	173	171	168	165	160	154	148	140	132
37	175	173	171	168	165	160	154	148	140	132
38	320	318	314	308	301	292	282	270	257	242
39	320	318	314	308	301	292	282	270	257	242
40	350	347	342	336	329	319	308	295	280	263
41	350	347	342	336	329	319	308	295	280	263

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	9Cr–1Mo–V	Forgings	SA–182	F91	K90901	...
2	9Cr–1Mo–V	Smls. tube	SA–213	T91	K90901	...
3	9Cr–1Mo–V	Fittings	SA–234	WP91	K90901	...
4	9Cr–1Mo–V	Smls. pipe	SA–335	P91	K90901	...
5	9Cr–1Mo–V	Forgings	SA–336	F91	K90901	...
6	9Cr–1Mo–V	Forged pipe	SA–369	FP91	K90901	...
7	9Cr–1Mo–V	Plate	SA–387	91	K90901	2
8	11Cr–Ti	Plate	SA–240	...	S40910	...
9	11Cr–Ti	Plate	SA–240	...	S40920	...
10	11Cr–Ti	Plate	SA–240	...	S40930	...
11	11Cr–Ti	Smls. & wld. tube	SA–268	TP409	S40900	...
12	12Cr	Plate	SA–1010	40	S41003	...
13	12Cr	Bar	SA–479	403	S40300	A
14	12Cr	Bar	SA–479	403	S40300	1
15	12Cr	Plate	SA–1010	50	S41003	...
16	12Cr–Al	Bar	SA/JIS G4303	SUS405	...	...
17	12Cr–Al	Plate	SA–240	405	S40500	...
18	12Cr–Al	Bar	SA–479	405	S40500	...
19	12Cr–Al	Smls. & wld. tube	SA–268	TP405	S40500	...
20	12Cr–9Ni–2Cu–1Ti	Bar	SA–564	XM–16	S45500	H1000
21	12Cr–9Ni–2Cu–1Ti	Forgings	SA–705	XM–16	S45500	H1000
22	12Cr–9Ni–2Cu–1Ti	Bar	SA–564	XM–16	S45500	H950
23	12Cr–9Ni–2Cu–1Ti	Forgings	SA–705	XM–16	S45500	H950
24	12Cr–9Ni–2Cu–1Ti	Bar	SA–564	XM–16	S45500	H900
25	12Cr–9Ni–2Cu–1Ti	Forgings	SA–705	XM–16	S45500	H900
26	12Cr–Ti	Smls. & wld. tube	SA–268	...	S40800	...
27	13Cr	Plate	SA–240	410S	S41008	...
28	13Cr	Smls. & wld. tube	SA–268	TP410	S41000	...
29	13Cr	Plate	SA–240	410	S41000	...
30	13Cr	Forgings	SA–182	F6a	S41000	1
31	13Cr	Bar	SA–479	410	S41000	...
32	13Cr	Bar	SA–479	410	S41000	A
33	13Cr	Bar	SA–479	410	S41000	1
34	13Cr	Forgings	SA–182	F6a	S41000	2
35	13Cr	Castings	SA–217	CA15	J91150	...
36	13Cr	Cast pipe	SA–426	CPCA15	J91150	...
37	13Cr	Bolting	SA–193	B6	S41000	...
38	13Cr–4Ni	Castings	SA–487	CA6NM	J91540	A
39	13Cr–4Ni	Forgings	SA–182	F6NM	S41500	...
(**13**) 40	13Cr–4Ni	Bar	SA–479	...	S41500	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	585	415	...
2	...	585	415	...
3	...	585	415	...
4	...	585	415	...
5	...	585	415	...
6	...	585	415	...
7	...	585	415	...
8	...	380	170	...
9	...	380	170	...
10	...	380	170	...
11	...	380	170	...
12	≤19	455	275	...
13	...	485	275	...
14	...	485	275	...
15	≤19	485	345	...
16	...	410	174	...
17	...	415	170	...
18	...	415	170	...
19	...	415	205	...
20	...	1410	1280	(3)
21	≥13	1410	1280	(3), (4)
22	...	1520	1410	(3)
23	≥13	1520	1410	(3), (4)
24	...	1620	1520	(3)
25	≥13	1620	1520	(3), (4)
26	...	380	205	...
27	...	415	205	...
28	...	415	205	...
29	...	450	205	...
30	...	485	275	...
31	...	485	275	...
32	...	485	275	...
33	...	485	275	...
34	...	585	380	...
35	...	620	450	...
36	...	620	450	...
37	≤100	760	585	...
38	...	760	550	...
39	...	795	620	...
40	...	795	620	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	414	394	384	380	378	378	377	377	377	377
2	414	394	384	380	378	378	377	377	377	377
3	414	394	384	380	378	378	377	377	377	377
4	414	394	384	380	378	378	377	377	377	377
5	414	394	384	380	378	378	377	377	377	377
6	414	394	384	380	378	378	377	377	377	377
7	414	394	384	380	378	378	377	377	377	377
8	172	159	148	141	135	130	125	122	120	118
9	172	159	148	141	135	130	125	122	120	118
10	172	159	148	141	135	130	125	122	120	118
11	172	159	148	141	135	130	125	122	120	118
12	276	276	274	263	253	248	235	229	224	220
13	276	261	252	248	245	243	241	239	238	236
14	276	261	252	248	245	243	241	239	238	236
15	345	345	342	329	316	304	294	286	280	275
16	172	163	158	155	153	152	150	150	149	147
17	172	163	158	155	153	152	150	150	149	147
18	172	163	158	155	153	152	150	150	149	147
19	207	196	189	186	183	182	181	180	178	177
20	1276	...	...	...	...	...	...	...	...	...
21	1276	...	...	...	...	...	...	...	...	...
22	1413	...	...	...	...	...	...	...	...	...
23	1413	...	...	...	...	...	...	...	...	...
24	1517	...	...	...	...	...	...	...	...	...
25	1517	...	...	...	...	...	...	...	...	...
26	207	196	189	186	183	182	181	180	178	177
27	207	196	189	186	183	182	181	180	178	177
28	207	196	189	186	183	182	181	180	178	177
29	207	196	189	186	183	182	181	180	178	177
30	276	261	252	248	245	243	241	239	238	236
31	276	261	252	248	245	243	241	239	238	236
32	276	261	252	248	245	243	241	239	238	236
33	276	261	252	248	245	243	241	239	238	236
34	379	359	347	341	336	333	331	329	327	325
35	448	424	410	403	398	394	391	389	387	384
36	448	424	410	403	398	394	391	389	387	384
37	586	555	535	524	517	511	508	505	503	500
38	552	531	517	508	502	497	492	489	486	483
39	621	605	595	589	583	578	572	566	560	553
40	621	605	595	589	583	578	572	566	560	553

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	377	375	371	366	358	348	337	322	306	288
2	377	375	371	366	358	348	337	322	306	288
3	377	375	371	366	358	348	337	322	306	288
4	377	375	371	366	358	348	337	322	306	288
5	377	375	371	366	358	348	337	322	306	288
6	377	375	371	366	358	348	337	322	306	288
7	377	375	371	366	358	348	337	322	306	288
8	118	117	117	116	116	115	113	110	107	103
9	118	117	117	116	116	115	113	110	107	103
10	118	117	117	116	116	115	113	110	107	103
11	118	117	117	116	116	115	113	110	107	103
12	217	213	208	202	193	183	172	161	151	146
13	234	231	227	223	216	209	200	190	179	166
14	234	231	227	223	216	209	200	190	179	166
15	271	266	260	252	242	229	215	201	189	182
16	146	144	142	139	135	131	125	119	111	103
17	146	144	142	139	135	131	125	119	111	103
18	146	144	142	139	135	131	125	119	111	103
19	176	173	170	167	162	157	150	142	134	124
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	176	173	170	167	162	157	150	142	134	124
27	176	173	170	167	162	157	150	142	134	124
28	176	173	170	167	162	157	150	142	134	124
29	176	173	170	167	162	157	150	142	134	124
30	234	231	227	223	216	209	200	190	179	166
31	234	231	227	223	216	209	200	190	179	166
32	234	231	227	223	...	...	...	...	...	...
33	234	231	227	223	...	...	...	...	...	...
34	322	318	312	306	297	288	275	262	246	227
35	380	375	369	361	351	339	325	309	290	269
36	380	375	369	361	...	...	...	...	...	...
37	497	492	486	477	465	451	433	412	387	359
38	479	475	468	461	450	438	426	...	...	...
39	546	538	530	520	...	...	...	...	...	...
40	546	538	530	520	...	...	...	...	...	... (13)

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1150M
2	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1150M
3	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1150
4	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1150
5	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1100
6	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1100
7	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1050
8	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1050
9	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1025
10	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1025
11	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H1000
12	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H1000
13	13Cr–8Ni–2Mo	Bar	SA–564	XM–13	S13800	H950
14	13Cr–8Ni–2Mo	Forgings	SA–705	XM–13	S13800	H950
15	15Cr	Smls. & wld. tube	SA–268	TP429	S42900	...
16	15Cr	Plate	SA–240	429	S42900	...
17	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H1150M
18	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H1150M
19	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H1150
20	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H1150
21	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H1100
22	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H1100
23	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H1075
24	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H1075
25	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H1025
26	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H1025
27	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H925
28	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H925
29	15Cr–5Ni–3Cu	Bar	SA–564	XM–12	S15500	H900
30	15Cr–5Ni–3Cu	Forgings	SA–705	XM–12	S15500	H900
31	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H1150
32	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H1150
33	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H1100
34	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H1100
35	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H1050
36	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H1050
37	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H1025
38	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H1025
39	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H1000
40	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H1000
41	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H950
42	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H950
43	15Cr–6Ni–Cu–Mo	Bar	SA–564	XM–25	S45000	H900
44	15Cr–6Ni–Cu–Mo	Forgings	SA–705	XM–25	S45000	H900

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	860	585	...
2	...	860	585	...
3	...	930	620	...
4	...	930	620	...
5	...	1035	930	...
6	...	1035	930	...
7	...	1205	1140	(3)
8	...	1205	1140	(3)
9	...	1275	1205	(3)
10	...	1275	1205	(3)
11	...	1415	1310	(3)
12	...	1415	1310	(3)
13	...	1515	1415	(3)
14	...	1515	1415	(3)
15	...	415	240	...
16	...	450	205	...
17	...	795	515	...
18	...	795	515	...
19	...	930	725	...
20	...	930	725	...
21	...	965	795	(5)
22	...	965	795	(5)
23	...	1000	860	...
24	...	1000	860	...
25	...	1070	1000	(3)
26	...	1070	1000	(3)
27	...	1170	1070	(3)
28	...	1170	1070	(3)
29	...	1310	1170	(3)
30	...	1310	1170	(3)
31	≥13	860	515	...
32	≥13	860	515	...
33	≥13	895	725	...
34	≥13	895	725	...
35	≥13	1000	930	...
36	≥13	1000	930	...
37	≥13	1035	965	(3)
38	≥13	1035	965	(3)
39	≥13	1105	1035	(3)
40	≥13	1105	1035	(3)
41	≥13	1170	1105	(3)
42	≥13	1170	1105	(3)
43	≥13	1240	1170	(3)
44	≥13	1240	1170	(3)

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	586	...	...	...	...	...	...	...	...	...
2	586	...	...	...	...	...	...	...	...	...
3	621	...	...	...	...	...	...	...	...	...
4	621	...	...	...	...	...	...	...	...	...
5	931	...	...	...	...	...	...	...	...	...
6	931	...	...	...	...	...	...	...	...	...
7	1140	...	...	...	...	...	...	...	...	...
8	1140	...	...	...	...	...	...	...	...	...
9	1210	...	...	...	...	...	...	...	...	...
10	1210	...	...	...	...	...	...	...	...	...
11	1310	...	...	...	...	...	...	...	...	...
12	1310	...	...	...	...	...	...	...	...	...
13	1410	...	...	...	...	...	...	...	...	...
14	1410	...	...	...	...	...	...	...	...	...
15	241	228	221	217	214	212	211	209	208	207
16	207	196	189	186	183	182	181	180	178	177
17	517	...	...	...	...	...	...	...	...	...
18	517	...	...	...	...	...	...	...	...	...
19	724	...	...	...	...	...	...	...	...	...
20	724	...	...	...	...	...	...	...	...	...
21	793	764	734	721	711	702	694	687	679	672
22	793	764	734	721	711	702	694	687	679	672
23	862	...	...	...	...	...	...	...	...	...
24	862	...	...	...	...	...	...	...	...	...
25	1000	...	...	...	...	...	...	...	...	...
26	1000	...	...	...	...	...	...	...	...	...
27	1070	...	...	...	...	...	...	...	...	...
28	1070	...	...	...	...	...	...	...	...	...
29	1170	...	...	...	...	...	...	...	...	...
30	1170	...	...	...	...	...	...	...	...	...
31	517	...	...	...	...	...	...	...	...	...
32	517	...	...	...	...	...	...	...	...	...
33	724	...	...	...	...	...	...	...	...	...
34	724	...	...	...	...	...	...	...	...	...
35	931	...	...	...	...	...	...	...	...	...
36	931	...	...	...	...	...	...	...	...	...
37	965	...	...	...	...	...	...	...	...	...
38	965	...	...	...	...	...	...	...	...	...
39	1030	...	...	...	...	...	...	...	...	...
40	1030	...	...	...	...	...	...	...	...	...
41	1100	...	...	...	...	...	...	...	...	...
42	1100	...	...	...	...	...	...	...	...	...
43	1170	...	...	...	...	...	...	...	...	...
44	1170	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...
15	205	202	199	194	189	182	175	166	156	145
16	176	173	170	167	162	157	150	142	134	124
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	663	...	...	...	...	...	...	...	...	...
22	663	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	17Cr	Smls. & wld. tube	SA–268	TP430	S43000	...
2	17Cr	Plate	SA–240	430	S43000	...
3	17Cr	Bar	SA–479	430	S43000	...
(13) 4	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1150M
(13) 5	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150M
6	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1150
7	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1150
8	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1150
9	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1100
10	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1100
11	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1100
12	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1075
13	17Cr–4Ni–4Cu	Plate	SA–693	630	S17400	H1075
14	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1075
15	17Cr–4Ni–4Cu	Bar	SA–564	630	S17400	H1025
16	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H1025
17	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H925
18	17Cr–4Ni–4Cu	Forgings	SA–705	630	S17400	H900
19	17Cr–7Ni–1Al	Forgings	SA–705	631	S17700	TH1050
20	17Cr–7Ni–1Al	Forgings	SA–705	631	S17700	RH950
21	18Cr–2Mo	Plate	SA–240	...	S44400	...
22	18Cr–2Mo	Smls. & wld. tube	SA–268	...	S44400	...
23	18Cr–Ti	Smls. & wld. tube	SA–268	TP439	S43035	...
24	18Cr–Ti	Wld. tube	SA–803	TP439	S43035	...
25	18Cr–Ti	Smls. & wld. pipe	SA–731	TP439	S43035	...
26	18Cr–Ti	Smls. & wld. tube	SA–268	TP430 Ti	S43036	...
27	18Cr–Ti	Bar	SA–479	439	S43035	...
28	26Cr–3Ni–3Mo	Plate	SA–240	26–3–3	S44660	...
29	26Cr–3Ni–3Mo	Smls. & wld. tube	SA–268	26–3–3	S44660	...
30	26Cr–3Ni–3Mo	Wld. tube	SA–803	26–3–3	S44660	...
31	27Cr	Smls. tube	SA–268	TP446–1	S44600	...
32	27Cr–1Mo	Forgings	SA–182	FXM–27Cb	S44627	...
33	27Cr–1Mo	Plate	SA–240	XM–27	S44627	...
34	27Cr–1Mo	Smls. & wld. tube	SA–268	TPXM–27	S44627	...
35	27Cr–1Mo	Bar	SA–479	XM–27	S44627	...
36	27Cr–1Mo	Smls. & wld. pipe	SA–731	TPXM–27	S44627	...
37	27Cr–1Mo–Ti	Smls. & wld. pipe	SA–731	TPXM–33	S44626	...
38	27Cr–1Mo–Ti	Plate	SA–240	XM–33	S44626	...
39	27Cr–1Mo–Ti	Smls. & wld. tube	SA–268	TPXM–33	S44626	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	415	240	...
2	...	450	205	...
3	...	485	275	...
4	...	795	515	(5)
5	...	795	515	(5)
6	...	930	725	...
7	...	930	725	...
8	...	930	725	...
9	...	965	795	...
10	...	965	795	...
11	...	965	795	...
12	...	1000	860	...
13	...	1000	860	...
14	...	1000	860	...
15	...	1070	1000	(3), (5)
16	...	1070	1000	(3), (5)
17	...	1170	1070	(3)
18	...	1310	1170	(3)
19	...	1170	965	(3)
20	...	1275	1035	(3)
21	...	415	275	...
22	...	415	275	...
23	...	415	205	...
24	...	415	205	...
25	...	415	205	...
26	...	415	240	...
27	...	485	275	...
28	≤5	585	450	...
29	≤5	585	450	...
30	≤5	585	450	...
31	...	485	275	...
32	...	415	240	...
33	...	450	275	...
34	...	450	275	...
35	...	450	275	...
36	...	450	275	...
37	...	450	275	...
38	...	470	310	...
39	...	470	310	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	241	228	221	217	214	212	211	209	208	207
2	207	196	189	186	183	182	181	180	178	177
3	276	261	252	248	245	243	241	239	238	236
4	515	...	474	...	419	...	359	...	299	...
5	515	...	474	...	419	...	359	...	299	...
6	724	688	666	652	641	630	620	611	603	595
7	724	688	666	652	641	630	620	611	603	595
8	724	688	666	652	641	630	620	611	603	595
9	793	754	729	714	701	690	680	669	660	651
10	793	754	729	714	701	690	680	669	660	651
11	793	754	729	714	701	690	680	669	660	651
12	862	819	793	777	763	750	738	727	717	708
13	862	819	793	777	763	750	738	727	717	708
14	862	819	793	777	763	750	738	727	717	708
15	1000	960	918	899	885	870	857	844	832	822
16	1000	950	919	901	885	870	856	844	832	822
17	1069	1018	983	963	946	930	915	902	890	878
18	1172	1114	1078	1056	1037	1020	1004	989	976	963
19	965	...	...	...	...	...	...	...	...	...
20	1030	...	...	...	...	...	...	...	...	...
21	276	252	238	230	223	218	213	209	204	200
22	276	252	238	230	223	218	213	209	204	200
23	207	189	176	168	162	156	152	148	145	143
24	207	189	176	168	162	156	152	148	145	143
25	207	189	176	168	162	156	152	148	145	143
26	241	221	206	197	189	182	177	172	169	167
27	276	252	236	225	215	208	202	197	193	191
28	448	418	399	387	377	368	362	356	351	347
29	448	418	399	387	377	368	362	356	351	347
30	448	418	399	387	377	368	362	356	351	347
31	276	252	236	225	215	208	202	197	193	191
32	241	222	206	197	190	183	178	174	172	170
33	276	253	235	225	215	208	203	199	196	194
34	276	253	235	225	215	208	203	199	196	194
35	276	253	235	225	215	208	203	199	196	194
36	276	253	235	225	215	208	203	199	196	194
37	276	255	239	229	220	211	204	198	193	189
38	310	287	269	257	247	238	230	222	216	212
39	310	287	269	257	247	238	230	222	216	212

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	205	202	199	194	189	182	175	166	156	145	
2	176	173	170	167	162	157	150	142	134	124	
3	234	231	227	223	216	209	200	190	179	166	
4	243	...	...	...	...	...	...	...	...	...	(13)
5	243	...	...	...	...	...	...	...	...	...	(13)
6	588	581	575	568	559	548	533	512	483	441	
7	588	581	575	568	559	548	533	512	483	441	
8	588	581	575	568	559	548	533	512	483	441	
9	644	636	629	621	612	600	584	561	530	483	
10	644	636	629	621	612	600	584	561	530	483	
11	644	636	629	621	612	600	584	561	530	483	
12	700	692	684	676	666	653	635	610	575	524	
13	700	692	684	676	666	653	635	610	575	524	
14	700	692	684	676	666	653	635	610	575	524	
15	811	...	...	...	...	...	...	...	...	...	
16	812	803	793	784	...	...	...	...	...	...	
17	868	858	848	838	...	...	...	...	...	...	
18	952	941	930	919	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	
21	196	191	187	183	178	173	168	162	155	147	
22	196	191	187	183	178	173	168	162	155	147	
23	142	141	140	139	139	137	134	131	126	119	
24	142	141	140	139	139	137	134	131	126	119	
25	142	141	140	139	139	137	134	131	126	119	
26	165	164	163	162	161	159	157	...	153	147	
27	189	188	187	185	184	182	179	174	167	158	
28	344	342	341	340	...	...	...	...	...	...	
29	344	342	341	340	...	...	...	...	...	...	
30	344	342	341	340	...	...	...	...	...	...	
31	189	188	187	185	184	182	179	174	167	158	
32	170	170	170	...	...	...	...	...	...	...	
33	193	193	193	193	193	193	193	193	193	193	
34	193	193	193	193	193	193	193	193	193	193	
35	193	193	193	193	193	193	193	193	193	193	
36	193	193	193	193	193	193	193	193	193	193	
37	186	183	182	182	...	...	...	...	...	...	
38	208	206	205	204	...	...	...	...	...	...	
39	208	206	205	204	...	...	...	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	29Cr–4Mo	Bar	SA–479	...	S44700	...
2	29Cr–4Mo	Plate	SA–240	...	S44700	...
3	29Cr–4Mo	Smls. & wld. tube	SA–268	29–4	S44700	...
4	29Cr–4Mo–2Ni	Bar	SA–479	...	S44800	...
5	29Cr–4Mo–2Ni	Plate	SA–240	...	S44800	...
6	29Cr–4Mo–2Ni	Smls. & wld. tube	SA–268	29–4–2	S44800	...
7	29Cr–4Mo–Ti	Smls. & wld. tube	SA–268	...	S44735	...
8	Mn–¼Mo	Forgings	SA–372	D	K14508	...
9	Mn–¼Mo–V	Castings	SA–487	2	J13005	A
10	Mn–¼Mo–V	Castings	SA–487	2	J13005	B
11	Mn–½Mo	Plate	SA–302	A	K12021	...
12	Mn–½Mo	Wld. pipe	SA–672	H75	K12021	...
13	Mn–½Mo	Plate	SA–302	B	K12022	...
14	Mn–½Mo	Plate	SA–533	A	K12521	1
15	Mn–½Mo	Plate	SA–533	A	K12521	2
16	Mn–½Mo	Plate	SA–533	A	K12521	3
17	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	1
18	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	2
19	Mn–½Mo–¼Ni	Plate	SA–533	D	K12529	3
20	Mn–½Mo–½Ni	Plate	SA–302	C	K12039	...
21	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	1
22	Mn–½Mo–½Ni	Wld. pipe	SA–672	H80	K12039	...
23	Mn–½Mo–½Ni	Wld. pipe	SA–672	J80	K12539	...
24	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	2
25	Mn–½Mo–½Ni	Wld. pipe	SA–672	J90	K12539	...
26	Mn–½Mo–½Ni	Plate	SA–533	B	K12539	3
27	Mn–½Mo–½Ni	Wld. pipe	SA–672	J100	K12539	...
28	Mn–½Mo–¾Ni	Plate	SA–302	D	K12054	...
29	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	1
(**13**) 30	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	1
31	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	2
(**13**) 32	Mn–½Mo–¾Ni	Plate	SA–533	E	K12554	2
33	Mn–½Mo–¾Ni	Plate	SA–533	C	K12554	3
(**13**) 34	Mn–½Ni–V	Plate	SA/NF A 36–215	P440NJ4	...	...
35	Mn–½Ni–V	Plate	SA–225	C	K12524	...
36	Mn–V	Castings	SA–487	1	J13002	A
37	Mn–V	Castings	SA–487	1	J13002	B
38	1½Si–½Mo	Smls. pipe	SA–335	P15	K11578	...
39	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	A
40	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	B
41	½Ni–½Cr–¼Mo–V	Castings	SA–487	4	J13047	E
42	½Ni–½Mo–V	Forgings	SA–541	3	K12045	1
43	½Ni–½Mo–V	Forgings	SA–541	3	K12045	2

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	485	380	...
2	...	550	415	...
3	...	550	415	...
4	...	485	380	...
5	...	550	415	...
6	...	550	415	...
7	...	515	415	...
8	...	725	450	...
9	...	585	365	...
10	...	620	450	...
11	...	515	310	...
12	...	515	310	...
13	...	550	345	...
14	...	550	345	...
15	...	620	485	...
16	...	690	570	...
17	...	550	345	...
18	...	620	485	...
19	...	690	570	...
20	...	550	345	...
21	...	550	345	...
22	...	550	345	...
23	...	550	345	...
24	...	620	485	...
25	...	620	485	...
26	...	690	570	...
27	...	690	570	...
28	...	550	345	...
29	...	550	345	...
30	...	550	345	...
31	...	620	485	...
32	...	620	485	...
33	...	690	570	...
34	$8 \le t \le 20$	630	440	...
35	...	725	485	...
36	...	585	380	...
37	...	620	450	...
38	...	415	205	...
39	...	620	415	...
40	...	725	585	...
41	...	795	655	...
42	...	550	345	...
43	...	620	450	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	379	351	330	318	308	300	295	290	288	286
2	414	382	360	347	336	327	321	316	314	312
3	414	382	360	347	336	327	321	316	314	312
4	379	338	311	294	280	267	256	247	239	233
5	414	369	339	321	305	291	279	269	261	254
6	414	369	339	321	305	291	279	269	261	254
7	414	369	339	321	305	291	279	269	261	254
8	448	433	422	416	411	407	404	403	402	400
9	365	353	346	340	332	323	313	304	295	289
10	448	433	424	416	407	396	384	372	362	354
11	310	299	290	286	282	278	275	272	269	266
12	310	299	290	286	282	278	275	272	269	266
13	345	332	323	318	314	309	305	302	299	296
14	345	332	323	318	314	309	305	302	299	296
15	483	464	452	445	439	433	428	423	418	414
16	572	551	536	528	520	513	507	501	496	490
17	345	332	323	318	314	309	305	302	299	296
18	483	464	452	445	439	433	428	423	418	414
19	572	551	536	528	520	513	507	501	496	490
20	345	332	323	318	314	309	305	302	299	296
21	345	332	323	318	314	309	305	302	299	296
22	345	332	323	318	314	309	305	302	299	296
23	345	332	323	318	314	309	305	302	299	296
24	483	464	452	445	439	433	428	423	418	414
25	483	464	452	445	439	433	428	423	418	414
26	572	551	536	528	520	513	507	501	496	490
27	572	551	536	528	520	513	507	501	496	490
28	345	332	323	318	314	309	305	302	299	296
29	345	332	323	318	314	309	305	302	299	296
30	345	332	323	318	314	309	305	302	299	296
31	483	464	452	445	439	433	428	423	418	414
32	483	464	452	445	439	433	428	423	418	414
33	572	551	536	528	520	513	507	501	496	490
34	438	406	...	...	...	...	...	...	...	...
35	483	448	438	434	430	423	414	403	391	379
36	379	...	...	...	...	...	...	...	...	...
37	448	...	...	...	...	...	...	...	...	...
38	207	199	194	191	188	186	183	181	179	177
39	414	405	390	381	375	371	368	365	360	353
40	586	573	553	540	531	525	521	517	511	501
41	655	641	618	604	594	587	583	578	571	559
42	345	332	323	318	314	309	305	302	299	296
43	448	435	425	419	415	411	407	404	401	398

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	285	284	283	279	273	...	...	...	...	...	
2	311	310	308	305	298	...	...	...	...	...	
3	311	310	308	305	298	...	...	...	...	...	
4	229	226	224	223	221	...	...	...	...	...	
5	249	247	245	243	241	...	...	...	...	...	
6	249	247	245	243	241	...	...	...	...	...	
7	249	247	245	243	241	...	...	...	...	...	
8	399	396	392	385	377	366	353	339	323	306	
9	284	281	278	274	...	...	...	...	...	...	
10	348	345	341	336	...	...	...	...	...	...	
11	263	260	256	252	247	240	231	220	206	187	
12	263	260	256	252	247	240	231	220	206	187	
13	292	289	285	280	274	267	257	245	229	208	
14	292	289	285	280	274	267	257	245	229	208	
15	409	404	398	392	384	374	361	343	321	291	
16	485	479	473	465	455	443	427	407	380	345	
17	292	289	285	280	274	267	257	245	229	208	
18	409	404	398	392	384	374	361	343	321	291	
19	485	479	473	465	455	443	427	407	380	345	
20	292	289	285	280	274	267	257	245	229	208	
21	292	289	285	280	274	267	257	245	229	208	
22	292	289	285	280	274	267	257	245	229	208	
23	292	289	285	280	274	267	257	245	229	208	
24	409	404	398	392	384	374	361	343	321	291	
25	409	404	398	392	384	374	361	343	321	291	
26	485	479	473	465	455	443	427	407	380	345	
27	485	479	473	465	455	443	427	407	380	345	
28	292	289	285	280	274	267	257	245	229	208	
29	292	289	285	280	274	267	257	245	229	208	
30	292	289	285	280	274	267	257	245	229	208	(**13**)
31	409	404	398	392	384	374	361	343	321	291	
32	409	404	398	392	384	374	361	343	321	291	(**13**)
33	485	479	473	465	455	443	427	407	380	345	
34	...	...	...	...	...	...	...	...	...	...	(**13**)
35	368	358	350	343	335	323	310	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	
38	175	173	171	168	165	160	154	147	138	125	
39	343	330	318	307	...	...	...	...	...	...	
40	486	468	449	435	...	...	...	...	...	...	
41	543	523	503	486	...	...	...	...	...	...	
42	292	289	285	280	274	267	257	245	229	208	
43	395	393	389	385	381	375	369	362	352	341	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	3/4Ni–1/2Cr–1/2Mo–V	Forgings	SA–592	F	K11576	...
2	3/4Ni–1/2Cr–1/2Mo–V	Plate	SA–517	F	K11576	...
3	3/4Ni–1/2Cr–1/2Mo–V	Forgings	SA–592	F	K11576	...
4	3/4Ni–1/2Cu–Mo	Smls. & wld. tube	SA–423	2	K11540	...
5	3/4Ni–1/2Mo–1/3Cr–V	Forgings	SA–508	2	K12766	1
6	3/4Ni–1/2Mo–1/3Cr–V	Forgings	SA–541	2	K12765	1
7	3/4Ni–1/2Mo–1/3Cr–V	Forgings	SA–508	2	K12766	2
8	3/4Ni–1/2Mo–1/3Cr–V	Forgings	SA–541	2	K12765	2
9	3/4Ni–1/2Mo–Cr–V	Forgings	SA–508	3	K12042	1
10	3/4Ni–1/2Mo–Cr–V	Forgings	SA–508	3	K12042	2
11	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	2
12	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	2
13	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	2
14	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	3
15	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	3
16	3/4Ni–1Cu–3/4Cr	Plate	SA–736	A	K12042	1
17	3/4Ni–1Mo–3/4Cr	Castings	SA–217	WC5	J22000	...
18	1Ni–1/2Cr–1/2Mo	Castings	SA–217	WC4	J12082	...
19	1 1/4Ni–1Cr–1/2Mo	Plate	SA–517	P	K21650	...
20	1 1/4Ni–1Cr–1/2Mo	Plate	SA–517	P	K21650	...
21	1 1/2Ni	Forgings	SA–350	LF5	K13050	1
22	1 1/2Ni	Forgings	SA–350	LF5	K13050	2
23	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–320	L43	G43400	...
24	1 3/4Ni–3/4Cr–1/4Mo	Forgings	SA–372	L	K24055	...
25	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–574	4340	G43400	...
26	1 3/4Ni–3/4Cr–1/4Mo	Bolting	SA–574	4340	G43400	...
27	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	5
28	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	5
29	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	4
30	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	3
31	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	2
32	2Ni–3/4Cr–1/4Mo	Bolting	SA–540	B23	H43400	1
33	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	5
34	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	5
35	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	4
36	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	3
37	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	2
38	2Ni–3/4Cr–1/3Mo	Bolting	SA–540	B24	K24064	1
39	2Ni–1Cu	Forgings	SA–182	FR	K22035	...
40	2Ni–1Cu	Fittings	SA–234	WPR	K22035	...
41	2Ni–1Cu	Smls. & wld. pipe	SA–333	9	K22035	...
42	2Ni–1Cu	Tube	SA–334	9	K22035	...
43	2Ni–1Cu	Forgings	SA–350	LF9	K22036	...
44	2Ni–1Cu	Smls. & wld. fittings	SA–420	WPL9	K22035	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	64 < t ≤ 100	725	620	...
2	≤64	795	690	...
3	≤64	795	690	...
4	...	415	255	...
5	...	550	345	...
6	...	550	345	...
7	...	620	450	...
8	...	620	450	...
9	...	550	345	...
10	...	620	450	...
11	50 < t ≤ 100	450	480	...
12	25 < t ≤ 50	495	415	...
13	≤25	495	450	...
14	50 < t ≤ 100	515	450	...
15	≤50	585	515	...
16	≤19	620	550	...
17	...	485	275	...
18	...	485	275	...
19	64 < t ≤ 100	725	620	...
20	≤64	795	690	...
21	...	415	205	...
22	...	485	260	...
23	≤100	860	725	...
24	...	1070	930	...
25	≥16	1170	930	...
26	≤13	1240	965	...
27	150 < t ≤ 238	795	690	...
28	≤150	825	725	...
29	≤238	930	825	...
30	≤238	1000	895	...
31	≤238	1070	965	...
32	≤200	1140	1035	...
33	...	795	690	...
34	...	825	725	...
35	...	930	825	...
36	...	1000	895	...
37	...	1070	965	...
38	...	1140	1035	...
39	...	435	315	...
40	...	435	315	...
41	...	435	315	...
42	...	435	315	...
43	...	435	315	...
44	...	435	315	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	621	604	591	581	573	566	559	553	546	540
2	689	670	656	646	637	629	621	614	607	600
3	689	670	656	646	637	629	621	614	607	600
4	255	...	...	...	...	...	...	...	...	...
5	345	332	323	318	314	309	305	302	299	296
6	345	332	323	318	314	309	305	302	299	296
7	448	431	420	413	407	402	397	393	388	384
8	448	431	420	413	407	402	397	393	388	384
9	345	332	323	318	314	309	305	302	299	296
10	448	431	420	413	407	402	397	393	388	384
11	379	366	355	349	343	337	331	326	321	317
12	414	399	388	381	374	368	361	355	350	346
13	448	433	420	413	406	399	392	385	380	375
14	448	433	420	413	406	399	392	385	380	375
15	517	499	485	476	468	460	452	444	438	433
16	552	533	517	508	499	491	482	474	467	461
17	276	265	258	255	251	248	245	242	239	236
18	276	265	258	255	251	248	245	242	239	236
19	621	604	591	581	573	566	559	553	546	540
20	689	670	656	646	637	629	621	614	607	600
21	207	...	...	...	...	...	...	...	...	...
22	259	...	...	...	...	...	...	...	...	...
23	724	702	679	669	659	647	635	624	615	603
24	931	911	891	879	869	862	856	851	846	840
25	931	911	890	879	870	863	857	851	846	840
26	965	945	923	912	903	895	888	883	877	871
27	689	675	659	651	644	639	634	630	626	622
28	724	709	692	684	677	671	666	662	658	654
29	827	810	791	781	773	767	761	757	752	747
30	896	878	857	846	838	831	825	820	814	809
31	965	945	923	912	903	895	888	883	877	871
32	1030	1010	989	977	967	959	952	946	940	934
33	689	675	659	651	644	639	634	630	626	622
34	724	709	692	684	677	671	666	662	658	654
35	827	810	791	781	773	767	761	757	752	747
36	896	878	857	846	838	831	825	820	814	809
37	965	945	923	912	903	895	888	883	877	871
38	1030	1010	989	977	967	959	952	946	940	934
39	317	...	...	...	...	...	...	...	...	...
40	317	...	...	...	...	...	...	...	...	...
41	317	...	...	...	...	...	...	...	...	...
42	317	...	...	...	...	...	...	...	...	...
43	317	...	...	...	...	...	...	...	...	...
44	317	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	534	528	521	514	505	494	481	466	447	423
2	594	587	579	571	561	549	534	517	496	470
3	594	587	579	571	561	549	534	517	496	470
4	...	...	...	...	...	...	...	...	...	...
5	292	289	285	280	274	267	257	245	229	208
6	292	289	285	280	274	267	257	245	229	208
7	380	375	370	364	357	347	335	319	298	270
8	380	375	370	364	357	347	335	319	298	270
9	292	289	285	280	274	267	257	245	229	208
10	380	375	370	364	357	347	335	319	298	270
11	314	309	302	...	...	...	...	...	...	...
12	342	337	329	...	...	...	...	...	...	...
13	371	365	357	...	...	...	...	...	...	...
14	371	365	357	...	...	...	...	...	...	...
15	428	422	412	...	...	...	...	...	...	...
16	456	450	439	...	...	...	...	...	...	...
17	234	231	228	224	219	213	206	196	183	166
18	234	231	228	224	219	213	206	196	183	166
19	534	528	521	514	505	494	481	466	447	423
20	594	587	579	571	561	549	534	517	496	470
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	590	576	562	543	...	...	...	...	...	...
24	833	824	812	798	781	760	738	714	690	667
25	833	824	812	798	781	761	738	714	689	667
26	864	855	842	828	810	789	766	740	715	692
27	617	610	602	591	579	564	546	528	511	494
28	648	641	632	621	607	591	574	555	536	519
29	740	732	722	709	694	676	656	634	613	593
30	802	793	782	769	752	732	711	687	664	642
31	864	855	842	828	810	789	766	740	715	692
32	926	915	902	887	868	845	820	793	766	741
33	617	610	602	591	579	564	546	528	511	494
34	648	641	632	621	607	591	574	555	536	519
35	740	732	722	709	694	676	656	634	613	593
36	802	793	782	769	752	732	711	687	664	642
37	864	855	842	828	810	789	766	740	715	692
38	926	915	902	887	868	845	820	793	766	741
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	1
2	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2
3	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	2a
4	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	3
5	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	4
6	2Ni–1½Cr–¼Mo–V	Forgings	SA–723	1	K23550	5
7	2½Ni	Pipe	SA–333	7	K21903	...
8	2½Ni	Tube	SA–334	7	K21903	...
9	2½Ni	Plate	SA–203	A	K21703	...
10	2½Ni	Plate	SA–203	B	K22103	...
11	2½Ni	Castings	SA–352	LC2	J22500	...
12	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	3
13	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	1
14	2¾Ni–1½Cr–½Mo	Plate	SA–543	C	...	2
15	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	1
16	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2
17	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	2a
18	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	3
19	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	4
20	2¾Ni–1½Cr–½Mo–V	Forgings	SA–723	2	K34035	5
21	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	3
22	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	A
23	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	1
(13) 24	3Ni–1¾Cr–½Mo	Forgings	SA–508	5	K42365	2
25	3Ni–1¾Cr–½Mo	Plate	SA–543	B	K42339	2
26	3Ni–1¾Cr–½Mo	Forgings	SA–372	M	K42365	B
27	3½Ni	Pipe	SA–333	3	K31918	...
28	3½Ni	Tube	SA–334	3	K31918	...
29	3½Ni	Fittings	SA–420	WPL3	...	...
30	3½Ni	Plate	SA–203	D	K31718	...
31	3½Ni	Forgings	SA–350	LF3	K32025	...
32	3½Ni	Forgings	SA–765	III	K32026	...
33	3½Ni	Plate	SA–203	E	K32018	...
34	3½Ni	Castings	SA–352	LC3	J31550	...
35	3½Ni	Plate	SA–203	F	...	...
36	3½Ni	Plate	SA–203	F	...	...
37	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	3
38	3½Ni–1¾Cr–½Mo–V	Forgings	SA–541	4N	K42343	3
39	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	1
40	3½Ni–1¾Cr–½Mo–V	Forgings	SA–541	5	K42348	1
41	3½Ni–1¾Cr–½Mo–V	Forgings	SA–508	4N	K22375	2
42	3½Ni–1¾Cr–½Mo–V	Forgings	SA–541	4N	K42343	2
43	3½Ni–1¾Cr–½Mo–V	Forgings	SA–541	5	K42348	2

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	795	690	...
2	...	930	825	...
3	...	1000	895	...
4	...	1070	965	...
5	...	1205	1105	...
6	...	1310	1240	...
7	...	450	240	...
8	...	450	240	...
9	...	450	255	...
10	...	485	275	...
11	...	485	275	...
12	...	620	485	...
13	...	725	585	...
14	...	795	690	...
15	...	795	690	...
16	...	930	825	...
17	...	1000	895	...
18	...	1070	965	...
19	...	1205	1105	...
20	...	1310	1240	...
21	...	620	485	...
22	...	725	585	...
23	...	725	585	...
24	...	795	690	...
25	...	795	690	...
26	...	825	690	...
27	...	450	240	...
28	...	450	240	...
29	...	450	240	...
30	...	450	255	...
31	...	485	260	...
32	...	485	260	...
33	...	485	275	...
34	...	485	275	...
35	>50	515	345	...
36	≤50	550	380	...
37	...	620	485	...
38	...	620	485	...
39	...	725	585	...
40	...	725	585	...
41	...	795	690	...
42	...	795	690	...
43	...	795	690	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	689	673	660	651	644	639	634	630	626	622
2	827	807	792	782	773	767	761	757	752	747
3	896	874	857	847	838	831	825	820	815	809
4	965	942	923	912	903	895	888	883	877	871
5	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
6	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
7	241	227	220	216	213	210	207	203	198	192
8	241	227	220	216	213	210	207	203	198	192
9	255	240	233	228	225	222	219	214	209	203
10	276	259	251	247	244	241	237	232	227	220
11	276	259	251	247	244	241	237	232	227	220
12	483	464	453	446	440	436	432	428	425	421
13	586	564	550	541	534	528	523	519	515	511
14	689	664	647	636	628	622	616	611	607	602
15	689	673	660	651	644	639	634	630	626	622
16	827	807	792	782	773	767	761	757	752	747
17	896	874	857	847	838	831	825	820	815	809
18	965	942	923	912	903	895	888	883	877	871
19	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
20	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
21	483	464	453	446	440	436	432	428	425	421
22	586	564	549	541	534	529	524	519	515	511
23	586	564	550	541	534	528	523	519	515	511
24	690	663	646	637	629	622	616	611	606	602
25	689	664	647	636	628	622	616	611	607	602
26	690	663	646	637	629	622	616	611	606	602
27	241	227	220	216	213	210	207	203	198	192
28	241	227	220	216	213	210	207	203	198	192
29	241	227	220	216	213	210	207	203	198	192
30	255	240	233	228	225	222	219	214	209	203
31	259	244	235	232	229	225	221	217	212	206
32	259	244	235	232	229	225	221	217	212	206
33	276	259	251	247	244	241	237	232	227	220
34	276	259	251	247	244	241	237	232	227	220
35	345	324	314	309	305	300	295	290	283	275
36	379	357	346	340	335	330	325	319	311	302
37	483	464	453	446	440	436	432	428	425	421
38	483	464	453	446	440	436	432	428	425	421
39	586	564	550	541	534	528	523	519	515	511
40	586	564	550	541	534	528	523	519	515	511
41	689	664	647	636	628	622	616	611	607	602
42	689	664	647	636	628	622	616	611	607	602
43	689	664	647	636	628	622	616	611	607	602

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	617	610	601	591	578	563	559	551	540	530
2	740	733	722	709	694	676	670	660	648	637
3	802	793	782	768	752	732	...	...	...	...
4	864	855	842	828	810	788	782	771	756	743
5	987	976	963	946	925	901	894	881	864	849
6	1110	1100	1080	1060	1040	1010	1010	990	972	955
7	186	178	170	161	152	142	133	123	114	105
8	186	178	170	161	152	142	133	123	114	105
9	196	189	180	170	161	150	140	130	120	111
10	212	204	195	185	174	163	152	140	130	120
11	212	204	195	185	174	163	152	140	130	120
12	418	413	409	404	397	388	378	366	352	336
13	507	502	497	490	482	472	459	445	428	407
14	596	591	584	576	566	554	541	523	503	479
15	617	610	601	591	578	563	559	551	540	530
16	740	733	722	709	694	676	670	660	648	637
17	802	793	782	768	752	732	...	...	...	...
18	864	855	842	828	810	788	782	771	756	743
19	987	976	963	946	925	901	894	881	864	849
20	1110	1100	1080	1060	1040	1010	1010	990	972	955
21	418	413	409	404	397	388	378	366	352	336
22	507	502	497	490	482	472	460	445	428	408
23	507	502	497	490	482	472	459	445	428	407
24	597	591	584	576	567	555	541	524	503	480 (**13**)
25	596	591	584	576	566	554	541	523	503	479
26	597	591	584	576	567	555	541	524	503	480
27	186	178	170	161	152	142	133	123	114	105
28	186	178	170	161	152	142	133	123	114	105
29	186	178	170	161	152	142	133	123	114	105
30	196	189	180	170	161	150	140	130	120	111
31	199	191	182	173	163	152	142	132	122	112
32	199	191	182	173	163	152	142	132	122	112
33	212	204	195	185	174	163	152	140	130	120
34	212	204	195	185	174	163	152	140	130	120
35	265	254	243	230	217	204	189	176	162	150
36	292	280	267	254	239	224	208	193	179	165
37	418	413	409	404	397	388	378	366	352	336
38	418	413	409	404	...	...	...	...	...	...
39	507	502	497	490	482	472	459	445	428	407
40	507	502	497	490	...	...	...	...	...	...
41	596	591	584	576	566	554	541	523	503	479
42	596	591	584	576	...	...	...	...	...	...
43	596	591	584	576	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	1
	2	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2
	3	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	2a
	4	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	3
	5	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	4
	6	4Ni–1½Cr–½Mo–V	Forgings	SA–723	3	K44045	5
	7	5Ni–¼Mo	Plate	SA–645	A	K41583	...
	8	8Ni	Forgings	SA–522	II	K71340	...
	9	8Ni	Plate	SA–553	II	K71340	...
(13)	10	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	NNT640
(13)	11	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT640
(13)	12	9Ni	Plate	SA/EN 10028–4	X7Ni9	...	QT
(13)	13	9Ni	Plate	SA/EN 10028–4	X8Ni9	...	QT680
	14	9Ni	Smls. & wld. pipe	SA–333	8	K81340	...
	15	9Ni	Smls. & wld. tube	SA–334	8	K81340	...
	16	9Ni	Plate	SA–353	...	K81340	...
	17	9Ni	Smls. & wld. fittings	SA–420	WPL8	K81340	...
	18	9Ni	Forgings	SA–522	I	K81340	...
	19	9Ni	Plate	SA–553	I	K81340	...
	20	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	A
	21	25Ni–15Cr–2Ti	Bolting	SA–453	660	S66286	B
	22	25Ni–15Cr–2Ti	Bar	SA–638	660	S66286	...
	23	27Ni–22Cr–7Mo–Mn–Cu–N	Forgings	SA–182	...	S31277	...
	24	27Ni–22Cr–7Mo–Mn–Cu–N	Smls. tube	SA–213	...	S31277	...
	25	27Ni–22Cr–7Mo–Mn–Cu–N	Plate	SA–240	...	S31277	...
	26	27Ni–22Cr–7Mo–Mn–Cu–N	Wld. tube	SA–249	...	S31277	...
	27	29Ni–20Cr–3Cu–2Mo	Castings	SA–351	CN7M	J95150	...
	28	16Cr–4Ni–6Mn	Plate	SA–240	201LN	S20153	...
	29	16Cr–9Mn–2Ni–N	Plate	SA–240	204	S20400	...
	30	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...
	31	16Cr–12Ni–2Mo	Forgings	SA–965	F316L	S31603	...
	32	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316L	...	...
	33	16Cr–12Ni–2Mo	Forgings	SA–182	F316L	S31603	...
	34	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316L	S31603	...
	35	16Cr–12Ni–2Mo	Plate	SA–240	316L	S31603	...
	36	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316L	S31603	...
	37	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316L	S31603	...
	38	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	1
(13)	39	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	3
(13)	40	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316L	S31603	4
	41	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316L	S31603	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	795	690	...
2	...	930	825	...
3	...	1000	895	...
4	...	1070	965	...
5	...	1205	1105	...
6	...	1310	1240	...
7	...	655	450	...
8	...	690	515	...
9	...	690	585	...
10	≤50	640	480	...
11	≤50	640	480	...
12	≤50	680	575	...
13	≤50	680	575	...
14	...	690	515	...
15	...	690	515	...
16	...	690	515	...
17	...	690	515	...
18	...	690	515	...
19	...	690	585	...
20	...	895	585	...
21	...	895	585	...
22	...	895	585	...
23	...	772	359	...
24	...	772	359	...
25	...	772	359	...
26	...	772	359	...
27	...	425	170	...
28	...	655	310	...
29	...	655	330	...
30	>125	450	170	...
31	...	450	170	...
32	...	480	175	...
33	≤125	485	170	...
34	...	485	170	...
35	...	485	170	...
36	...	485	170	...
37	...	485	170	...
38	...	485	170	...
39	...	485	170	...
40	...	485	170	...
41	...	485	170	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	689	673	660	651	644	639	634	630	626	622
2	827	807	792	782	773	767	761	757	752	747
3	896	874	857	847	838	831	825	820	815	809
4	965	942	923	912	903	895	888	883	877	871
5	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
6	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
7	448	...	...	...	...	...	...	...	...	...
8	517	502	495	483	461	...	...	...	...	...
9	586	569	561	548	522	...	...	...	...	...
10	480	466	459	449	427	...	...	...	...	...
11	480	466	459	449	427	...	...	...	...	...
12	575	558	550	538	512	...	...	...	...	...
13	575	558	550	538	512	...	...	...	...	...
14	517	502	495	483	461	...	...	...	...	...
15	517	502	495	483	461	...	...	...	...	...
16	517	502	495	483	461	...	...	...	...	...
17	517	502	495	483	461	...	...	...	...	...
18	517	502	495	483	461	...	...	...	...	...
19	586	569	561	548	522	...	...	...	...	...
20	586	580	573	569	565	562	558	553	549	544
21	586	580	573	569	565	562	558	553	549	544
22	586	580	573	569	565	561	557	553	549	545
23	359	348	328	...	314	...	274	...	265	...
24	359	348	328	...	314	...	274	...	265	...
25	359	348	328	...	314	...	274	...	265	...
26	359	348	328	...	314	...	274	...	265	...
27	172	160	147	140	133	128	122	117	113	109
28	310	269	246	235	226	220	215	211	208	205
29	331	279	246	225	210	197	186	179	173	169
30	172	157	145	137	131	125	121	118	114	111
31	172	157	145	137	131	125	121	118	114	111
32	172	157	145	137	131	125	121	118	114	111
33	172	157	145	137	131	125	121	118	114	111
34	172	157	145	137	131	125	121	118	114	111
35	172	157	145	137	131	125	121	118	114	111
36	172	157	145	137	131	125	121	118	114	111
37	172	157	145	137	131	125	121	118	114	111
38	172	157	145	137	131	125	121	118	114	111
39	172	157	145	137	131	125	121	118	114	111
40	172	157	145	137	131	125	121	118	114	111
41	172	157	145	137	131	125	121	118	114	111

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	617	610	601	591	578	563	559	551	540	530	
2	740	733	722	709	694	676	670	660	648	637	
3	802	793	782	768	752	732	...	...	...	...	
4	864	855	842	828	810	788	782	771	756	743	
5	987	976	963	946	925	901	894	881	864	849	
6	1110	1100	1080	1060	1040	1010	1010	990	972	955	
7	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	(**13**)
11	...	...	...	...	...	...	...	...	...	...	(**13**)
12	...	...	...	...	...	...	...	...	...	...	(**13**)
13	...	...	...	...	...	...	...	...	...	...	(**13**)
14	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	
20	540	536	531	526	522	517	511	506	501	495	
21	540	536	531	526	522	517	511	506	501	495	
22	540	535	531	526	...	...	...	...	...	...	
23	263	263	262	261	260	258	257	...	...	...	
24	263	263	262	261	260	258	257	...	...	...	
25	263	263	262	261	260	258	257	...	...	...	
26	263	263	262	261	260	258	257	...	...	...	
27	106	102	99.2	96.0	...	...	...	...	...	...	
28	201	196	191	185	179	173	168	164	162	162	
29	166	163	162	160	159	157	154	150	144	136	
30	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
31	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
32	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
33	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
34	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
35	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
36	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
37	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
38	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
39	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	(**13**)
40	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	(**13**)
41	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316L	S31603	...
	2	16Cr–12Ni–2Mo	Bar	SA–479	316L	S31603	...
	3	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316L	S31603	...
	4	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316L	S31603	...
	5	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316L	S31603	...
	6	16Cr–12Ni–2Mo	Castings	SA–351	CF3M	J92800	...
	7	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF3M	J92800	...
	8	16Cr–12Ni–2Mo	Castings	SA–351	CF8M	J92900	...
	9	16Cr–12Ni–2Mo	Cast pipe	SA–451	CPF8M	J92900	...
	10	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...
	11	16Cr–12Ni–2Mo	Forgings	SA–965	F316	S31600	...
	12	16Cr–12Ni–2Mo	Forgings	SA–182	F316	S31600	...
	13	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	1
(**13**)	14	16Cr–12Ni–2Mo	Bolting	SA–193	B8MA	S31600	1A
	15	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316	S31600	...
	16	16Cr–12Ni–2Mo	Plate	SA–240	316	S31600	...
	17	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316	S31600	...
	18	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316	S31600	...
	19	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	1
	20	16Cr–12Ni–2Mo	Bolting	SA–320	B8MA	S31600	1A
	21	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	1
(**13**)	22	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	3
(**13**)	23	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316	S31600	4
	24	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316	S31600	...
	25	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316	S31600	...
	26	16Cr–12Ni–2Mo	Wld. pipe	SA–409	TP316	S31600	...
	27	16Cr–12Ni–2Mo	Bar	SA–479	316	S31600	...
	28	16Cr–12Ni–2Mo	Wld. tube	SA–688	TP316	S31600	...
	29	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316	S31600	...
	30	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316	S31600	...
	31	16Cr–12Ni–2Mo	Bar	SA/JIS G4303	SUS316	...	...
	32	16Cr–12Ni–2Mo	Plate	SA/EN 10028–7	X5CrNiMo17–12–2	...	...
(**13**)	33	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...
	34	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	S
	35	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2
	36	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2
	37	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...
	38	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	S
	39	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	B
	40	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2
	41	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2
	42	16Cr–12Ni–2Mo	Bolting	SA–193	B8M2	S31600	...
	43	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	S

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	485	170	...
2	...	485	170	...
3	...	485	170	...
4	...	485	170	...
5	...	485	170	...
6	...	485	205	...
7	...	485	205	...
8	...	485	205	...
9	...	485	205	...
10	>125	485	205	...
11	...	485	205	...
12	≤125	515	205	...
13	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	...	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	515	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	520	205	...
32	≤75	520	220	...
33	$64 < t \leq 75$	550	380	(4)
34	$64 < t \leq 75$	550	380	(4)
35	$32 < t \leq 38$	620	345	...
36	$32 < t \leq 38$	620	345	...
37	$50 < t \leq 64$	620	450	...
38	$50 < t \leq 64$	620	450	(4)
39	$38 < t \leq 44$	655	310	(4)
40	$25 < t \leq 32$	655	450	...
41	$25 < t \leq 32$	655	450	...
42	≤50	655	515	...
43	≤50	655	515	(4)

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	172	157	145	137	131	125	121	118	114	111
2	172	157	145	137	131	125	121	118	114	111
3	172	157	145	137	131	125	121	118	114	111
4	172	157	145	137	131	125	121	118	114	111
5	172	157	145	137	131	125	121	118	114	111
6	207	189	176	168	160	154	148	143	139	135
7	207	189	176	168	160	154	148	143	139	135
8	207	189	176	168	160	154	148	143	139	135
9	207	189	176	168	160	154	148	143	139	135
10	207	189	176	168	161	154	148	144	139	136
11	207	189	176	168	161	154	148	144	139	136
12	207	189	176	168	161	154	148	144	139	136
13	207	192	176	168	161	155	149	144	139	136
14	207	192	176	168	161	155	149	144	139	136
15	207	189	176	168	161	154	148	144	139	136
16	207	189	176	168	161	154	148	144	139	136
17	207	189	176	168	161	154	148	144	139	136
18	207	189	176	168	161	154	148	144	139	136
19	207	192	176	168	161	155	149	144	139	136
20	207	192	176	168	161	155	149	144	139	136
21	207	189	176	168	161	154	148	144	139	136
22	207	189	176	168	161	154	148	144	139	136
23	207	189	176	168	161	154	148	144	139	136
24	207	189	176	168	161	154	148	144	139	136
25	207	189	176	168	161	154	148	144	139	136
26	207	189	176	168	161	154	148	144	139	136
27	207	189	176	168	161	154	148	144	139	136
28	207	189	176	168	161	154	148	144	139	136
29	207	189	176	168	161	154	148	144	139	136
30	207	189	176	168	161	154	148	144	139	136
31	207	189	176	168	161	154	148	144	139	136
32	220	201	187	179	171	164	158	153	148	144
33	379	368	354	345	336	329	322	317	313	311
34	379	368	354	345	336	328	322	317	313	311
35	345	334	322	313	306	299	293	288	285	283
36	345	334	322	313	306	299	293	288	285	283
37	448	435	418	408	397	388	380	374	370	367
38	448	435	418	408	397	388	380	374	370	367
39	310	301	290	282	275	268	263	259	256	254
40	448	435	418	408	397	388	380	374	370	367
41	448	435	418	408	397	388	380	374	370	367
42	517	502	483	470	458	447	438	432	427	423
43	517	502	483	470	458	447	438	432	427	423

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
2	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
3	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
4	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
5	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
6	131	129	126	124	123	121	120	119	118	117
7	131	129	126	124	123	121	120	119	118	117
8	131	129	126	124	123	121	120	119	118	117
9	131	129	126	124	123	121	120	119	118	117
10	132	129	127	125	123	122	121	120	118	117
11	132	129	127	125	123	122	121	120	118	117
12	132	129	127	125	123	122	121	120	118	117
13	132	129	127	125	123	122	121	120	118	117
14	132	129	127	125	123	122	121	120	118	117 (**13**)
15	132	129	127	125	123	122	121	120	118	117
16	132	129	127	125	123	122	121	120	118	117
17	132	129	127	125	123	122	121	120	118	117
18	132	129	127	125	123	122	121	120	118	117
19	132	129	127	125	123	122	121	120	118	117
20	132	129	127	125	123	122	121	120	118	117
21	132	129	127	125	123	122	121	120	118	117
22	132	129	127	125	123	122	121	120	118	117 (**13**)
23	132	129	127	125	123	122	121	120	118	117 (**13**)
24	132	129	127	125	123	122	121	120	118	117
25	132	129	127	125	123	122	121	120	118	117
26	132	129	127	125	123	122	121	120	118	117
27	132	129	127	125	123	122	121	120	118	117
28	132	129	127	125	123	122	121	120	118	117
29	132	129	127	125	123	122	121	120	118	117
30	132	129	127	125	123	122	121	120	118	117
31	132	129	127	125	123	122	121	120	118	117
32	141	138	135	133	131	130	128	127	126	125
33	308	305	301	297	294	290	287	283	279	276 (**13**)
34	308	305	...	...	...	...	...	...	...	...
35	280	277	274	270	267	264	261	257	254	251
36	280	277	274	270	267	264	261	257	254	251
37	364	360	356	351	347	343	339	335	330	325
38	364	360	...	...	...	...	...	...	...	...
39	252	249	...	...	...	...	...	...	...	...
40	364	360	356	351	347	343	339	335	330	325
41	364	360	356	351	347	343	339	335	330	325
42	419	416	411	405	400	396	391	386	381	376
43	419	416	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	B
	2	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2
	3	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2
	4	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	B
	5	16Cr–12Ni–2Mo	Bolting	SA–193	B8M	S31600	2
	6	16Cr–12Ni–2Mo	Bolting	SA–320	B8M	S31600	2
	7	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	B
	8	16Cr–12Ni–2Mo	Bar	SA–276	316	S31600	B
	9	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...
	10	16Cr–12Ni–2Mo	Forgings	SA–965	F316H	S31609	...
	11	16Cr–12Ni–2Mo	Forgings	SA–182	F316H	S31609	...
	12	16Cr–12Ni–2Mo	Smls. tube	SA–213	TP316H	S31609	...
	13	16Cr–12Ni–2Mo	Plate	SA–240	316H	S31609	...
	14	16Cr–12Ni–2Mo	Wld. tube	SA–249	TP316H	S31609	...
	15	16Cr–12Ni–2Mo	Smls. & wld. pipe	SA–312	TP316H	S31609	...
	16	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	1
(**13**)	17	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	3
(**13**)	18	16Cr–12Ni–2Mo	Wld. pipe	SA–358	316H	S31609	4
	19	16Cr–12Ni–2Mo	Smls. pipe	SA–376	TP316H	S31609	...
	20	16Cr–12Ni–2Mo	Smls. & wld. fittings	SA–403	316H	S31609	...
	21	16Cr–12Ni–2Mo	Bar	SA–479	316H	S31609	...
	22	16Cr–12Ni–2Mo	Wld. pipe	SA–813	TP316H	S31609	...
	23	16Cr–12Ni–2Mo	Wld. pipe	SA–814	TP316H	S31609	...
	24	16Cr–12Ni–2Mo–Cb	Plate	SA–240	316Cb	S31640	...
	25	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...
	26	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316LN	S31653	...
	27	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316LN	S31653	...
	28	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316LN	S31653	...
	29	16Cr–12Ni–2Mo–N	Plate	SA–240	316LN	S31653	...
	30	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316LN	S31653	...
	31	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316LN	S31653	...
	32	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	1
(**13**)	33	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	3
(**13**)	34	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316LN	S31653	4
	35	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316LN	S31653	...
	36	16Cr–12Ni–2Mo–N	Fittings	SA–403	316LN	S31653	...
	37	16Cr–12Ni–2Mo–N	Bar	SA–479	316LN	S31653	...
	38	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316LN	S31653	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	32 < t ≤ 38	690	345	(4)
2	19 < t ≤ 25	690	550	...
3	19 < t ≤ 25	690	550	...
4	25 < t ≤ 32	725	450	(4)
5	≤19	760	655	...
6	≤19	760	655	...
7	19 < t ≤ 25	795	550	(4)
8	≤19	860	690	(4)
9	>125	485	205	...
10	...	485	205	...
11	≤125	515	205	...
12	...	515	205	...
13	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	...	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	515	205	...
23	...	515	205	...
24	...	515	205	...
25	>125	485	205	...
26	...	485	205	...
27	≤125	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	345	334	322	313	306	299	293	288	285	283
2	552	509	472	460	451	434	414	397	383	374
3	552	509	472	460	451	434	414	397	383	374
4	448	435	418	408	397	388	380	374	370	367
5	655	597	537	509	489	471	454	440	428	418
6	655	597	537	509	489	471	454	440	428	418
7	552	535	515	501	489	477	468	460	455	451
8	689	669	643	627	611	596	584	576	570	564
9	207	189	176	168	161	154	148	144	139	136
10	207	189	176	168	161	154	148	144	139	136
11	207	189	176	168	161	154	148	144	139	136
12	207	189	176	168	161	154	148	144	139	136
13	207	189	176	168	161	154	148	144	139	136
14	207	189	176	168	161	154	148	144	139	136
15	207	189	176	168	161	154	148	144	139	136
16	207	189	176	168	161	154	148	144	139	136
17	207	189	176	168	161	154	148	144	139	136
18	207	189	176	168	161	154	148	144	139	136
19	207	189	176	168	161	154	148	144	139	136
20	207	189	176	168	161	154	148	144	139	136
21	207	189	176	168	161	154	148	144	139	136
22	207	189	176	168	161	154	148	144	139	136
23	207	189	176	168	161	154	148	144	139	136
24	207	193	180	172	164	156	149	143	138	134
25	207	187	174	165	158	151	146	141	136	132
26	207	187	174	165	158	151	146	141	136	132
27	207	187	174	165	158	151	146	141	136	132
28	207	187	174	165	158	151	146	141	136	132
29	207	187	174	165	158	151	146	141	136	132
30	207	187	174	165	158	151	146	141	136	132
31	207	187	174	165	158	151	146	141	136	132
32	207	187	174	165	158	151	146	141	136	132
33	207	187	174	165	158	151	146	141	136	132
34	207	187	174	165	158	151	146	141	136	132
35	207	187	174	165	158	151	146	141	136	132
36	207	187	174	165	158	151	146	141	136	132
37	207	187	174	165	158	151	146	141	136	132
38	207	187	174	165	158	151	146	141	136	132

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	280	277	...	...	...	...	...	...	...	...
2	364	350	338	333	329	325	322	319	316	314
3	364	350	338	333	329	325	322	319	316	314
4	364	360	...	...	...	...	...	...	...	...
5	408	399	391	383	375	369	362	356	349	342
6	408	399	391	383	375	369	362	356	349	342
7	448	444	...	...	...	...	...	...	...	...
8	559	555	...	...	...	...	...	...	...	...
9	132	129	127	125	123	122	121	120	118	117
10	132	129	127	125	123	122	121	120	118	117
11	132	129	127	125	123	122	121	120	118	117
12	132	129	127	125	123	122	121	120	118	117
13	132	129	127	125	123	122	121	120	118	117
14	132	129	127	125	123	122	121	120	118	117
15	132	129	127	125	123	122	121	120	118	117
16	132	129	127	125	123	122	121	120	118	117
17	132	129	127	125	123	122	121	120	118	117 (**13**)
18	132	129	127	125	123	122	121	120	118	117 (**13**)
19	132	129	127	125	123	122	121	120	118	117
20	132	129	127	125	123	122	121	120	118	117
21	132	129	127	125	123	122	121	120	118	117
22	132	129	127	125	123	122	121	120	118	117
23	132	129	127	125	123	122	121	120	118	117
24	131	128	126	124	123	121	121	120	120	119
25	128	125	122	119	116	114	111	109	108	106
26	128	125	122	119	116	114	111	109	108	106
27	128	125	122	119	116	114	111	109	108	106
28	128	125	122	119	116	114	111	109	108	106
29	128	125	122	119	116	114	111	109	108	106
30	128	125	122	119	116	114	111	109	108	106
31	128	125	122	119	116	114	111	109	108	106
32	128	125	122	119	116	114	111	109	108	106
33	128	125	122	119	116	114	111	109	108	106 (**13**)
34	128	125	122	119	116	114	111	109	108	106 (**13**)
35	128	125	122	119	116	114	111	109	108	106
36	128	125	122	119	116	114	111	109	108	106
37	128	125	122	119	116	114	111	109	108	106
38	128	125	122	119	116	114	111	109	108	106

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	16Cr–12Ni–2Mo–N	Forgings	SA–182	F316N	S31651	...
	2	16Cr–12Ni–2Mo–N	Smls. tube	SA–213	TP316N	S31651	...
	3	16Cr–12Ni–2Mo–N	Plate	SA–240	316N	S31651	...
	4	16Cr–12Ni–2Mo–N	Wld. tube	SA–249	TP316N	S31651	...
	5	16Cr–12Ni–2Mo–N	Smls. & wld. pipe	SA–312	TP316N	S31651	...
	6	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	1
(13)	7	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	3
(13)	8	16Cr–12Ni–2Mo–N	Wld. pipe	SA–358	316N	S31651	4
	9	16Cr–12Ni–2Mo–N	Smls. pipe	SA–376	TP316N	S31651	...
	10	16Cr–12Ni–2Mo–N	Smls. & wld. fittings	SA–403	316N	S31651	...
	11	16Cr–12Ni–2Mo–N	Bar	SA–479	316N	S31651	...
	12	16Cr–12Ni–2Mo–N	Wld. tube	SA–688	TP316N	S31651	...
	13	16Cr–12Ni–2Mo–N	Wld. pipe	SA–813	TP316N	S31651	...
	14	16Cr–12Ni–2Mo–N	Wld. pipe	SA–814	TP316N	S31651	...
	15	16Cr–12Ni–2Mo–N	Forgings	SA–965	F316N	S31651	...
	16	16Cr–12Ni–2Mo–Ti	Plate	SA–240	316Ti	S31635	...
	17	17Cr–4Ni–6Mn	Plate	SA–240	201–1	S20100	...
	18	17Cr–4Ni–6Mn	Plate	SA–666	201–1	S20100	...
	19	17Cr–4Ni–6Mn	Plate	SA–240	201–2	S20100	...
	20	17Cr–4Ni–6Mn	Plate	SA–666	201–2	S20100	...
	21	17Cr–7Ni	Plate, sheet, strip	SA–240	301	S30100	...
	22	18Cr–3Ni–12Mn	Plate	SA–240	XM–29	S24000	...
	23	18Cr–3Ni–12Mn	Wld. tube	SA–249	XM–29	S24000	...
	24	18Cr–3Ni–12Mn	Wld. pipe	SA–312	XM–29	S24000	...
	25	18Cr–3Ni–12Mn	Bar	SA–479	XM–29	S24000	...
	26	18Cr–3Ni–12Mn	Wld. tube	SA–688	TPXM–29	S24000	...
	27	18Cr–5Ni–3Mo	Smls. & wld. tube	SA–789	...	S31500	...
	28	18Cr–5Ni–3Mo	Smls. & wld. pipe	SA–790	...	S31500	...
	29	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...
	30	18Cr–8Ni	Forgings	SA–965	F304L	S30403	...
	31	18Cr–8Ni	Bar	SA/JIS G4303	SUS304L	...	...
	32	18Cr–8Ni	Forgings	SA–182	F304L	S30403	...
	33	18Cr–8Ni	Smls. tube	SA–213	TP304L	S30403	...
	34	18Cr–8Ni	Plate	SA–240	304L	S30403	...
	35	18Cr–8Ni	Wld. tube	SA–249	TP304L	S30403	...
	36	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304L	S30403	...
	37	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	1
(13)	38	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	3
(13)	39	18Cr–8Ni	Wld. pipe	SA–358	304L	S30403	4
	40	18Cr–8Ni	Smls. & wld. fittings	SA–403	304L	S30403	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	550	240	...
2	...	550	240	...
3	...	550	240	...
4	...	550	240	...
5	...	550	240	...
6	...	550	240	...
7	...	550	240	...
8	...	550	240	...
9	...	550	240	...
10	...	550	240	...
11	...	550	240	...
12	...	550	240	...
13	...	550	240	...
14	...	550	240	...
15	...	550	240	...
16	...	515	205	...
17	...	515	260	...
18	...	515	260	...
19	...	655	310	...
20	...	655	310	...
21	...	515	205	...
22	...	690	380	...
23	...	690	380	...
24	...	690	380	...
25	...	690	380	...
26	...	690	380	...
27	...	635	440	...
28	...	635	440	...
29	>125	450	170	...
30	...	450	170	...
31	...	480	175	...
32	≤125	485	170	...
33	...	485	170	...
34	...	485	170	...
35	...	485	170	...
36	...	485	170	...
37	...	485	170	...
38	...	485	170	...
39	...	485	170	...
40	...	485	170	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	241	224	212	204	196	189	183	177	172	168
2	241	224	212	204	196	189	183	177	172	168
3	241	224	212	204	196	189	183	177	172	168
4	241	224	212	204	196	189	183	177	172	168
5	241	224	212	204	196	189	183	177	172	168
6	241	224	212	204	196	189	183	177	172	168
7	241	224	212	204	196	189	183	177	172	168
8	241	224	212	204	196	189	183	177	172	168
9	241	224	212	204	196	189	183	177	172	168
10	241	224	212	204	196	189	183	177	172	168
11	241	224	212	204	196	189	183	177	172	168
12	241	224	212	204	196	189	183	177	172	168
13	241	224	212	204	196	189	183	177	172	168
14	241	224	212	204	196	189	183	177	172	168
15	241	224	212	204	196	189	183	177	172	168
16	207	193	180	172	164	156	149	143	138	134
17	262	220	195	182	172	165	158	151	...	...
18	262	220	195	182	172	165	158	151	...	...
19	310	261	231	215	204	195	187	179	...	...
20	310	261	231	215	204	195	187	179	...	...
21	207	179	164	155	149	144	140	137	135	133
22	379	334	299	277	258	242	229	219	211	205
23	379	334	299	277	258	242	229	219	211	205
24	379	334	299	277	258	242	229	219	211	205
25	379	334	299	277	258	242	229	219	211	205
26	379	334	299	277	258	242	229	219	211	205
27	441	384	357	345	338	333	329	326	323	319
28	441	384	357	345	338	333	329	326	323	319
29	172	157	146	138	132	126	121	117	114	111
30	172	157	146	138	132	126	121	117	114	111
31	172	157	146	138	132	126	121	117	114	111
32	172	157	146	138	132	126	121	117	114	111
33	172	157	146	138	132	126	121	117	114	111
34	172	157	146	138	132	126	121	117	114	111
35	172	157	146	138	132	126	121	117	114	111
36	172	157	146	138	132	126	121	117	114	111
37	172	157	146	138	132	126	121	117	114	111
38	172	157	146	138	132	126	121	117	114	111
39	172	157	146	138	132	126	121	117	114	111
40	172	157	146	138	132	126	121	117	114	111

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	164	160	156	153	150	147	145	142	140	137	
2	164	160	156	153	150	147	145	142	140	137	
3	164	160	156	153	150	147	145	142	140	137	
4	164	160	156	153	150	147	145	142	140	137	
5	164	160	156	153	150	147	145	142	140	137	
6	164	160	156	153	150	147	145	142	140	137	
7	164	160	156	153	150	147	145	142	140	137	(**13**)
8	164	160	156	153	150	147	145	142	140	137	(**13**)
9	164	160	156	153	150	147	145	142	140	137	
10	164	160	156	153	150	147	145	142	140	137	
11	164	160	156	153	150	147	145	142	140	137	
12	164	160	156	153	150	147	145	142	140	137	
13	164	160	156	153	150	147	145	142	140	137	
14	164	160	156	153	150	147	145	142	140	137	
15	164	160	156	153	150	147	145	142	140	137	
16	131	128	126	124	123	121	121	120	120	119	
17	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	
21	131	128	126	123	119	115	112	109	108	...	
22	200	197	194	191	188	184	179	175	169	164	
23	200	197	194	191	188	184	179	175	169	164	
24	200	197	194	191	188	184	179	175	169	164	
25	200	197	194	191	188	184	179	175	169	164	
26	200	197	194	191	188	184	179	175	169	164	
27	315	310	305	300	295	292	289	...	...	...	
28	315	310	305	300	295	292	289	...	...	...	
29	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
30	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
31	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
32	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
33	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
34	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
35	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
36	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
37	108	106	104	103	101	100	98.9	97.1	95.2	93.0	
38	108	106	104	103	101	100	98.9	97.1	95.2	93.0	(**13**)
39	108	106	104	103	101	100	98.9	97.1	95.2	93.0	(**13**)
40	108	106	104	103	101	100	98.9	97.1	95.2	93.0	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	18Cr–8Ni	Wld. pipe	SA–409	TP304L	S30403	...
	2	18Cr–8Ni	Bar	SA–479	304L	S30403	...
	3	18Cr–8Ni	Wld. tube	SA–688	TP304L	S30403	...
	4	18Cr–8Ni	Wld. pipe	SA–813	TP304L	S30403	...
	5	18Cr–8Ni	Wld. pipe	SA–814	TP304L	S30403	...
	6	18Cr–8Ni	Forgings	SA–182	F304	S30400	...
	7	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...
	8	18Cr–8Ni	Castings	SA–351	CF3	J92500	...
	9	18Cr–8Ni	Castings	SA–351	CF8	J92600	...
	10	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...
	11	18Cr–8Ni	Cast pipe	SA–451	CPF3	J92500	...
	12	18Cr–8Ni	Cast pipe	SA–451	CPF8	J92600	...
	13	18Cr–8Ni	Forgings	SA–965	F304	S30400	...
	14	18Cr–8Ni	Forgings	SA–965	F304H	S30409	...
	15	18Cr–8Ni	Forgings	SA–182	F304	S30400	...
	16	18Cr–8Ni	Forgings	SA–182	F304H	S30409	...
	17	18Cr–8Ni	Bolting	SA–193	B8	S30400	1
(**13**)	18	18Cr–8Ni	Bolting	SA–193	B8A	S30400	1A
	19	18Cr–8Ni	Smls. tube	SA–213	TP304	S30400	...
	20	18Cr–8Ni	Smls. tube	SA–213	TP304H	S30409	...
	21	18Cr–8Ni	Plate	SA–240	302	S30200	...
	22	18Cr–8Ni	Plate	SA–240	304	S30400	...
	23	18Cr–8Ni	Plate	SA–240	304H	S30409	...
	24	18Cr–8Ni	Wld. tube	SA–249	TP304	S30400	...
	25	18Cr–8Ni	Wld. tube	SA–249	TP304H	S30409	...
	26	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304	S30400	...
	27	18Cr–8Ni	Smls. & wld. pipe	SA–312	TP304H	S30409	...
	28	18Cr–8Ni	Bolting	SA–320	B8	S30400	1
	29	18Cr–8Ni	Bolting	SA–320	B8A	S30400	1A
	30	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	1
(**13**)	31	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	3
(**13**)	32	18Cr–8Ni	Wld. pipe	SA–358	304	S30400	4
	33	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	1
(**13**)	34	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	3
(**13**)	35	18Cr–8Ni	Wld. pipe	SA–358	304H	S30409	4
	36	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	1
(**13**)	37	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	3
(**13**)	38	18Cr–8Ni	Wld. pipe	SA–358	304LN	S30453	4
	39	18Cr–8Ni	Smls. pipe	SA–376	TP304	S30400	...
	40	18Cr–8Ni	Smls. pipe	SA–376	TP304H	S30409	...
	41	18Cr–8Ni	Smls. & wld. fittings	SA–403	304	S30400	...
	42	18Cr–8Ni	Smls. & wld. fittings	SA–403	304H	S30409	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	485	170	...
2	...	485	170	...
3	...	485	170	...
4	...	485	170	...
5	...	485	170	...
6	>125	485	205	...
7	>125	485	205	...
8	...	485	205	...
9	...	485	205	...
10	...	485	205	...
11	...	485	205	...
12	...	485	205	...
13	...	485	205	...
14	...	485	205	...
15	≤125	515	205	...
16	≤125	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	515	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	...	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	172	157	146	138	132	126	121	117	114	111
2	172	157	146	138	132	126	121	117	114	111
3	172	157	146	138	132	126	121	117	114	111
4	172	157	146	138	132	126	121	117	114	111
5	172	157	146	138	132	126	121	117	114	111
6	207	184	170	161	154	148	144	139	135	132
7	207	184	170	161	154	148	144	139	135	132
8	207	184	170	161	154	148	144	139	135	132
9	207	184	170	161	154	148	144	139	135	132
10	207	184	170	161	154	148	144	139	135	132
11	207	184	170	161	154	148	144	139	135	132
12	207	184	170	161	154	148	144	139	135	132
13	207	184	170	161	154	148	144	139	135	132
14	207	184	170	161	154	148	144	139	135	132
15	207	184	170	161	154	148	144	139	135	132
16	207	184	170	161	154	148	144	139	135	132
17	207	188	169	161	154	149	144	139	135	132
18	207	188	169	161	154	149	144	139	135	132
19	207	184	170	161	154	148	144	139	135	132
20	207	184	170	161	154	148	144	139	135	132
21	207	184	170	161	154	148	144	139	135	132
22	207	184	170	161	154	148	144	139	135	132
23	207	184	170	161	154	148	144	139	135	132
24	207	184	170	161	154	148	144	139	135	132
25	207	184	170	161	154	148	144	139	135	132
26	207	184	170	161	154	148	144	139	135	132
27	207	184	170	161	154	148	144	139	135	132
28	207	188	169	161	154	149	144	139	135	132
29	207	188	169	161	154	149	144	139	135	132
30	207	184	170	161	154	148	144	139	135	132
31	207	184	170	161	154	148	144	139	135	132
32	207	184	170	161	154	148	144	139	135	132
33	207	184	170	161	154	148	144	139	135	132
34	207	184	170	161	154	148	144	139	135	132
35	207	184	170	161	154	148	144	139	135	132
36	207	184	170	161	154	148	144	139	135	132
37	207	184	170	161	154	148	144	139	135	132
38	207	184	170	161	154	148	144	139	135	132
39	207	184	170	161	154	148	144	139	135	132
40	207	184	170	161	154	148	144	139	135	132
41	207	184	170	161	154	148	144	139	135	132
42	207	184	170	161	154	148	144	139	135	132

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	108	106	104	103	101	100	98.9	97.1	95.2	93.0
2	108	106	104	103	101	100	98.9	97.1	95.2	93.0
3	108	106	104	103	101	100	98.9	97.1	95.2	93.0
4	108	106	104	103	101	100	98.9	97.1	95.2	93.0
5	108	106	104	103	101	100	98.9	97.1	95.2	93.0
6	129	126	123	121	118	117	114	112	110	108
7	129	126	123	121	118	117	114	112	110	108
8	129	126	123	121	118	117	114	112	110	108
9	129	126	123	121	118	117	114	112	110	108
10	129	126	123	121	118	117	114	112	110	108
11	129	126	123	121	118	117	114	112	110	108
12	129	126	123	121	118	117	114	112	110	108
13	129	126	123	121	118	117	114	112	110	108
14	129	126	123	121	118	117	114	112	110	108
15	129	126	123	121	118	117	114	112	110	108
16	129	126	123	121	118	117	114	112	110	108
17	129	126	123	121	118	117	114	112	110	108
18	129	126	123	121	118	117	114	112	110	108 (**13**)
19	129	126	123	121	118	117	114	112	110	108
20	129	126	123	121	118	117	114	112	110	108
21	129	126	123	121	118	117	114	112	110	108
22	129	126	123	121	118	117	114	112	110	108
23	129	126	123	121	118	117	114	112	110	108
24	129	126	123	121	118	117	114	112	110	108
25	129	126	123	121	118	117	114	112	110	108
26	129	126	123	121	118	117	114	112	110	108
27	129	126	123	121	118	117	114	112	110	108
28	129	126	123	121	118	117	114	112	110	108
29	129	126	123	121	118	117	114	112	110	108
30	129	126	123	121	118	117	114	112	110	108
31	129	126	123	121	118	117	114	112	110	108 (**13**)
32	129	126	123	121	118	117	114	112	110	108 (**13**)
33	129	126	123	121	118	117	114	112	110	108
34	129	126	123	121	118	117	114	112	110	108 (**13**)
35	129	126	123	121	118	117	114	112	110	108 (**13**)
36	129	126	123	121	118	117	114	112	110	108
37	129	126	123	121	118	117	114	112	110	108 (**13**)
38	129	126	123	121	118	117	114	112	110	108 (**13**)
39	129	126	123	121	118	117	114	112	110	108
40	129	126	123	121	118	117	114	112	110	108
41	129	126	123	121	118	117	114	112	110	108
42	129	126	123	121	118	117	114	112	110	108

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	18Cr–8Ni	Wld. pipe	SA–409	TP304	S30400	...
	2	18Cr–8Ni	Bar	SA–479	302	S30200	...
	3	18Cr–8Ni	Bar	SA–479	304	S30400	...
	4	18Cr–8Ni	Bar	SA–479	304H	S30409	...
	5	18Cr–8Ni	Wld. tube	SA–688	TP304	S30400	...
	6	18Cr–8Ni	Wld. pipe	SA–813	TP304	S30400	...
	7	18Cr–8Ni	Wld. pipe	SA–813	TP304H	S30409	...
	8	18Cr–8Ni	Wld. pipe	SA–814	TP304	S30400	...
	9	18Cr–8Ni	Wld. pipe	SA–814	TP304H	S30409	...
	10	18Cr–8Ni	Bar	SA/JIS G4303	SUS302	...	...
	11	18Cr–8Ni	Bar	SA/JIS G4303	SUS304	...	...
	12	18Cr–8Ni	Plate	SA/EN 10028–7	X5CrNi18–10	...	...
	13	18Cr–8Ni	Castings	SA–351	CF3A	J92500	...
	14	18Cr–8Ni	Castings	SA–351	CF8A	J92600	...
	15	18Cr–8Ni	Cast pipe	SA–451	CPF3A	J92500	...
	16	18Cr–8Ni	Cast pipe	SA–451	CPF8A	J92600	...
(**13**)	17	18Cr–8Ni	Bolting	SA–193	B8	S30400	2
(**13**)	18	18Cr–8Ni	Bolting	SA–320	B8	S30400	2
(**13**)	19	18Cr–8Ni	Bolting	SA–193	B8	S30400	2
(**13**)	20	18Cr–8Ni	Bolting	SA–320	B8	S30400	2
(**13**)	21	18Cr–8Ni	Bolting	SA–193	B8	S30400	2
(**13**)	22	18Cr–8Ni	Bolting	SA–320	B8	S30400	2
(**13**)	23	18Cr–8Ni	Bolting	SA–193	B8	S30400	2
(**13**)	24	18Cr–8Ni	Bolting	SA–320	B8	S30400	2
	25	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...
	26	18Cr–8Ni–N	Forgings	SA–965	F304LN	S30453	...
	27	18Cr–8Ni–N	Forgings	SA–182	F304LN	S30453	...
	28	18Cr–8Ni–N	Bolting	SA–193	B8NA	S30451	1A
	29	18Cr–8Ni–N	Smls. tube	SA–213	TP304LN	S30453	...
	30	18Cr–8Ni–N	Plate	SA–240	304LN	S30453	...
	31	18Cr–8Ni–N	Wld. tube	SA–249	TP304LN	S30453	...
	32	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304LN	S30453	...
	33	18Cr–8Ni–N	Smls. pipe	SA–376	TP304LN	S30453	...
	34	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304LN	S30453	WP
	35	18Cr–8Ni–N	Bar	SA–479	304LN	S30453	...
	36	18Cr–8Ni–N	Wld. tube	SA–688	TP304LN	S30453	...
	37	18Cr–8Ni–N	Wld. pipe	SA–813	TP304LN	S30453	...
	38	18Cr–8Ni–N	Wld. pipe	SA–814	TP304LN	S30453	...
	39	18Cr–8Ni–N	Forgings	SA–182	F304N	S30451	...
	40	18Cr–8Ni–N	Smls. tube	SA–213	TP304N	S30451	...
	41	18Cr–8Ni–N	Plate	SA–240	304N	S30451	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	...	515	205	...
5	...	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	520	205	...
11	...	520	205	...
12	≤75	520	210	...
13	...	530	240	...
14	...	530	240	...
15	...	530	240	...
16	...	530	240	...
17	32 < t ≤ 38	690	345	(6)
18	32 < t ≤ 38	690	345	(6)
19	25 < t ≤ 32	725	450	(6)
20	25 < t ≤ 32	725	450	(6)
21	19 < t ≤ 25	795	550	(6)
22	19 < t ≤ 25	795	550	(6)
23	≤19	860	690	(6)
24	≤19	860	690	(6)
25	>125	485	205	...
26	...	485	205	...
27	≤125	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	...	550	240	...
40	...	550	240	...
41	...	550	240	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	184	170	161	154	148	144	139	135	132
2	207	184	170	161	154	148	144	139	135	132
3	207	184	170	161	154	148	144	139	135	132
4	207	184	170	161	154	148	144	139	135	132
5	207	184	170	161	154	148	144	139	135	132
6	207	184	170	161	154	148	144	139	135	132
7	207	184	170	161	154	148	144	139	135	132
8	207	184	170	161	154	148	144	139	135	132
9	207	184	170	161	154	148	144	139	135	132
10	207	184	170	161	154	148	144	139	135	132
11	207	184	170	161	154	148	144	139	135	132
12	210	187	173	164	157	151	146	141	137	134
13	241	216	198	188	180	173	167	162	157	154
14	241	216	198	188	180	173	167	162	157	154
15	241	216	198	188	180	173	167	162	157	154
16	241	216	198	188	180	173	167	162	157	154
17	345	307	283	268	257	247	240	232	225	220
18	345	307	283	268	257	247	240	232	225	220
19	448	398	368	348	333	320	312	301	292	286
20	448	398	368	348	333	320	312	301	292	286
21	552	491	453	429	411	395	384	371	360	352
22	552	491	453	429	411	395	384	371	360	352
23	689	612	566	536	513	493	479	463	449	439
24	689	612	566	536	513	493	479	463	449	439
25	207	184	170	161	154	148	144	139	135	132
26	207	184	170	161	154	148	144	139	135	132
27	207	184	170	161	154	148	144	139	135	132
28	207	188	169	161	154	149	144	139	135	132
29	207	184	170	161	154	148	144	139	135	132
30	207	184	170	161	154	148	144	139	135	132
31	207	184	170	161	154	148	144	139	135	132
32	207	184	170	161	154	148	144	139	135	132
33	207	184	170	161	154	148	144	139	135	132
34	207	184	170	161	154	148	144	139	135	132
35	207	184	170	161	154	148	144	139	135	132
36	207	184	170	161	154	148	144	139	135	132
37	207	184	170	161	154	148	144	139	135	132
38	207	184	170	161	154	148	144	139	135	132
39	241	213	194	182	172	164	157	151	146	142
40	241	213	194	182	172	164	157	151	146	142
41	241	213	194	182	172	164	157	151	146	142

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Ferrous Materials (Cont'd)
1	129	126	123	121	118	117	114	112	110	108
2	129	126	123	121	118	117	114	112	110	108
3	129	126	123	121	118	117	114	112	110	108
4	129	126	123	121	118	117	114	112	110	108
5	129	126	123	121	118	117	114	112	110	108
6	129	126	123	121	118	117	114	112	110	108
7	129	126	123	121	118	117	114	112	110	108
8	129	126	123	121	118	117	114	112	110	108
9	129	126	123	121	118	117	114	112	110	108
10	129	126	123	121	118	117	114	112	110	108
11	129	126	123	121	118	117	114	112	110	108
12	131	128	125	123	120	118	116	114	112	110
13	150	147	144	141	138	136	134	131	129	126
14	150	147	144	141	138	136	134	131	129	126
15	150	147	144	141	138	136	134	131	129	126
16	150	147	144	141	138	136	134	131	129	126
17	215	210	205	202	197	195	190	187	183	180 (**13**)
18	215	210	205	202	197	195	190	187	183	180 (**13**)
19	279	273	266	262	255	253	247	242	238	234 (**13**)
20	279	273	266	262	255	253	247	242	238	234 (**13**)
21	344	336	328	323	315	312	304	299	293	288 (**13**)
22	344	336	328	323	315	312	304	299	293	288 (**13**)
23	429	419	409	403	393	389	379	373	366	359 (**13**)
24	429	419	409	403	393	389	379	373	366	359 (**13**)
25	129	126	123	121	118	117	114	112	110	108
26	129	126	123	121	118	117	114	112	110	108
27	129	126	123	121	118	117	114	112	110	108
28	129	126	123	121	118	117	114	112	110	108
29	129	126	123	121	118	117	114	112	110	108
30	129	126	123	121	118	117	114	112	110	108
31	129	126	123	121	118	117	114	112	110	108
32	129	126	123	121	118	117	114	112	110	108
33	129	126	123	121	118	117	114	112	110	108
34	129	126	123	121	118	117	114	112	110	108
35	129	126	123	121	118	117	114	112	110	108
36	129	126	123	121	118	117	114	112	110	108
37	129	126	123	121	118	117	114	112	110	108
38	129	126	123	121	118	117	114	112	110	108
39	139	136	134	131	130	128	125	123	120	118
40	139	136	134	131	130	128	125	123	120	118
41	139	136	134	131	130	128	125	123	120	118

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	18Cr–8Ni–N	Wld. tube	SA–249	TP304N	S30451	...
	2	18Cr–8Ni–N	Smls. & wld. pipe	SA–312	TP304N	S30451	...
	3	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	1
(13)	4	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	3
(13)	5	18Cr–8Ni–N	Wld. pipe	SA–358	304N	S30451	4
	6	18Cr–8Ni–N	Smls. pipe	SA–376	TP304N	S30451	...
	7	18Cr–8Ni–N	Smls. & wld. fittings	SA–403	304N	S30451	...
	8	18Cr–8Ni–N	Bar	SA–479	304N	S30451	...
	9	18Cr–8Ni–N	Wld. tube	SA–688	TP304N	S30451	...
	10	18Cr–8Ni–N	Wld. pipe	SA–813	TP304N	S30451	...
	11	18Cr–8Ni–N	Wld. pipe	SA–814	TP304N	S30451	...
	12	18Cr–8Ni–N	Forgings	SA–965	F304N	S30451	...
	13	18Cr–8Ni–S	Bolting	SA–320	B8F	S30323	1
	14	18Cr–8Ni–S	Bolting	SA–320	B8FA	S30323	1A
	15	18Cr–8Ni–Se	Bolting	SA–320	B8F	S30323	1
	16	18Cr–8Ni–Se	Bolting	SA–320	B8FA	S30323	1A
(13)	17	18Cr–8Ni–4Si–N	Bolting	SA–193	B8S	S21800	...
(13)	18	18Cr–8Ni–4Si–N	Bolting	SA–193	B8SA	S21800	...
	19	18Cr–8Ni–4Si–N	Bar	SA–479	...	S21800	...
	20	18Cr–10Ni–Cb	Forgings	SA–965	F348H	S34809	...
	21	18Cr–10Ni–Cb	Castings	SA–351	CF8C	J92710	...
	22	18Cr–10Ni–Cb	Cast pipe	SA–451	CPF8C	J92710	...
	23	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...
	24	18Cr–10Ni–Cb	Forgings	SA–965	F347	S34700	...
	25	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...
	26	18Cr–10Ni–Cb	Forgings	SA–965	F347H	S34709	...
	27	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...
	28	18Cr–10Ni–Cb	Forgings	SA–965	F348	S34800	...
	29	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...
	30	18Cr–10Ni–Cb	Forgings	SA–182	F347	S34700	...
	31	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	1
	32	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347	S34700	...
	33	18Cr–10Ni–Cb	Plate	SA–240	347	S34700	...
	34	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347	S34700	...
	35	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347	S34700	...
	36	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	1
	37	18Cr–10Ni–Cb	Bolting	SA–320	B8CA	S34700	1A
	38	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	1
(13)	39	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	3
(13)	40	18Cr–10Ni–Cb	Wld. pipe	SA–358	347	S34700	4
	41	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347	S34700	...
	42	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347	S34700	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	550	240	...
2	...	550	240	...
3	...	550	240	...
4	...	550	240	...
5	...	550	240	...
6	...	550	240	...
7	...	550	240	...
8	...	550	240	...
9	...	550	240	...
10	...	550	240	...
11	...	550	240	...
12	...	550	240	...
13	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	...	515	205	...
17	...	655	345	...
18	...	655	345	...
19	...	655	345	...
20	...	450	170	...
21	...	485	205	...
22	...	485	205	...
23	>125	485	205	...
24	...	485	205	...
25	>125	485	205	...
26	...	485	205	...
27	>125	485	205	...
28	...	485	205	...
29	>125	485	205	...
30	≤125	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	...	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	241	213	194	182	172	164	157	151	146	142
2	241	213	194	182	172	164	157	151	146	142
3	241	213	194	182	172	164	157	151	146	142
4	241	213	194	182	172	164	157	151	146	142
5	241	213	194	182	172	164	157	151	146	142
6	241	213	194	182	172	164	157	151	146	142
7	241	213	194	182	172	164	157	151	146	142
8	241	213	194	182	172	164	157	151	146	142
9	241	213	194	182	172	164	157	151	146	142
10	241	213	194	182	172	164	157	151	146	142
11	241	213	194	182	172	164	157	151	146	142
12	241	213	194	182	172	164	157	151	146	142
13	207	188	169	161	154	149	144	139	135	132
14	207	188	169	161	154	149	144	139	135	132
15	207	188	169	161	154	149	144	139	135	132
16	207	188	169	161	154	149	144	139	135	132
17	345	294	262	243	228	216	206	198	192	188
18	345	294	262	243	228	216	206	198	192	188
19	345	294	262	243	228	216	206	198	192	188
20	172	164	157	152	147	143	139	135	131	128
21	207	197	189	182	177	172	166	162	157	154
22	207	197	189	182	177	172	166	162	157	154
23	207	197	189	182	177	172	166	162	157	154
24	207	197	189	182	177	172	166	162	157	154
25	207	197	189	182	177	172	166	162	157	154
26	207	197	189	182	177	172	166	162	157	154
27	207	197	189	182	177	172	166	162	157	154
28	207	197	189	182	177	172	166	162	157	154
29	207	197	189	182	177	172	166	162	157	154
30	207	197	189	182	177	172	166	162	157	154
31	207	198	189	182	177	172	166	161	157	153
32	207	197	189	182	177	172	166	162	157	154
33	207	197	189	182	177	172	166	162	157	154
34	207	197	189	182	177	172	166	162	157	154
35	207	197	189	182	177	172	166	162	157	154
36	207	198	189	182	177	172	166	161	157	153
37	207	198	189	182	177	172	166	161	157	153
38	207	197	189	182	177	172	166	162	157	154
39	207	197	189	182	177	172	166	162	157	154
40	207	197	189	182	177	172	166	162	157	154
41	207	197	189	182	177	172	166	162	157	154
42	207	197	189	182	177	172	166	162	157	154

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
									Ferrous Materials (Cont'd)		
1	139	136	134	131	130	128	125	123	120	118	
2	139	136	134	131	130	128	125	123	120	118	
3	139	136	134	131	130	128	125	123	120	118	
4	139	136	134	131	130	128	125	123	120	118	(**13**)
5	139	136	134	131	130	128	125	123	120	118	(**13**)
6	139	136	134	131	130	128	125	123	120	118	
7	139	136	134	131	130	128	125	123	120	118	
8	139	136	134	131	130	128	125	123	120	118	
9	139	136	134	131	130	128	125	123	120	118	
10	139	136	134	131	130	128	125	123	120	118	
11	139	136	134	131	130	128	125	123	120	118	
12	139	136	134	131	130	128	125	123	120	118	
13	129	126	123	121	118	117	114	112	110	108	
14	129	126	123	121	118	117	114	112	110	108	
15	129	126	123	121	118	117	114	...	...	...	
16	129	126	123	121	118	117	114	...	...	...	
17	184	181	178	176	175	174	173	172	172	172	(**13**)
18	184	181	178	176	175	174	173	172	172	172	(**13**)
19	184	181	178	176	175	174	173	172	172	172	
20	125	123	121	119	118	117	117	116	116	116	
21	150	147	145	142	141	140	139	139	139	139	
22	150	147	145	142	141	140	139	139	139	139	
23	150	147	145	142	141	140	139	139	139	139	
24	150	147	145	142	141	140	139	139	139	139	
25	150	147	145	142	141	140	139	139	139	139	
26	150	147	145	142	141	140	139	139	139	139	
27	150	147	145	142	141	140	139	139	139	139	
28	150	147	145	142	141	140	139	139	139	139	
29	150	147	145	142	141	140	139	139	139	139	
30	150	147	145	142	141	140	139	139	139	139	
31	150	147	145	142	141	141	140	139	139	139	
32	150	147	145	142	141	140	139	139	139	139	
33	150	147	145	142	141	140	139	139	139	139	
34	150	147	145	142	141	140	139	139	139	139	
35	150	147	145	142	141	140	139	139	139	139	
36	150	147	145	142	141	141	140	139	139	139	
37	150	147	145	142	141	141	140	139	139	139	
38	150	147	145	142	141	140	139	139	139	139	
39	150	147	145	142	141	140	139	139	139	139	(**13**)
40	150	147	145	142	141	140	139	139	139	139	(**13**)
41	150	147	145	142	141	140	139	139	139	139	
42	150	147	145	142	141	140	139	139	139	139	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Ferrous Materials (Cont'd)					
1	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP347	S34700	...
2	18Cr–10Ni–Cb	Bar	SA–479	347	S34700	...
3	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347	S34700	...
4	18Cr–10Ni–Cb	Forgings	SA–182	F347H	S34709	...
5	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347H	S34709	...
6	18Cr–10Ni–Cb	Plate	SA–240	347H	S34709	...
7	18Cr–10Ni–Cb	Wld. tube	SA–249	TP347H	S34709	...
8	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP347H	S34709	...
9	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP347H	S34709	...
10	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	347H	S34709	...
11	18Cr–10Ni–Cb	Bar	SA–479	347H	S34709	...
12	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP347H	S34709	...
13	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP347H	S34709	...
14	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347LN	S34751	...
15	18Cr–10Ni–Cb	Smls. pipe	SA–312	TP347LN	S34751	...
16	18Cr–10Ni–Cb	Forgings	SA–182	F348	S34800	...
17	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348	S34800	...
18	18Cr–10Ni–Cb	Plate	SA–240	348	S34800	...
19	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348	S34800	...
20	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348	S34800	...
21	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	1
(**13**) 22	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	3
(**13**) 23	18Cr–10Ni–Cb	Wld. pipe	SA–358	348	S34800	4
24	18Cr–10Ni–Cb	Smls. pipe	SA–376	TP348	S34800	...
25	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348	S34800	...
26	18Cr–10Ni–Cb	Wld. pipe	SA–409	TP348	S34800	...
27	18Cr–10Ni–Cb	Bar	SA–479	348	S34800	...
28	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348	S34800	...
29	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348	S34800	...
30	18Cr–10Ni–Cb	Forgings	SA–182	F348H	S34809	...
31	18Cr–10Ni–Cb	Smls. tube	SA–213	TP348H	S34809	...
32	18Cr–10Ni–Cb	Plate	SA–240	348H	S34809	...
33	18Cr–10Ni–Cb	Wld. tube	SA–249	TP348H	S34809	...
34	18Cr–10Ni–Cb	Smls. & wld. pipe	SA–312	TP348H	S34809	...
35	18Cr–10Ni–Cb	Smls. & wld. fittings	SA–403	348H	S34809	...
36	18Cr–10Ni–Cb	Bar	SA–479	348H	S34809	...
37	18Cr–10Ni–Cb	Wld. pipe	SA–813	TP348H	S34809	...
38	18Cr–10Ni–Cb	Wld. pipe	SA–814	TP348H	S34809	...
39	18Cr–10Ni–Cb	Bar	SA/JIS G4303	SUS347	...	...
40	18Cr–10Ni–Cb	Smls. tube	SA–213	TP347HFG	S34710	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	≤125	515	205	...
5	...	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	515	205	...
11	...	515	205	...
12	...	515	205	...
13	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	≤125	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	515	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	≤125	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	...	520	205	...
40	...	550	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	197	189	182	177	172	166	162	157	154
2	207	197	189	182	177	172	166	162	157	154
3	207	197	189	182	177	172	166	162	157	154
4	207	197	189	182	177	172	166	162	157	154
5	207	197	189	182	177	172	166	162	157	154
6	207	197	189	182	177	172	166	162	157	154
7	207	197	189	182	177	172	166	162	157	154
8	207	197	189	182	177	172	166	162	157	154
9	207	197	189	182	177	172	166	162	157	154
10	207	197	189	182	177	172	166	162	157	154
11	207	197	189	182	177	172	166	162	157	154
12	207	197	189	182	177	172	166	162	157	154
13	207	197	189	182	177	172	166	162	157	154
14	207	192	180	172	165	158	152	147	142	138
15	207	192	180	172	165	158	152	147	142	138
16	207	197	189	182	177	172	166	162	157	154
17	207	197	189	182	177	172	166	162	157	154
18	207	197	189	182	177	172	166	162	157	154
19	207	197	189	182	177	172	166	162	157	154
20	207	197	189	182	177	172	166	162	157	154
21	207	197	189	182	177	172	166	162	157	154
22	207	197	189	182	177	172	166	162	157	154
23	207	197	189	182	177	172	166	162	157	154
24	207	197	189	182	177	172	166	162	157	154
25	207	197	189	182	177	172	166	162	157	154
26	207	197	189	182	177	172	166	162	157	154
27	207	197	189	182	177	172	166	162	157	154
28	207	197	189	182	177	172	166	162	157	154
29	207	197	189	182	177	172	166	162	157	154
30	207	197	189	182	177	172	166	162	157	154
31	207	197	189	182	177	172	166	162	157	154
32	207	197	189	182	177	172	166	162	157	154
33	207	197	189	182	177	172	166	162	157	154
34	207	197	189	182	177	172	166	162	157	154
35	207	197	189	182	177	172	166	162	157	154
36	207	197	189	182	177	172	166	162	157	154
37	207	197	189	182	177	172	166	162	157	154
38	207	197	189	182	177	172	166	162	157	154
39	207	197	189	182	177	172	166	162	157	154
40	207	194	185	179	174	170	165	162	158	155

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
									Ferrous Materials (Cont'd)	
1	150	147	145	142	141	140	139	139	139	139
2	150	147	145	142	141	140	139	139	139	139
3	150	147	145	142	141	140	139	139	139	139
4	150	147	145	142	141	140	139	139	139	139
5	150	147	145	142	141	140	139	139	139	139
6	150	147	145	142	141	140	139	139	139	139
7	150	147	145	142	141	140	139	139	139	139
8	150	147	145	142	141	140	139	139	139	139
9	150	147	145	142	141	140	139	139	139	139
10	150	147	145	142	141	140	139	139	139	139
11	150	147	145	142	141	140	139	139	139	139
12	150	147	145	142	141	140	139	139	139	139
13	150	147	145	142	141	140	139	139	139	139
14	135	133	131	130	129	129	129	129	128	128
15	135	133	131	130	129	129	129	129	128	128
16	150	147	145	142	141	140	139	139	139	139
17	150	147	145	142	141	140	139	139	139	139
18	150	147	145	142	141	140	139	139	139	139
19	150	147	145	142	141	140	139	139	139	139
20	150	147	145	142	141	140	139	139	139	139
21	150	147	145	142	141	140	139	139	139	139
22	150	147	145	142	141	140	139	139	139	139 (**13**)
23	150	147	145	142	141	140	139	139	139	139 (**13**)
24	150	147	145	142	141	140	139	139	139	139
25	150	147	145	142	141	140	139	139	139	139
26	150	147	145	142	141	140	139	139	139	139
27	150	147	145	142	141	140	139	139	139	139
28	150	147	145	142	141	140	139	139	139	139
29	150	147	145	142	141	140	139	139	139	139
30	150	147	145	142	141	140	139	139	139	139
31	150	147	145	142	141	140	139	139	139	139
32	150	147	145	142	141	140	139	139	139	139
33	150	147	145	142	141	140	139	139	139	139
34	150	147	145	142	141	140	139	139	139	139
35	150	147	145	142	141	140	139	139	139	139
36	150	147	145	142	141	140	139	139	139	139
37	150	147	145	142	141	140	139	139	139	139
38	150	147	145	142	141	140	139	139	139	139
39	150	147	145	142	141	140	139	139	139	139
40	152	150	148	146	144	142	141	139	138	137

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
(13)	1	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2
(13)	2	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2
(13)	3	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2
(13)	4	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2
(13)	5	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2
(13)	6	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2
(13)	7	18Cr–10Ni–Cb	Bolting	SA–193	B8C	S34700	2
(13)	8	18Cr–10Ni–Cb	Bolting	SA–320	B8C	S34700	2
	9	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321	S32100	...
	10	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...
	11	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321H	S32109	...
	12	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...
	13	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...
	14	18Cr–10Ni–Ti	Forgings	SA–965	F321	S32100	...
	15	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...
	16	18Cr–10Ni–Ti	Forgings	SA–965	F321H	S32109	...
	17	18Cr–10Ni–Ti	Forgings	SA–182	F321	S32100	...
	18	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	1
	19	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321	S32100	...
	20	18Cr–10Ni–Ti	Plate	SA–240	321	S32100	...
	21	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321	S32100	...
	22	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321	S32100	...
	23	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	1
	24	18Cr–10Ni–Ti	Bolting	SA–320	B8TA	S32100	1A
	25	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	1
(13)	26	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	3
(13)	27	18Cr–10Ni–Ti	Wld. pipe	SA–358	321	S32100	4
	28	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321	S32100	...
	29	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321	S32100	...
	30	18Cr–10Ni–Ti	Wld. pipe	SA–409	TP321	S32100	...
	31	18Cr–10Ni–Ti	Bar	SA–479	321	S32100	...
	32	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321	S32100	...
	33	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321	S32100	...
	34	18Cr–10Ni–Ti	Forgings	SA–182	F321H	S32109	...
	35	18Cr–10Ni–Ti	Smls. tube	SA–213	TP321H	S32109	...
	36	18Cr–10Ni–Ti	Plate	SA–240	321H	S32109	...
	37	18Cr–10Ni–Ti	Wld. tube	SA–249	TP321H	S32109	...
	38	18Cr–10Ni–Ti	Smls. & wld. pipe	SA–312	TP321H	S32109	...
	39	18Cr–10Ni–Ti	Smls. pipe	SA–376	TP321H	S32109	...
	40	18Cr–10Ni–Ti	Smls. & wld. fittings	SA–403	321H	S32109	...
	41	18Cr–10Ni–Ti	Bar	SA–479	321H	S32109	...
	42	18Cr–10Ni–Ti	Wld. pipe	SA–813	TP321H	S32109	...
	43	18Cr–10Ni–Ti	Wld. pipe	SA–814	TP321H	S32109	...
	44	18Cr–10Ni–Ti	Bar	SA/JIS G4303	SUS321	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	32 < t ≤ 38	690	345	(6)
2	32 < t ≤ 38	690	345	(6)
3	25 < t ≤ 32	725	450	(6)
4	25 < t ≤ 32	725	450	(6)
5	19 < t ≤ 25	795	550	(6)
6	19 < t ≤ 25	795	550	(6)
7	≤19	860	690	(6)
8	≤19	860	690	(6)
9	>10	485	170	...
10	>10	485	170	...
11	>5	485	170	...
12	>10	485	170	...
13	>125	485	205	...
14	...	485	205	...
15	>125	485	205	...
16	...	485	205	...
17	≤125	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	≤10	515	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	≤10	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	≤125	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	≤5	515	205	...
39	≤10	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	520	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	345	328	315	303	295	287	277	270	262	257
2	345	328	315	303	295	287	277	270	262	257
3	450	428	411	396	385	374	361	352	341	335
4	448	428	411	396	385	374	361	352	341	335
5	550	523	502	484	470	457	441	430	417	409
6	552	523	502	484	470	457	441	430	417	409
7	690	657	630	607	590	573	553	540	523	513
8	689	657	630	607	590	573	553	540	523	513
9	172	162	154	147	143	138	133	129	125	121
10	172	162	154	147	143	138	133	129	125	121
11	172	162	154	147	143	138	133	129	125	121
12	172	162	154	147	143	138	133	129	125	121
13	207	194	184	177	171	165	160	154	150	146
14	207	194	184	177	171	165	160	154	150	146
15	207	194	184	177	171	165	160	154	150	146
16	207	194	184	177	171	165	160	154	150	146
17	207	194	184	177	171	165	160	154	150	146
18	207	196	184	177	171	165	159	154	150	146
19	207	194	184	177	171	165	160	154	150	146
20	207	194	184	177	171	165	160	154	150	146
21	207	194	184	177	171	165	160	154	150	146
22	207	194	184	177	171	165	160	154	150	146
23	207	196	184	177	171	165	159	154	150	146
24	207	196	184	177	171	165	159	154	150	146
25	207	194	184	177	171	165	160	154	150	146
26	207	194	184	177	171	165	160	154	150	146
27	207	194	184	177	171	165	160	154	150	146
28	207	194	184	177	171	165	160	154	150	146
29	207	194	184	177	171	165	160	154	150	146
30	207	194	184	177	171	165	160	154	150	146
31	207	194	184	177	171	165	160	154	150	146
32	207	194	184	177	171	165	160	154	150	146
33	207	194	184	177	171	165	160	154	150	146
34	207	194	184	177	171	165	160	154	150	146
35	207	194	184	177	171	165	160	154	150	146
36	207	194	184	177	171	165	160	154	150	146
37	207	194	184	177	171	165	160	154	150	146
38	207	194	184	177	171	165	160	154	150	146
39	207	194	184	177	171	165	160	154	150	146
40	207	194	184	177	171	165	160	154	150	146
41	207	194	184	177	171	165	160	154	150	146
42	207	194	184	177	171	165	160	154	150	146
43	207	194	184	177	171	165	160	154	150	146
44	207	194	184	177	171	165	160	154	150	146

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	250	245	242	237	235	233	232	232	232	232	(**13**)
2	250	245	242	237	235	233	232	232	232	232	(**13**)
3	326	320	315	309	307	304	302	302	302	302	(**13**)
4	326	320	315	309	307	304	302	302	302	302	(**13**)
5	399	391	385	377	375	372	369	369	369	369	(**13**)
6	399	391	385	377	375	372	369	369	369	369	(**13**)
7	500	490	483	473	470	467	463	463	463	463	(**13**)
8	500	490	483	473	470	467	463	463	463	463	(**13**)
9	118	116	113	111	110	108	107	106	105	104	
10	118	116	113	111	110	108	107	106	105	104	
11	118	116	113	111	110	108	107	106	105	104	
12	118	116	113	111	110	108	107	106	105	104	
13	142	139	136	133	132	130	128	127	126	125	
14	142	139	136	133	132	130	128	127	126	125	
15	142	139	136	133	132	130	128	127	126	125	
16	142	139	136	133	132	130	128	127	126	125	
17	142	139	136	133	132	130	128	127	126	125	
18	142	139	136	133	132	130	128	127	126	125	
19	142	139	136	133	132	130	128	127	126	125	
20	142	139	136	133	132	130	128	127	126	125	
21	142	139	136	133	132	130	128	127	126	125	
22	142	139	136	133	132	130	128	127	126	125	
23	142	139	136	133	132	130	128	127	126	125	
24	142	139	136	133	132	130	128	127	126	125	
25	142	139	136	133	132	130	128	127	126	125	
26	142	139	136	133	132	130	128	127	126	125	(**13**)
27	142	139	136	133	132	130	128	127	126	125	(**13**)
28	142	139	136	133	132	130	128	127	126	125	
29	142	139	136	133	132	130	128	127	126	125	
30	142	139	136	133	132	130	128	127	126	125	
31	142	139	136	133	132	130	128	127	126	125	
32	142	139	136	133	132	130	128	127	126	125	
33	142	139	136	133	132	130	128	127	126	125	
34	142	139	136	133	132	130	128	127	126	125	
35	142	139	136	133	132	130	128	127	126	125	
36	142	139	136	133	132	130	128	127	126	125	
37	142	139	136	133	132	130	128	127	126	125	
38	142	139	136	133	132	130	128	127	126	125	
39	142	139	136	133	132	130	128	127	126	125	
40	142	139	136	133	132	130	128	127	126	125	
41	142	139	136	133	132	130	128	127	126	125	
42	142	139	136	133	132	130	128	127	126	125	
43	142	139	136	133	132	130	128	127	126	125	
44	142	139	136	133	132	130	128	127	126	125	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
(13)	1	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2
(13)	2	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2
(13)	3	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2
(13)	4	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2
(13)	5	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2
(13)	6	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2
(13)	7	18Cr–10Ni–Ti	Bolting	SA–193	B8T	S32100	2
(13)	8	18Cr–10Ni–Ti	Bolting	SA–320	B8T	S32100	2
(13)	9	18Cr–11Ni	Bolting	SA–193	B8P	S30500	1
	10	18Cr–11Ni	Plate	SA–240	305	S30500	...
(13)	11	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2
(13)	12	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2
(13)	13	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2
(13)	14	18Cr–11Ni	Bolting	SA–193	B8P	S30500	2
	15	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...
	16	18Cr–13Ni–3Mo	Forgings	SA–182	F317L	S31703	...
	17	18Cr–13Ni–3Mo	Forgings	SA–182	F317	S31700	...
	18	18Cr–13Ni–3Mo	Plate	SA–240	317	S31700	...
	19	18Cr–13Ni–3Mo	Plate	SA–240	317L	S31703	...
	20	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317	S31700	...
	21	18Cr–13Ni–3Mo	Wld. tube	SA–249	TP317L	S31703	...
	22	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317	S31700	...
	23	18Cr–13Ni–3Mo	Smls. & wld. pipe	SA–312	TP317L	S31703	...
	24	18Cr–13Ni–3Mo	Smls. & wld. fittings	SA–403	317	S31700	...
	25	18Cr–13Ni–3Mo	Fittings	SA–403	317L	S31703	...
	26	18Cr–18Ni–2Si	Smls. tube	SA–213	XM–15	S38100	...
	27	18Cr–18Ni–2Si	Plate	SA–240	XM–15	S38100	...
	28	18Cr–18Ni–2Si	Wld. tube	SA–249	TPXM–15	S38100	...
	29	18Cr–18Ni–2Si	Wld. pipe	SA–312	TPXM–15	S38100	...
	30	19Cr–9Ni–½Mo	Castings	SA–351	CF10	J92590	...
	31	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B
	32	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	B
	33	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A
	34	19Cr–9Ni–Mo–W	Bolting	SA–453	651	S63198	A
	35	19Cr–9Ni–2Mo	Castings	SA–351	CF10M	...	...
	36	19Cr–10Ni–3Mo	Castings	SA–351	CG8M	J93000	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	32 < t ≤ 38	690	345	(6)
2	32 < t ≤ 38	690	345	(6)
3	25 < t ≤ 32	725	450	(6)
4	25 < t ≤ 32	725	450	(6)
5	19 < t ≤ 25	795	550	(6)
6	19 < t ≤ 25	795	550	(6)
7	≤19	860	690	(6)
8	≤19	860	690	(6)
9	...	515	205	...
10	...	515	205	...
11	32 < t ≤ 38	690	345	(6)
12	25 < t ≤ 32	725	450	(6)
13	19 < t ≤ 25	795	550	(6)
14	≤19	860	690	(6)
15	>125	450	170	...
16	≤125	485	170	...
17	≤125	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	515	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	485	205	...
31	>75	655	345	...
32	≤75	655	415	...
33	>75	690	415	...
34	≤75	690	485	...
35	...	485	205	...
36	...	515	240	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	345	327	307	295	285	275	265	257	250	243
2	345	327	307	295	285	275	265	257	250	243
3	448	424	398	383	370	357	344	333	325	316
4	448	424	398	383	370	357	344	333	325	316
5	552	523	491	472	456	440	424	411	400	389
6	552	523	491	472	456	440	424	411	400	389
7	689	652	612	589	569	549	529	513	499	486
8	689	652	612	589	569	549	529	513	499	486
9	207	184	170	161	154	148	144	139	135	132
10	207	184	170	161	154	148	144	139	135	132
11	345	307	283	268	257	247	240	232	225	220
12	450	400	370	350	335	322	313	302	293	287
13	550	489	452	428	409	393	383	369	359	351
14	690	613	567	537	513	493	480	463	450	440
15	172	157	145	137	131	125	121	118	114	111
16	172	157	145	137	131	125	121	118	114	111
17	207	189	176	168	161	154	148	144	139	136
18	207	189	176	168	161	154	148	144	139	136
19	207	189	173	165	157	151	146	141	137	134
20	207	189	176	168	161	154	148	144	139	136
21	207	189	173	165	157	151	146	141	137	134
22	207	189	176	168	161	154	148	144	139	136
23	207	189	173	165	157	151	146	141	137	134
24	207	189	176	168	161	154	148	144	139	136
25	207	189	173	165	157	151	146	141	137	134
26	207	184	170	161	154	148	144	139	135	132
27	207	184	170	161	154	148	144	139	135	132
28	207	184	170	161	154	148	144	139	135	132
29	207	184	170	161	154	148	144	139	135	132
30	207	184	170	161	154	148	143	138	134	131
31	345	332	318	311	305	299	294	289	285	281
32	414	398	381	373	366	359	353	348	343	338
33	414	398	381	373	366	359	353	348	343	338
34	483	464	445	435	427	419	412	405	399	394
35	207	191	178	170	162	155	149	143	139	135
36	241	211	191	179	169	160	153	148	143	139

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	237	232	227	222	220	217	213	212	210	208	(**13**)
2	237	232	227	222	220	217	213	212	210	208	(**13**)
3	307	301	294	288	286	281	277	275	273	271	(**13**)
4	307	301	294	288	286	281	277	275	273	271	(**13**)
5	379	371	363	355	352	347	341	339	336	333	(**13**)
6	379	371	363	355	352	347	341	339	336	333	(**13**)
7	473	463	453	443	439	433	426	423	419	416	(**13**)
8	473	463	453	443	439	433	426	423	419	416	(**13**)
9	129	126	123	121	118	117	114	112	110	108	(**13**)
10	129	126	123	121	118	117	114	112	110	108	
11	215	210	205	202	197	195	190	187	183	180	(**13**)
12	280	274	267	263	257	254	248	243	239	235	(**13**)
13	343	335	327	321	314	311	303	298	292	287	(**13**)
14	430	420	410	403	393	390	380	373	367	360	(**13**)
15	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
16	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0	
17	132	129	127	125	123	122	121	120	118	117	
18	132	129	127	125	123	122	121	120	118	117	
19	131	128	126	124	121	119	117	115	112	110	
20	132	129	127	125	123	122	121	120	118	117	
21	131	128	126	124	121	119	117	115	112	110	
22	132	129	127	125	123	122	121	120	118	117	
23	131	128	126	124	121	119	117	115	112	110	
24	132	129	127	125	123	122	121	120	118	117	
25	131	128	126	124	121	119	117	115	112	110	
26	129	126	123	121	118	117	114	112	110	108	
27	129	126	123	121	118	117	114	112	110	108	
28	129	126	123	121	118	117	114	112	110	108	
29	129	126	123	121	118	117	114	112	110	108	
30	129	126	123	121	118	117	115	113	111	108	
31	277	274	271	268	264	261	258	254	250	246	
32	333	329	325	321	317	313	309	305	300	295	
33	333	329	325	321	317	313	309	305	300	295	
34	389	383	379	374	370	365	361	355	350	345	
35	131	129	127	125	123	121	120	119	118	117	
36	136	133	130	129	127	126	124	123	121	119	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	19Cr–15Ni–4Mo	Smls. tube	SA–213	...	S31725	...
	2	19Cr–15Ni–4Mo	Plate	SA–240	...	S31725	...
	3	19Cr–15Ni–4Mo	Wld. tube	SA–249	...	S31725	...
	4	19Cr–15Ni–4Mo	Smls. & wld. pipe	SA–312	...	S31725	...
	5	19Cr–15Ni–4Mo	Wld. pipe	SA–358	...	S31725	...
	6	19Cr–15Ni–4Mo	Smls. pipe	SA–376	...	S31725	...
	7	19Cr–15Ni–4Mo	Wld. pipe	SA–409	...	S31725	...
	8	19Cr–15Ni–4Mo	Bar	SA–479	...	S31725	...
	9	20Cr–10Ni	Bar	SA–479	ER308	S30880	...
	10	20Cr–18Ni–6Mo	Castings	SA–351	CK3MCuN	J93254	...
	11	20Cr–18Ni–6Mo	Forgings	SA–182	F44	S31254	...
	12	20Cr–18Ni–6Mo	Wld. tube	SA–249	...	S31254	...
	13	20Cr–18Ni–6Mo	Smls. & wld. pipe	SA–312	...	S31254	...
	14	20Cr–18Ni–6Mo	Wld. pipe	SA–358	...	S31254	...
	15	20Cr–18Ni–6Mo	Plate	SA–240	...	S31254	...
	16	21Cr–6Ni–9Mn	Forgings	SA–182	FXM–11	S21904	...
	17	21Cr–6Ni–9Mn	Smls. & wld. pipe	SA–312	TPXM–11	S21904	...
	18	21Cr–6Ni–9Mn	Plate	SA–666	XM–11	S21904	...
	19	21Cr–6Ni–9Mn	Forgings	SA–965	FXM–11	S21904	...
	20	21Cr–11Ni–N	Forgings	SA–182	F45	S30815	...
	21	21Cr–11Ni–N	Smls. tube	SA–213	...	S30815	...
	22	21Cr–11Ni–N	Plate	SA–240	...	S30815	...
	23	21Cr–11Ni–N	Wld. tube	SA–249	...	S30815	...
	24	21Cr–11Ni–N	Smls. & wld. pipe	SA–312	...	S30815	...
	25	21Cr–11Ni–N	Bar	SA–479	...	S30815	...
(13)	26	22Cr–2Ni–Mo–N	Forgings	SA–182	F66	S32202	...
(13)	27	22Cr–2Ni–Mo–N	Plate	SA–240	...	S32202	...
(13)	28	22Cr–2Ni–Mo–N	Bar	SA–479	...	S32202	...
(13)	29	22Cr–2Ni–Mo–N	Smls. & wld. tube	SA–789	...	S32202	...
(13)	30	22Cr–2Ni–Mo–N	Smls. & wld. pipe	SA–790	...	S32202	...
(13)	31	22Cr–2Ni–Mo–N	Smls. & wld. fittings	SA–815	...	S32202	...
	32	22Cr–5Ni–3Mo–N	Forgings	SA–182	F51	S31803	...
	33	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S31803	...
	34	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S31803	...
	35	22Cr–5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S31803	...
	36	22Cr–5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S31803	...
	37	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S31803	...
(13)	38	22Cr–5Ni–3Mo–N	Plate	SA–240	...	S32205	...
(13)	39	22Cr–5Ni–3Mo–N	Bar	SA–479	...	S32205	...
(13)	40	22Cr–5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S32205	...
(13)	41	22Cr–5Ni–3Mo–N	Smls. & wld. fittings	SA–815	...	S32205	...
(13)	42	22Cr–5Ni–3Mo–N	Forgings	SA–182	F60	S32205	...
(13)	43	22Cr–5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S32205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	...	515	205	...
5	...	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	550	260	...
11	...	650	305	...
12	...	650	305	...
13	...	650	305	...
14	...	650	305	...
15	...	690	310	...
16	...	620	345	...
17	...	620	345	...
18	...	620	345	...
19	...	620	345	...
20	...	600	310	...
21	...	600	310	...
22	...	600	310	...
23	...	600	310	...
24	...	600	310	...
25	...	600	310	...
26	...	648	448	...
27	...	648	448	...
28	...	648	448	...
29	...	648	448	...
30	...	648	448	...
31	...	648	448	...
32	...	620	450	...
33	...	620	450	...
34	...	620	450	...
35	...	620	450	...
36	...	620	450	...
37	...	620	450	...
38	...	655	450	...
39	...	655	450	...
40	...	655	450	...
41	...	655	450	...
42	...	655	480	...
43	...	655	480	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	186	172	164	157	151	146	141	137	134
2	207	186	172	164	157	151	146	141	137	134
3	207	186	172	164	157	151	146	141	137	134
4	207	186	172	164	157	151	146	141	137	134
5	207	186	172	164	157	151	146	141	137	134
6	207	186	172	164	157	151	146	141	137	134
7	207	186	172	164	157	151	146	141	137	134
8	207	186	172	164	157	151	146	141	137	134
9	207	184	170	161	154	148	144	139	135	132
10	262	230	211	200	191	184	178	172	168	165
11	303	266	244	231	221	213	206	200	195	190
12	303	266	244	231	221	213	206	200	195	190
13	303	266	244	231	221	213	206	200	195	190
14	303	266	244	231	221	213	206	200	195	190
15	310	272	250	237	226	218	211	205	199	195
16	345	294	261	242	227	215	204	196	189	184
17	345	294	261	242	227	215	204	196	189	184
18	345	294	261	242	227	215	204	196	189	184
19	345	294	261	242	227	215	204	196	189	184
20	310	278	255	240	227	216	208	200	194	189
21	310	278	255	240	227	216	208	200	194	189
22	310	278	255	240	227	216	208	200	194	189
23	310	278	255	240	227	216	208	200	194	189
24	310	278	255	240	227	216	208	200	194	189
25	310	278	255	240	227	216	208	200	194	189
26	448	411	377	355	339	328	321	317	315	312
27	448	411	377	355	339	328	321	317	315	312
28	448	411	377	355	339	328	321	317	315	312
29	448	411	377	355	339	328	321	317	315	312
30	448	411	377	355	339	328	321	317	315	312
31	448	411	377	355	339	328	321	317	315	312
32	448	418	395	381	370	361	354	349	344	339
33	448	418	395	381	370	361	354	349	344	339
34	448	418	395	381	370	361	354	349	344	339
35	448	418	395	381	370	361	354	349	344	339
36	448	418	395	381	370	361	354	349	344	339
37	448	418	395	381	370	361	354	349	344	339
38	448	418	395	381	370	361	354	349	344	339
39	448	418	395	381	370	361	354	349	344	339
40	448	418	395	381	370	361	354	349	344	339
41	448	418	395	381	370	361	354	349	344	339
42	483	449	425	410	399	389	382	376	370	365
43	483	449	425	410	399	389	382	376	370	365

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
									Ferrous Materials (Cont'd)		
1	131	128	126	124	121	119	117	115	113	111	
2	131	128	126	124	121	119	117	115	113	111	
3	131	128	126	124	121	119	117	115	113	111	
4	131	128	126	124	121	119	117	115	113	111	
5	131	128	126	124	121	119	117	115	113	111	
6	131	128	126	124	121	119	117	115	113	111	
7	131	128	126	124	121	119	117	115	113	111	
8	131	128	126	124	121	119	117	115	113	111	
9	129	126	123	121	118	117	114	112	110	108	
10	162	159	157	156	154	154	153	151	...	...	
11	187	184	182	180	179	178	177	175	...	...	
12	187	184	182	180	179	178	177	175	...	...	
13	187	184	182	180	179	178	177	175	...	...	
14	187	184	182	180	179	178	177	175	...	...	
15	191	188	186	185	183	182	181	180	...	...	
16	179	176	174	172	171	170	168	167	164	159	
17	179	176	174	172	171	170	168	167	164	159	
18	179	176	174	172	171	170	168	167	164	159	
19	179	176	174	172	171	170	168	167	164	159	
20	185	182	179	178	176	174	173	171	169	166	
21	185	182	179	178	176	174	173	171	169	166	
22	185	182	179	178	176	174	173	171	169	166	
23	185	182	179	178	176	174	173	171	169	166	
24	185	182	179	178	176	174	173	171	169	166	
25	185	182	179	178	176	174	173	171	169	166	
26	307	299	290	281	276	...	...	...	...	...	(**13**)
27	307	299	290	281	276	...	...	...	...	...	(**13**)
28	307	299	290	281	276	...	...	...	...	...	(**13**)
29	307	299	290	281	276	...	...	...	...	...	(**13**)
30	307	299	290	281	276	...	...	...	...	...	(**13**)
31	307	299	290	281	276	...	...	...	...	...	(**13**)
32	334	328	322	...	...	...	...	...	...	...	
33	334	328	322	...	...	...	...	...	...	...	
34	334	328	322	...	...	...	...	...	...	...	
35	334	328	322	...	...	...	...	...	...	...	
36	334	328	322	...	...	...	...	...	...	...	
37	334	328	322	...	...	...	...	...	...	...	
38	334	328	322	...	...	...	...	...	...	...	(**13**)
39	334	328	322	...	...	...	...	...	...	...	(**13**)
40	334	328	322	...	...	...	...	...	...	...	(**13**)
41	334	328	322	...	...	...	...	...	...	...	(**13**)
42	360	353	347	...	...	...	...	...	...	...	(**13**)
43	360	353	347	...	...	...	...	...	...	...	(**13**)

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	22Cr–13Ni–5Mn	Castings	SA–351	CG6MMN	J93790	...
	2	22Cr–13Ni–5Mn	Forgings	SA–182	FXM–19	S20910	...
	3	22Cr–13Ni–5Mn	Bolting	SA–193	B8R	S20910	Annealed
	4	22Cr–13Ni–5Mn	Bolting	SA–193	B8RA	S20910	Annealed
	5	22Cr–13Ni–5Mn	Smls. tube	SA–213	XM–19	S20910	...
	6	22Cr–13Ni–5Mn	Plate	SA–240	XM–19	S20910	...
	7	22Cr–13Ni–5Mn	Wld. tube	SA–249	TPXM–19	S20910	...
	8	22Cr–13Ni–5Mn	Smls. & wld. pipe	SA–312	TPXM–19	S20910	...
	9	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	1
(**13**)	10	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	3
(**13**)	11	22Cr–13Ni–5Mn	Wld. pipe	SA–358	XM–19	S20910	4
	12	22Cr–13Ni–5Mn	Smls. & wld. fittings	SA–403	XM–19	S20910	...
	13	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Annealed
	14	22Cr–13Ni–5Mn	Wld. pipe	SA–813	TPXM–19	S20910	...
	15	22Cr–13Ni–5Mn	Wld. pipe	SA–814	TPXM–19	S20910	...
	16	22Cr–13Ni–5Mn	Forgings	SA–965	FXM–19	S20910	...
	17	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled
	18	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled
	19	22Cr–13Ni–5Mn	Bar	SA–479	XM–19	S20910	Hot rolled
	20	23Cr–4Ni–Mo–Cu–N	Plate	SA–240	...	S32304	...
	21	23Cr–4Ni–Mo–Cu–N	Smls. & wld. tube	SA–789	...	S32304	...
	22	23Cr–4Ni–Mo–Cu–N	Smls. & wld. pipe	SA–790	...	S32304	...
	23	23Cr–4Ni–Mo–Cu–N	Smls. & wld. tube	SA–789	...	S32304	...
	24	23Cr–12Ni	Smls. & wld. fittings	SA–403	309	S30900	...
	25	23Cr–12Ni	Smls. tube	SA–213	TP309S	S30908	...
	26	23Cr–12Ni	Plate	SA–240	309S	S30908	...
	27	23Cr–12Ni	Wld. tube	SA–249	TP309S	S30908	...
	28	23Cr–12Ni	Smls. & wld. pipe	SA–312	TP309S	S30908	...
	29	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	1
(**13**)	30	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	3
(**13**)	31	23Cr–12Ni	Wld. pipe	SA–358	309S	S30908	4
	32	23Cr–12Ni	Bar	SA–479	309S	S30908	...
	33	23Cr–12Ni	Wld. pipe	SA–813	TP309S	S30908	...
	34	23Cr–12Ni	Wld. pipe	SA–814	TP309S	S30908	...
	35	23Cr–12Ni	Smls. tube	SA–213	TP309H	S30909	...
	36	23Cr–12Ni	Plate	SA–240	309H	S30909	...
	37	23Cr–12Ni	Wld. tube	SA–249	TP309H	S30909	...
	38	23Cr–12Ni	Smls. & wld. pipe	SA–312	TP309H	S30909	...
	39	23Cr–12Ni	Bar	SA–479	309H	S30909	...
	40	23Cr–12Ni	Bar	SA/JIS G4303	SUS309S	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	585	295	...
2	...	690	380	...
3	...	690	380	...
4	...	690	380	...
5	...	690	380	...
6	...	690	380	...
7	...	690	380	...
8	...	690	380	...
9	...	690	380	...
10	...	690	380	...
11	...	690	380	...
12	...	690	380	...
13	...	690	380	...
14	...	690	380	...
15	...	690	380	...
16	...	690	380	...
17	$75 < t \le 200$	690	415	...
18	$50 < t \le 75$	795	515	...
19	≤50	930	725	...
20	...	600	400	...
21	>25	600	400	...
22	...	600	400	...
23	≤25	690	450	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	...	515	205	...
40	...	520	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	293	265	248	238	230	223	218	213	209	205
2	379	344	321	308	298	289	282	275	270	265
3	379	344	321	308	298	289	282	275	270	265
4	379	344	321	308	298	289	282	275	270	265
5	379	344	321	308	298	289	282	275	270	265
6	379	344	321	308	298	289	282	275	270	265
7	379	344	321	308	298	289	282	275	270	265
8	379	344	321	308	298	289	282	275	270	265
9	379	344	321	308	298	289	282	275	270	265
10	379	344	321	308	298	289	282	275	270	265
11	379	344	321	308	298	289	282	275	270	265
12	379	344	321	308	298	289	282	275	270	265
13	379	344	321	308	298	289	282	275	270	265
14	379	344	321	308	298	289	282	275	270	265
15	379	344	321	308	298	289	282	275	270	265
16	379	344	321	308	298	289	282	275	270	265
17	414	382	349	335	325	316	307	300	295	289
18	517	477	436	419	406	395	384	376	368	361
19	724	668	611	586	569	553	539	526	516	506
20	400	363	340	328	319	312	308	304	301	297
21	400	363	340	328	319	312	308	304	301	297
22	400	363	340	328	319	312	308	304	301	297
23	448	407	382	368	357	349	343	339	336	333
24	207	191	179	172	167	162	157	153	150	147
25	207	191	179	172	167	162	157	153	150	147
26	207	191	179	172	167	162	157	153	150	147
27	207	191	179	172	167	162	157	153	150	147
28	207	191	179	172	167	162	157	153	150	147
29	207	191	179	172	167	162	157	153	150	147
30	207	191	179	172	167	162	157	153	150	147
31	207	191	179	172	167	162	157	153	150	147
32	207	191	179	172	167	162	157	153	150	147
33	207	191	179	172	167	162	157	153	150	147
34	207	191	179	172	167	162	157	153	150	147
35	207	191	179	172	167	162	157	153	150	147
36	207	191	179	172	167	162	157	153	150	147
37	207	191	179	172	167	162	157	153	150	147
38	207	191	179	172	167	162	157	153	150	147
39	207	191	179	172	167	162	157	153	150	147
40	207	191	179	172	167	162	157	153	150	147

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
									Ferrous Materials (Cont'd)		
1	201	198	195	193	190	188	186	185	183	181	
2	260	256	253	250	247	244	241	239	236	234	
3	260	256	253	250	247	244	241	239	236	234	
4	260	256	253	250	247	244	241	239	236	234	
5	260	256	253	250	247	244	241	239	236	234	
6	260	256	253	250	247	244	241	239	236	234	
7	260	256	253	250	247	244	241	239	236	234	
8	260	256	253	250	247	244	241	239	236	234	
9	260	256	253	250	247	244	241	239	236	234	
10	260	256	253	250	247	244	241	239	236	234	(**13**)
11	260	256	253	250	247	244	241	239	236	234	(**13**)
12	260	256	253	250	247	244	241	239	236	234	
13	260	256	253	250	247	244	241	239	236	234	
14	260	256	253	250	247	244	241	239	236	234	
15	260	256	253	250	247	244	241	239	236	234	
16	260	256	253	250	247	244	241	239	236	234	
17	284	280	275	272	269	266	263	261	258	255	
18	355	350	345	340	336	333	329	326	323	319	
19	497	490	483	476	471	466	461	456	452	446	
20	293	288	283	278	271	266	262	...	...	...	
21	293	288	283	278	271	266	262	...	...	...	
22	293	288	283	278	271	266	262	...	...	...	
23	329	323	318	311	...	...	...	...	...	...	
24	145	143	141	139	138	136	134	132	130	128	
25	145	143	141	139	138	136	134	132	130	128	
26	145	143	141	139	138	136	134	132	130	128	
27	145	143	141	139	138	136	134	132	130	128	
28	145	143	141	139	138	136	134	132	130	128	
29	145	143	141	139	138	136	134	132	130	128	
30	145	143	141	139	138	136	134	132	130	128	(**13**)
31	145	143	141	139	138	136	134	132	130	128	(**13**)
32	145	143	141	139	138	136	134	132	130	128	
33	145	143	141	139	138	136	134	132	130	128	
34	145	143	141	139	138	136	134	132	130	128	
35	145	143	141	139	138	136	134	132	130	128	
36	145	143	141	139	138	136	134	132	130	128	
37	145	143	141	139	138	136	134	132	130	128	
38	145	143	141	139	138	136	134	132	130	128	
39	145	143	141	139	138	136	134	132	130	128	
40	145	143	141	139	138	136	134	132	130	128	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	23Cr–12Ni–Cb	Smls. tube	SA–213	TP309Cb	S30940	...
	2	23Cr–12Ni–Cb	Plate	SA–240	309Cb	S30940	...
	3	23Cr–12Ni–Cb	Wld. tube	SA–249	TP309Cb	S30940	...
	4	23Cr–12Ni–Cb	Smls. & wld. pipe	SA–312	TP309Cb	S30940	...
	5	23Cr–12Ni–Cb	Bar	SA–479	309Cb	S30940	...
	6	23Cr–12Ni–Cb	Wld. pipe	SA–813	TP309Cb	S30940	...
	7	23Cr–12Ni–Cb	Wld. pipe	SA–814	TP309Cb	S30940	...
	8	24Cr–10Ni–4Mo–N	Castings	SA–995	2A	J93345	...
	9	25Cr–4Ni–4Mo–Ti	Plate	SA–240	...	S44635	...
	10	25Cr–4Ni–4Mo–Ti	Wld. tube	SA–268	...	S44635	...
	11	25Cr–5Ni–3Mo–2Cu	Castings	SA–995	1B	J93372	...
	12	25Cr–5Ni–3Mo–2Cu	Plate	SA–240	...	S32550	...
	13	25Cr–5Ni–3Mo–2Cu	Bar	SA–479	...	S32550	...
	14	25Cr–5Ni–3Mo–2Cu	Smls. & wld. tube	SA–789	...	S32550	...
	15	25Cr–5Ni–3Mo–2Cu	Smls. & wld. pipe	SA–790	...	S32550	...
	16	25Cr–6Ni–Mo–N	Plate	SA–240	...	S31200	...
	17	25Cr–6.5Ni–3Mo–N	Smls. & wld. tube	SA–789	...	S31260	...
	18	25Cr–6.5Ni–3Mo–N	Smls. & wld. pipe	SA–790	...	S31260	...
	19	25Cr–6.5Ni–3Mo–N	Plate	SA–240	...	S31260	...
	20	25Cr–7Ni–3Mo–W–Cu–N	Forgings	SA–182	F54	S39274	...
	21	25Cr–7Ni–3Mo–W–Cu–N	Smls. & wld. tube	SA–789	...	S39274	...
	22	25Cr–7Ni–3Mo–W–Cu–N	Smls. & wld. pipe	SA–790	...	S39274	...
	23	25Cr–7Ni–4Mo–N	Forgings	SA–182	F53	S32750	...
	24	25Cr–7Ni–4Mo–N	Plate	SA–240	...	S32750	...
	25	25Cr–7Ni–4Mo–N	Smls. & wld. tube	SA–789	...	S32750	...
	26	25Cr–7Ni–4Mo–N	Smls. & wld. pipe	SA–790	...	S32750	...
(13)	27	25Cr–7.5Ni–3.5Mo–N–Cu–W	Forgings	SA–182	F55	S32760	...
(13)	28	25Cr–7.5Ni–3.5Mo–N–Cu–W	Plate	SA–240	...	S32760	...
(13)	29	25Cr–7.5Ni–3.5Mo–N–Cu–W	Bar	SA–479	...	S32760	Annealed
(13)	30	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. tube	SA–789	...	S32760	...
(13)	31	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. pipe	SA–790	...	S32760	...
(13)	32	25Cr–7.5Ni–3.5Mo–N–Cu–W	Smls. & wld. fittings	SA–815	...	S32760	...
	33	25Cr–12Ni	Castings	SA–351	CH8	J93400	...
	34	25Cr–12Ni	Cast pipe	SA–451	CPH8	J93400	...
	35	25Cr–12Ni	Castings	SA–351	CH20	J93402	...
	36	25Cr–12Ni	Cast pipe	SA–451	CPH20	J93402	...
	37	25Cr–20Ni	Castings	SA–351	CK20	J94202	...
	38	25Cr–20Ni	Cast pipe	SA–451	CPK20	J94202	...
	39	25Cr–20Ni	Forgings	SA–182	F310	S31000	...
	40	25Cr–20Ni	Forgings	SA–965	F310	S31000	...
	41	25Cr–20Ni	Smls. tube	SA–213	TP310S	S31008	...
	42	25Cr–20Ni	Plate	SA–240	310S	S31008	...
	43	25Cr–20Ni	Wld. tube	SA–249	TP310S	S31008	...
	44	25Cr–20Ni	Smls. & wld. pipe	SA–312	TP310S	S31008	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	...	515	205	...
5	...	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	655	450	...
9	...	620	515	...
10	...	620	515	...
11	...	690	485	...
12	...	760	550	...
13	...	760	550	...
14	...	760	550	...
15	...	760	550	...
16	...	690	450	...
17	...	690	450	...
18	...	690	450	...
19	...	690	485	...
20	...	800	550	...
21	...	800	550	...
22	...	800	550	...
23	...	800	550	...
24	...	800	550	...
25	≤25	800	550	...
26	≤25	800	550	...
27	...	750	550	...
28	...	750	550	...
29	...	750	550	...
30	...	750	550	...
31	...	750	550	...
32	...	750	550	...
33	...	450	195	...
34	...	450	195	...
35	...	485	205	...
36	...	485	205	...
37	...	450	195	...
38	...	450	195	...
39	≤125	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	191	179	172	167	162	157	153	150	147
2	207	191	179	172	167	162	157	153	150	147
3	207	191	179	172	167	162	157	153	150	147
4	207	191	179	172	167	162	157	153	150	147
5	207	191	179	172	167	162	157	153	150	147
6	207	191	179	172	167	162	157	153	150	147
7	207	191	179	172	167	162	157	153	150	147
8	448	391	356	337	322	312	304	298	294	291
9	517	457	422	402	384	368	354	342	331	323
10	517	457	422	402	384	368	354	342	331	323
11	483	...	...	...	...	...	...	...	...	...
12	552	510	479	459	443	429	419	411	406	404
13	552	510	479	459	443	429	419	411	406	404
14	552	510	479	459	443	429	419	411	406	404
15	552	510	479	459	443	429	419	411	406	404
16	448	405	377	360	347	337	329	322	316	311
17	448	411	386	372	360	350	343	336	332	328
18	448	411	386	372	360	350	343	336	332	328
19	483	443	416	400	388	377	369	362	357	353
20	552	487	456	440	427	418	410	405	402	401
21	552	487	456	440	427	418	410	405	402	401
22	552	487	456	440	427	418	410	405	402	401
23	552	511	481	462	445	432	420	411	404	399
24	552	511	481	462	445	432	420	411	404	399
25	552	511	481	462	445	432	420	411	404	399
26	552	511	481	462	445	432	420	411	404	399
27	550	489	455	437	424	415	409	405	404	403
28	550	489	455	437	424	415	409	405	404	403
29	550	489	455	437	424	415	409	405	404	403
30	550	489	455	437	424	415	409	405	404	403
31	550	489	455	437	424	415	409	405	404	403
32	550	489	455	437	424	415	409	405	404	403
33	193	169	156	149	145	142	140	138	136	134
34	193	169	156	149	145	142	140	138	136	134
35	207	180	167	160	156	152	150	148	146	144
36	207	180	167	160	156	152	150	148	146	144
37	193	169	156	149	145	142	140	138	136	134
38	193	169	156	149	145	142	140	138	136	134
39	207	193	181	173	167	161	157	152	149	146
40	207	193	181	173	167	161	157	152	149	146
41	207	193	181	173	167	161	157	152	149	146
42	207	193	181	173	167	161	157	152	149	146
43	207	193	181	173	167	161	157	152	149	146
44	207	193	181	173	167	161	157	152	149	146

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	145	143	141	139	138	136	134	132	130	128	
2	145	143	141	139	138	136	134	132	130	128	
3	145	143	141	139	138	136	134	132	130	128	
4	145	143	141	139	138	136	134	132	130	128	
5	145	143	141	139	138	136	134	132	130	128	
6	145	143	141	139	138	136	134	132	130	128	
7	145	143	141	139	138	136	134	132	130	128	
8	288	284	278	270	...	...	...	...	...	...	
9	315	307	297	...	...	...	...	...	...	...	
10	315	307	297	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	
12	403	402	400	395	381	357	332	...	...	...	
13	403	402	400	395	381	357	332	...	...	...	
14	403	402	400	395	381	357	332	...	...	...	
15	403	402	400	395	381	357	332	...	...	...	
16	305	298	289	...	...	...	...	...	...	...	
17	325	321	318	315	311	...	...	...	...	...	
18	325	321	318	315	311	...	...	...	...	...	
19	349	346	343	340	336	...	...	...	...	...	
20	401	401	401	401	393	...	...	...	...	...	
21	401	401	401	401	393	...	...	...	...	...	
22	401	401	401	401	393	...	...	...	...	...	
23	396	394	393	393	393	...	...	...	...	...	
24	396	394	393	393	393	...	...	...	...	...	
25	396	394	393	393	393	...	...	...	...	...	
26	396	394	393	393	393	...	...	...	...	...	
27	402	401	...	...	...	...	...	...	...	...	(13)
28	402	401	...	...	...	...	...	...	...	...	(13)
29	402	401	...	...	...	...	...	...	...	...	(13)
30	402	401	...	...	...	...	...	...	...	...	(13)
31	402	401	...	...	...	...	...	...	...	...	(13)
32	402	401	...	...	...	...	...	...	...	...	(13)
33	132	130	127	124	121	118	115	111	108	104	
34	132	130	127	124	121	118	115	111	108	104	
35	141	139	136	133	130	126	123	119	115	112	
36	141	139	136	133	130	126	123	119	115	112	
37	132	130	127	124	121	118	115	111	108	104	
38	132	130	127	124	121	118	115	111	108	104	
39	144	141	139	137	135	134	132	130	128	126	
40	144	141	139	137	135	134	132	130	128	126	
41	144	141	139	137	135	134	132	130	128	126	
42	144	141	139	137	135	134	132	130	128	126	
43	144	141	139	137	135	134	132	130	128	126	
44	144	141	139	137	135	134	132	130	128	126	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Ferrous Materials (Cont'd)					
	1	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	1
(13)	2	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	3
(13)	3	25Cr–20Ni	Wld. pipe	SA–358	310S	S31008	4
	4	25Cr–20Ni	Smls. & wld. fittings	SA–403	310S	S31008	...
	5	25Cr–20Ni	Bar	SA–479	310S	S31008	...
	6	25Cr–20Ni	Wld. pipe	SA–813	TP310S	S31008	...
	7	25Cr–20Ni	Wld. pipe	SA–814	TP310S	S31008	...
	8	25Cr–20Ni	Smls. tube	SA–213	TP310H	S31009	...
	9	25Cr–20Ni	Plate	SA–240	310H	S31009	...
	10	25Cr–20Ni	Wld. tube	SA–249	TP310H	S31009	...
	11	25Cr–20Ni	Smls. & wld. pipe	SA–312	TP310H	S31009	...
	12	25Cr–20Ni	Bar	SA–479	310H	S31009	...
	13	25Cr–20Ni	Bar	SA/JIS G4303	SUS310S	...	...
	14	25Cr–20Ni–Cb	Smls. tube	SA–213	TP310Cb	S31040	...
	15	25Cr–20Ni–Cb	Plate	SA–240	310Cb	S31040	...
	16	25Cr–20Ni–Cb	Wld. tube	SA–249	TP310Cb	S31040	...
	17	25Cr–20Ni–Cb	Smls. & wld. pipe	SA–312	TP310Cb	S31040	...
	18	25Cr–20Ni–Cb	Bar	SA–479	310Cb	S31040	...
	19	25Cr–20Ni–Cb	Wld. pipe	SA–813	TP310Cb	S31040	...
	20	25Cr–20Ni–Cb	Wld. pipe	SA–814	TP310Cb	S31040	...
	21	25Cr–20Ni–Cb–N	Smls. tube	SA–213	TP310HCbN	S31042	...
	22	25Cr–22Ni–2Mo–N	Forgings	SA–182	F310MoLN	S31050	...
	23	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...
(13)	24	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...
	25	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...
	26	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...
	27	25Cr–22Ni–2Mo–N	Smls. tube	SA–213	TP310MoLN	S31050	...
(13)	28	25Cr–22Ni–2Mo–N	Plate	SA–240	310MoLN	S31050	...
	29	25Cr–22Ni–2Mo–N	Wld. tube	SA–249	TP310MoLN	S31050	...
	30	25Cr–22Ni–2Mo–N	Wld. pipe	SA–312	TP310MoLN	S31050	...
	31	26Cr–4Ni–Mo	Plate	SA–240	329	S32900	...
	32	26Cr–4Ni–Mo	Smls. & wld. tube	SA–789	...	S32900	...
	33	26Cr–4Ni–Mo	Smls. & wld. pipe	SA–790	...	S32900	...
	34	26Cr–4Ni–Mo–N	Plate	SA–240	...	S32950	...
	35	26Cr–4Ni–Mo–N	Smls. & wld. tube	SA–789	...	S32950	...
	36	26Cr–4Ni–Mo–N	Smls. & wld. pipe	SA–790	...	S32950	...
	37	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...
	38	29Cr–6.5Ni–2Mo–N	Bar	SA–479	...	S32906	...
	39	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...
	40	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...
	41	29Cr–6.5Ni–2Mo–N	Plate, sheet, strip	SA–240	...	S32906	...
	42	29Cr–6.5Ni–2Mo–N	Smls. tube	SA–789	...	S32906	...
	43	29Cr–6.5Ni–2Mo–N	Smls. pipe	SA–790	...	S32906	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Ferrous Materials (Cont'd)
1	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	...	515	205	...
5	...	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	515	205	...
11	...	515	205	...
12	...	515	205	...
13	...	520	205	...
14	...	515	205	...
15	...	515	205	...
16	...	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	655	295	...
22	...	540	255	...
23	$6 < t \le 32$	540	255	...
24	$t > 6$	540	255	...
25	$6 < t \le 32$	540	255	...
26	$6 < t \le 32$	540	255	...
27	≤6, wall	580	270	...
28	$t \le 6$	580	270	...
29	≤6, wall	580	270	...
30	≤6, wall	580	270	...
31	...	620	485	...
32	...	620	485	...
33	...	620	485	...
34	...	690	485	...
35	...	690	485	...
36	...	690	485	...
37	≥10	750	550	...
38	...	750	550	...
39	≥10	750	550	...
40	≥10	750	550	...
41	<10	800	650	...
42	<10	800	650	...
43	<10	800	650	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	193	181	173	167	161	157	152	149	146
2	207	193	181	173	167	161	157	152	149	146
3	207	193	181	173	167	161	157	152	149	146
4	207	193	181	173	167	161	157	152	149	146
5	207	193	181	173	167	161	157	152	149	146
6	207	193	181	173	167	161	157	152	149	146
7	207	193	181	173	167	161	157	152	149	146
8	207	193	181	173	167	161	157	152	149	146
9	207	193	181	173	167	161	157	152	149	146
10	207	193	181	173	167	161	157	152	149	146
11	207	193	181	173	167	161	157	152	149	146
12	207	193	181	173	167	161	157	152	149	146
13	207	193	181	173	167	161	157	152	149	146
14	207	193	181	173	167	161	157	152	149	146
15	207	193	181	173	167	161	157	152	149	146
16	207	193	181	173	167	161	157	152	149	146
17	207	193	181	173	167	161	157	152	149	146
18	207	193	181	173	167	161	157	152	149	146
19	207	193	181	173	167	161	157	152	149	146
20	207	193	181	173	167	161	157	152	149	146
21	296	265	245	233	224	216	209	204	200	196
22	255	231	215	205	197	190	185	180	175	171
23	255	231	215	205	197	190	185	180	175	171
24	255	231	215	205	197	190	185	180	175	171
25	255	231	215	205	197	190	185	180	175	171
26	255	231	215	205	197	190	185	180	175	171
27	269	243	226	216	208	201	195	189	185	180
28	269	243	226	216	208	201	195	189	185	180
29	269	243	226	216	208	201	195	189	185	180
30	269	243	226	216	208	201	195	189	185	180
31	483	451	426	410	397	384	373	364	356	350
32	483	451	426	410	397	384	373	364	356	350
33	483	451	426	410	397	384	373	364	356	350
34	483	448	423	408	395	383	373	364	356	350
35	483	448	423	408	395	383	373	364	356	350
36	483	448	423	408	395	383	373	364	356	350
37	552	501	470	451	435	...	411	...	396	...
38	552	501	470	451	435	...	411	...	396	...
39	552	501	470	451	435	...	411	...	396	...
40	552	501	470	451	435	...	411	...	396	...
41	648	588	552	530	511	...	483	...	465	...
42	648	588	552	530	511	...	483	...	465	...
43	648	588	552	530	511	...	483	...	465	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Ferrous Materials (Cont'd)	
1	144	141	139	137	135	134	132	130	128	126	
2	144	141	139	137	135	134	132	130	128	126	(**13**)
3	144	141	139	137	135	134	132	130	128	126	(**13**)
4	144	141	139	137	135	134	132	130	128	126	
5	144	141	139	137	135	134	132	130	128	126	
6	144	141	139	137	135	134	132	130	128	126	
7	144	141	139	137	135	134	132	130	128	126	
8	144	141	139	137	135	134	132	130	128	126	
9	144	141	139	137	135	134	132	130	128	126	
10	144	141	139	137	135	134	132	130	128	126	
11	144	141	139	137	135	134	132	130	128	126	
12	144	141	139	137	135	134	132	130	128	126	
13	144	141	139	137	135	134	132	130	128	126	
14	144	141	139	137	135	134	132	130	128	126	
15	144	141	139	137	135	134	132	130	128	126	
16	144	141	139	137	135	134	132	130	128	126	
17	144	141	139	137	135	134	132	130	128	126	
18	144	141	139	137	135	134	132	130	128	126	
19	144	141	139	137	135	134	132	130	128	126	
20	144	141	139	137	135	134	132	130	128	126	
21	193	191	189	186	184	182	180	178	175	173	
22	167	163	160	156	152	149	145	143	140	138	
23	167	163	160	156	152	149	145	143	140	138	
24	167	163	160	156	152	149	145	143	140	138	(**13**)
25	167	163	160	156	152	149	145	143	140	138	
26	167	163	160	156	152	149	145	143	140	138	
27	176	172	168	164	160	157	154	150	148	146	
28	176	172	168	164	160	157	154	150	148	146	(**13**)
29	176	172	168	164	160	157	154	150	148	146	
30	176	172	168	164	160	157	154	150	148	146	
31	345	341	338	336	...	...	...	...	...	...	
32	345	341	338	336	...	...	...	...	...	...	
33	345	341	338	336	...	...	...	...	...	...	
34	345	341	338	335	...	...	...	...	...	...	
35	345	341	338	335	...	...	...	...	...	...	
36	345	341	338	335	...	...	...	...	...	...	
37	387	385	...	...	...	...	...	...	...	...	
38	387	385	...	...	...	...	...	...	...	...	
39	387	385	...	...	...	...	...	...	...	...	
40	387	385	...	...	...	...	...	...	...	...	
41	455	452	...	...	...	...	...	...	...	...	
42	455	452	...	...	...	...	...	...	...	...	
43	455	452	...	...	...	...	...	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials					
1	...	Drawn smls. tube	SB–210	...	Alclad 3003	O
2	...	Smls. extr. tube	SB–241	...	Alclad 3003	O
3	...	Plate, sheet	SB–209	...	A93003	O
4	...	Plate, sheet	SB–209	...	A93003	H112
5	...	Plate, sheet	SB–209	...	A93003	H112
6	...	Drawn smls. tube	SB–210	...	A93003	O
7	...	Drawn smls. tube	SB–210	...	A93003	H113
8	...	Bar, rod, shapes	SB–221	...	A93003	O
9	...	Bar, rod, shapes	SB–221	...	A93003	H112
10	...	Smls. extr. tube	SB–241	...	A93003	O
11	...	Smls. extr. tube	SB–241	...	A93003	H112
12	...	Smls. extr. tube	SB–241	...	A93003	H112
13	...	Smls. pipe	SB–241	...	A93003	H112
14	...	Plate, sheet	SB–209	...	A93004	O
15	...	Plate, sheet	SB–209	...	A93004	H112
16	...	Plate, sheet	SB–209	...	A95052	O
17	...	Plate, sheet	SB–209	...	A95052	H112
18	...	Plate, sheet	SB–209	...	A95052	H112
19	...	Plate, sheet	SB–209	...	A95083	O
20	...	Plate, sheet	SB–209	...	A95083	O
21	...	Plate, sheet	SB–209	...	A95083	O
22	...	Plate, sheet	SB–209	...	A95083	O
23	...	Plate, sheet	SB–209	...	A95083	O
24	...	Plate, sheet	SB–209	...	A95083	H112
25	...	Plate, sheet	SB–209	...	A95083	H112
26	...	Bar, rod, shapes	SB–221	...	A95083	H111
27	...	Smls. extr. tube	SB–241	...	A95083	H111
28	...	Plate, sheet	SB–209	...	A95086	O
29	...	Plate, sheet	SB–209	...	A95086	H112
30	...	Plate, sheet	SB–209	...	A95086	H112
31	...	Plate, sheet	SB–209	...	A95086	H112
32	...	Plate, sheet	SB–209	...	A95454	O
33	...	Plate, sheet	SB–209	...	A95454	H112
34	...	Plate, sheet	SB–209	...	A95454	H112
35	...	Bar, rod, shapes	SB–221	...	A95454	O
36	...	Bar, rod, shapes	SB–221	...	A95454	H112
37	...	Smls. extr. tube	SB–241	...	A95454	O
38	...	Smls. extr. tube	SB–241	...	A95454	H112
39	...	Plate, sheet	SB–209	...	A96061	T4
40	...	Plate, sheet	SB–209	...	A96061	T451
41	...	Plate, sheet	SB–209	...	A96061	T6
42	...	Plate, sheet	SB–209	...	A96061	T651

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials
1	0.25–12.7	...	31	...
2	...	90	31	...
3	1.30–76.2	...	34	...
4	6.35–12.69	...	69	...
5	12.70–76.20	...	41	...
6	0.25–12.7	...	34	...
7	1.27–12.7	97	31	...
8	...	...	34	...
9	...	...	34	...
10	...	97	34	...
11	...	97	34	...
12	...	97	34	...
13	...	97	34	...
14	1.30–76.2	...	59	...
15	6.35–76.2	...	62	...
16	1.30–76.2	...	65	...
17	6.35–12.69	...	110	...
18	12.70–76.20	...	65	...
19	1.30–38.10	275	125	...
20	38.11–76.20	270	120	...
21	76.21–127.00	260	110	...
22	127.01–177.80	255	100	...
23	177.81–203.2	250	97	...
24	6.35–38.10	...	125	...
25	38.11–76.20	270	120	...
26	≤127.0	...	165	...
27	≤127.0	275	165	...
28	1.30–50.8	...	97	...
29	6.35–12.69	...	125	...
30	12.70–25.40	...	110	...
31	25.41–76.2	...	97	...
32	1.30–76.2	205	83	...
33	6.35–12.69	...	125	...
34	12.70–76.20	210	83	...
35	≤127.0	210	83	...
36	≤127.0	210	83	...
37	≤127.0	210	83	...
38	≤127.0	210	83	...
39	1.30–6.34	...	110	...
40	6.35–76.2	...	110	...
41	1.30–6.34	...	240	...
42	6.35–152.4	...	240	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials									
1	31.0	31.0	31.0	30.1	28.2	27.0	23.5	19.6	...	...
2	31.0	31.0	31.0	30.1	28.2	27.0	23.5	19.6	...	...
3	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
4	68.9	68.3	64.5	59.9	54.2	48.0	41.2	34.4	...	...
5	41.4	41.4	40.4	39.0	36.4	33.3	29.1	24.7	...	...
6	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
7	31.0	31.0	31.0	30.1	28.2	27.0	23.5	19.6	...	...
8	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
9	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
10	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
11	31.0	31.0	31.0	30.1	28.2	27.0	23.5	19.6	...	...
12	34.5	34.5	34.4	33.5	31.6	29.8	26.2	22.4	...	...
13	41.4	41.4	40.4	39.0	36.4	33.3	29.1	24.7	...	...
14	58.6	58.6	58.6	58.6	58.6	55.4	51.7	48.0	...	...
15	62.1	62.1	62.1	62.1	62.0	58.2	53.8	49.5	...	...
16	65.5	65.5	65.5	65.5	65.5	65.5	59.4	52.1	...	...
17	110	110	110	104	96.8	86.9	75.8	64.6	...	...
18	65.5	65.5	65.5	65.5	65.5	65.5	63.8	61.9	...	...
19	124	124	...	...	...	...	...	...	...	...
20	117	117	...	...	...	...	...	...	...	...
21	110	110	...	...	...	...	...	...	...	...
22	103	103	...	...	...	...	...	...	...	...
23	96.5	96.5	...	...	...	...	...	...	...	...
24	124	124	...	...	...	...	...	...	...	...
25	117	117	...	...	...	...	...	...	...	...
26	165	165	...	...	...	...	...	...	...	...
27	165	165	...	...	...	...	...	...	...	...
28	96.5	94.5	...	...	...	...	...	...	...	...
29	124	123	...	...	...	...	...	...	...	...
30	110	108	...	...	...	...	...	...	...	...
31	96.5	94.5	...	...	...	...	...	...	...	...
32	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
33	124	124	124	123	120	115	104	92.8	...	...
34	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
35	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
36	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
37	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
38	82.7	82.7	82.7	82.7	82.0	80.2	77.1	74.0	...	...
39	110	108	106	105	105	105	85.1	60.4	...	...
40	110	108	106	105	105	105	85.1	60.4	...	...
41	241	239	231	220	187	141	98.9	57.6	...	...
42	241	239	231	220	187	141	98.9	57.6	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	...	Drawn smls. tube	SB–210	...	A96061	T4
2	...	Drawn smls. tube	SB–210	...	A96061	T6
(**13**) 3	...	Bolting	SB–211	...	A96061	T6
(**13**) 4	...	Bolting	SB–211	...	A96061	T651
5	...	Bar, rod, shapes	SB–221	...	A96061	T4
6	...	Bar, rod, shapes	SB–221	...	A96061	T6
7	...	Smls. extr. tube	SB–241	...	A96061	T4
8	...	Smls. pipe & extr. tube	SB–241	...	A96061	T6
9	...	Bar, rod, shapes	SB–308	...	A96061	T6
10	...	Drawn smls. tube	SB–210	...	A96063	T6
11	...	Bar, rod, shapes	SB–221	...	A96063	T5
12	...	Bar, rod, shapes	SB–221	...	A96063	T5
13	...	Bar, rod, shapes	SB–221	...	A96063	T6
14	...	Smls. extr. tube	SB–241	...	A96063	T5
15	...	Smls. extr. tube	SB–241	...	A96063	T5
16	...	Smls. extr. tube	SB–241	...	A96063	T6
17	...	Rod	SB–187	...	C10200	O60
18	...	Smls. pipe	SB–42	...	C10200	O61
19	...	Smls. tube	SB–75	...	C10200	O60
20	...	Plate, sheet, strip	SB–152	...	C10200	H00
21	...	Plate, sheet, strip	SB–152	...	C10200	H01
22	...	Plate, sheet, strip	SB–152	...	C10200	H02
23	...	Plate, sheet, strip	SB–152	...	C10200	H03
24	...	Plate, sheet, strip	SB–152	...	C10200	H04
25	...	Plate, sheet, strip	SB–152	...	C10200	O25
26	...	Smls. pipe	SB–42	...	C10200	H55
27	...	Smls. tube	SB–75	...	C10200	H55
28	...	Smls. cond. tube	SB–111	...	C10200	H55
29	...	Smls. U–bend tube	SB–395	...	C10200	H55
30	...	Smls. pipe	SB–42	...	C10200	H80
31	...	Smls. tube	SB–75	...	C10200	H80
32	...	Smls. cond. tube	SB–111	...	C10200	H80
33	...	Plate, sheet, strip	SB–152	...	C10400	H00
34	...	Plate, sheet, strip	SB–152	...	C10400	H01
35	...	Plate, sheet, strip	SB–152	...	C10400	H02
36	...	Plate, sheet, strip	SB–152	...	C10400	H03
37	...	Plate, sheet, strip	SB–152	...	C10400	H04
38	...	Plate, sheet, strip	SB–152	...	C10400	O25
39	...	Plate, sheet, strip	SB–152	...	C10500	H00
40	...	Plate, sheet, strip	SB–152	...	C10500	H01
41	...	Plate, sheet, strip	SB–152	...	C10500	H02
42	...	Plate, sheet, strip	SB–152	...	C10500	H03
43	...	Plate, sheet, strip	SB–152	...	C10500	H04
44	...	Plate, sheet, strip	SB–152	...	C10500	O25

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	0.64–12.7	...	110	...
2	0.64–12.7	...	240	...
3	3 < t ≤ 205	290	240	...
4	3 < t ≤ 205	290	240	...
5	...	...	110	...
6	...	...	240	...
7	...	180	110	...
8	...	260	240	...
9	...	...	240	...
10	0.64–12.7	...	195	...
11	≤12.70	...	110	...
12	12.71–25.4	...	100	...
13	≤25.4	...	170	...
14	≤12.70	150	110	...
15	12.71–25.4	145	100	...
16	≤25.4	205	170	...
17	...	195	55	...
18	6 < DN ≤ 50	205	62	...
19	...	205	62	...
20	...	205	69	...
21	...	205	69	...
22	...	205	69	...
23	...	205	69	...
24	...	205	69	...
25	...	205	69	...
26	50 < DN ≤ 300	250	205	...
27	...	250	205	...
28	<75	250	205	...
29	...	250	205	...
30	6 < DN ≤ 50	310	275	...
31	<100	310	275	...
32	<75	310	275	...
33	...	205	69	...
34	...	205	69	...
35	...	205	69	...
36	...	205	69	...
37	...	205	69	...
38	...	205	69	...
39	...	205	69	...
40	...	205	69	...
41	...	205	69	...
42	...	205	69	...
43	...	205	69	...
44	...	205	69	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	110	108	106	105	105	105	85.1	60.4	...	...
2	241	239	231	220	187	141	98.9	57.6	...	...
3	241	239	231	220	187	141	98.9	57.6	...	...
4	241	239	231	220	187	141	98.9	57.6	...	...
5	110	108	106	105	105	105	85.1	60.4	...	...
6	241	239	231	220	187	141	98.9	57.6	...	...
7	110	108	106	105	105	105	85.1	60.4	...	...
8	241	239	231	220	187	141	98.9	57.6	...	...
9	241	239	231	220	187	141	98.9	57.6	...	...
10	193	185	178	167	121	71.5	43.4	17.8	...	...
11	110	106	103	100	90.8	63.2	39.1	15.9	...	...
12	103	99.4	96.1	94.0	85.5	63.0	39.3	15.8	...	...
13	172	166	160	149	108	63.7	38.8	16.2	...	...
14	110	106	103	100	90.8	63.2	39.1	15.9	...	...
15	103	99.4	96.1	94.0	85.5	63.0	39.3	15.8	...	...
16	172	166	160	149	108	63.7	38.8	16.2	...	...
17	55.2	47.0	44.5	44.1	43.4	42.2	40.3	38.9	37.7	...
18	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
19	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
20	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
21	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
22	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
23	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
24	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
25	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
26	207	205	199	193	186	178	170	161	152	...
27	207	205	199	193	186	178	170	161	152	...
28	207	205	199	193	186	178	170	161	152	...
29	207	205	199	193	186	178	170	161	152	...
30	276	264	258	254	246	233	215	185	154	...
31	276	264	258	254	246	233	215	185	154	...
32	276	264	258	254	246	233	215	185	154	...
33	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
34	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
35	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
36	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
37	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
38	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
39	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
40	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
41	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
42	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
43	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
44	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Nonferrous Materials (Cont'd)	
1	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	(13)
4	...	...	...	...	...	...	...	...	...	...	(13)
5	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	
32	...	...	...	...	...	...	...	...	...	...	
33	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	
35	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	
39	...	...	...	...	...	...	...	...	...	...	
40	...	...	...	...	...	...	...	...	...	...	
41	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	
44	...	...	...	...	...	...	...	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	...	Plate, sheet, strip	SB–152	...	C10700	H00
2	...	Plate, sheet, strip	SB–152	...	C10700	H01
3	...	Plate, sheet, strip	SB–152	...	C10700	H02
4	...	Plate, sheet, strip	SB–152	...	C10700	H03
5	...	Plate, sheet, strip	SB–152	...	C10700	H04
6	...	Plate, sheet, strip	SB–152	...	C10700	O25
7	...	Bar, rod	SB–187	...	C11000	O60
8	...	Plate, sheet, strip, bar	SB–152	...	C11000	O25
9	...	Smls. tube	SB–75	...	C12000	O50
10	...	Smls. tube	SB–75	...	C12000	O60
11	...	Smls. pipe	SB–42	...	C12000	O61
12	...	Smls. pipe	SB–42	...	C12000	H55
13	...	Smls. tube	SB–75	...	C12000	H55
14	...	Smls. cond. tube	SB–111	...	C12000	H55
15	...	Smls. U–bend tube	SB–395	...	C12000	H55
16	...	Smls. pipe	SB–42	...	C12000	H80
17	...	Smls. tube	SB–75	...	C12000	H80
18	...	Smls. cond. tube	SB–111	...	C12000	H80
19	...	Smls. tube	SB–75	...	C12200	O50
20	...	Smls. tube	SB–75	...	C12200	O60
21	...	Smls. pipe	SB–42	...	C12200	O61
22	...	Finned tube	SB–359	...	C12200	O61
23	...	Plate, sheet, strip	SB–152	...	C12200	H00
24	...	Plate, sheet, strip	SB–152	...	C12200	H01
25	...	Plate, sheet, strip	SB–152	...	C12200	H02
26	...	Plate, sheet, strip	SB–152	...	C12200	H03
27	...	Plate, sheet, strip	SB–152	...	C12200	H04
28	...	Plate, sheet, strip	SB–152	...	C12200	O25
29	...	Wld. cond. tube	SB–543	...	C12200	Light cold worked
30	...	Smls. pipe	SB–42	...	C12200	H55
31	...	Smls. tube	SB–75	...	C12200	H55
32	...	Smls. cond. tube	SB–111	...	C12200	H55
33	...	Finned tube	SB–359	...	C12200	H55
34	...	Smls. U–bend tube	SB–395	...	C12200	H55
35	...	Smls. pipe	SB–42	...	C12200	H80
36	...	Smls. cond. tube	SB–75	...	C12200	H80
37	...	Smls. tube	SB–111	...	C12200	H80
38	...	Plate, sheet, strip, bar	SB–152	...	C12300	H00
39	...	Plate, sheet, strip, bar	SB–152	...	C12300	H01
40	...	Plate, sheet, strip, bar	SB–152	...	C12300	H02
41	...	Plate, sheet, strip, bar	SB–152	...	C12300	H03
42	...	Plate, sheet, strip, bar	SB–152	...	C12300	H04
43	...	Plate, sheet, strip, bar	SB–152	...	C12300	O25

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	205	69	...
2	...	205	69	...
3	...	205	69	...
4	...	205	69	...
5	...	205	69	...
6	...	205	69	...
7	...	195	55	...
8	≤50	205	69	...
9	...	205	62	...
10	...	205	62	...
11	6 < DN ≤ 50	205	62	...
12	50 < DN ≤ 300	250	205	...
13	...	250	205	...
14	<75	250	205	...
15	<50	250	205	...
16	6 < DN ≤ 50	310	275	...
17	...	310	275	...
18	<75	310	275	...
19	...	205	62	...
20	...	205	62	...
21	3 < t ≤ 50	205	62	...
22	...	205	62	...
23	...	205	69	...
24	...	205	69	...
25	...	205	69	...
26	...	205	69	...
27	...	205	69	...
28	...	205	69	...
29	...	220	100	...
30	50 < t ≤ 300	250	205	...
31	...	250	205	...
32	<75	250	205	...
33	...	250	205	...
34	<50	250	205	...
35	3 < t ≤ 75	310	275	...
36	<100	310	275	...
37	<75	310	275	...
38	...	205	69	...
39	...	205	69	...
40	...	205	69	...
41	...	205	69	...
42	...	205	69	...
43	...	205	69	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
2	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
3	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
4	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
5	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
6	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
7	55.2	47.0	44.5	44.1	43.4	42.2	40.3	38.9	37.7	...
8	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
9	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
10	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
11	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
12	207	205	199	193	186	178	170	161	152	...
13	207	205	199	193	186	178	170	161	152	...
14	207	205	199	193	186	178	170	161	152	...
15	207	205	199	193	186	178	170	161	152	...
16	276	264	258	254	246	233	215	185	154	...
17	276	264	258	254	246	233	215	185	154	...
18	276	264	258	254	246	233	215	185	154	...
19	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
20	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
21	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
22	62.1	52.5	50.0	49.5	48.2	47.0	45.8	44.0	42.1	...
23	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
24	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
25	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
26	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
27	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
28	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
29	103	102	99.4	96.7	92.9	89.2	84.9	80.5	76.2	...
30	207	205	199	193	186	178	170	161	152	...
31	207	205	199	193	186	178	170	161	152	...
32	207	205	199	193	186	178	170	161	152	...
33	207	205	199	193	186	178	170	161	152	...
34	207	205	199	193	186	178	170	161	152	...
35	276	264	258	254	246	233	215	185	154	...
36	276	264	258	254	246	233	215	185	154	...
37	276	264	258	254	246	233	215	185	154	...
38	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
39	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
40	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
41	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
42	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
43	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Nonferrous Materials (Cont'd)					
	1	...	Plate, sheet, strip	SB–152	...	C14200	O25
	2	...	Smls. cond. tube	SB–111	...	C14200	H55
	3	...	Smls. U–bend tube	SB–395	...	C14200	H55
	4	...	Smls. cond. tube	SB–111	...	C14200	H80
	5	...	Smls. cond. tube	SB–111	...	C19200	O61
	6	...	Smls. U–bend tube	SB–395	...	C19200	O61
	7	...	Wld. cond. tube	SB–543	...	C19400	Annealed
	8	...	Wld. cond. tube	SB–543	...	C19400	Light cold worked
	9	...	Smls. cond. tube	SB–111	...	C60800	O61
	10	...	Smls. U–bend tube	SB–395	...	C60800	O61
	11	...	Plate, sheet	SB–169	...	C61400	O25 or O60
	12	...	Plate	SB–171	...	C61400	O25
(13)	13	...	Bar, rod	SB–150	...	C61400	HR50
	14	...	Plate, sheet	SB–169	...	C61400	O25 or O60
	15	...	Plate	SB–171	...	C61400	O25
(13)	16	...	Bar, rod	SB–150	...	C61400	HR50
	17	...	Plate, sheet	SB–169	...	C61400	O25 or O60
(13)	18	...	Bar, rod	SB–150	...	C61400	HR50
(13)	19	...	Bar, rod	SB–150	...	C61400	HR50
	20	...	Plate	SB–171	...	C63000	O25
	21	...	Plate	SB–171	...	C63000	O25
(13)	22	...	Rod	SB–150	...	C63000	HR50
(13)	23	...	Bar	SB–150	...	C63000	M20
	24	...	Plate	SB–171	...	C63000	O25
(13)	25	...	Bar, rod	SB–150	...	C63000	HR50
(13)	26	...	Bar, rod	SB–150	...	C63000	HR50
	27	...	Forgings	SB–283	...	C64200	M10
	28	...	Forgings	SB–283	...	C64200	M10
(13)	29	...	Bar, rod	SB–150	...	C64200	M20
(13)	30	...	Bar, rod	SB–150	...	C64200	M30
(13)	31	...	Bar, rod	SB–150	...	C64200	M10
(13)	32	...	Bar, rod	SB–150	...	C64200	HR50
(13)	33	...	Bar, rod	SB–150	...	C64200	HR50
(13)	34	...	Bar, rod	SB–150	...	C64200	HR50
(13)	35	...	Bar, rod	SB–150	...	C64200	HR50
	36	...	Plate, sheet	SB–96	...	C65500	O61
(13)	37	...	Rod	SB–98	...	C65500	O60
(13)	38	...	Rod	SB–98	...	C65500	H01
(13)	39	...	Rod	SB–98	...	C65500	H02
	40	...	Smls. pipe & tube	SB–466	...	C70600	O60
	41	...	Wld. pipe	SB–467	...	C70600	WO61
	42	...	Bar, rod	SB–151	...	C70600	O60

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	205	69	...
2	<75	250	205	...
3	...	250	205	...
4	<75	310	275	...
5	<75	260	83	...
6	...	260	83	...
7	...	310	100	...
8	...	310	150	...
9	...	345	130	...
10	...	345	130	...
11	$50 < t \le 125$	450	195	...
12	$50 < t \le 125$	450	195	...
13	$50 < t \le 75$	485	205	...
14	$13 < t \le 50$	485	205	...
15	≤50	485	205	...
16	$25 < t \le 50$	485	220	...
17	≤13	495	220	...
18	$13 < t \le 25$	515	240	...
19	≤13	550	275	...
20	$89 < t \le 125$	550	205	...
21	$50 < t \le 89$	585	230	...
22	$50 < t \le 75$	585	290	...
23	$50 < t \le 100$	585	290	...
24	≤50	620	250	...
25	$25 < t \le 50$	620	310	...
26	$13 < t \le 25$	690	345	...
27	>38	470	160	...
28	≤38	485	170	...
29	>100	485	170	...
30	>100	485	170	...
31	$75 < t \le 100$	485	205	...
32	$50 < t \le 75$	515	240	...
33	$25 < t \le 50$	550	290	...
34	$13 < t \le 25$	585	310	...
35	≤13	620	310	...
36	≤50	345	125	...
37	...	360	105	...
38	...	380	165	...
39	...	485	260	...
40	...	260	90	...
41	>114	260	90	...
42	...	260	100	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
2	207	205	199	193	186	178	170	161	152	...
3	207	205	199	193	186	178	170	161	152	...
4	276	264	258	254	246	233	215	185	154	...
5	82.7	73.9	68.8	65.8	64.0	62.2	60.9	59.2	57.3	...
6	82.7	73.9	68.8	65.8	64.0	62.2	60.9	59.2	57.3	...
7	103	102	100	98.2	95.0	92.6	88.9	85.6	82.6	...
8	152	150	147	144	140	135	131	126	121	...
9	131	126	126	126	124	121	118	115	112	108
10	131	126	126	126	124	121	118	115	112	108
11	193	192	191	189	189	188	186	184	182	180
12	193	192	191	189	189	188	186	184	182	180
13	207	206	204	203	202	201	199	197	195	193
14	207	206	204	203	202	201	199	197	195	193
15	207	206	204	203	202	201	199	197	195	193
16	221	220	218	216	216	215	213	210	208	206
17	221	220	218	216	216	215	213	210	208	206
18	240	239	237	235	235	233	231	228	226	224
19	275	274	271	269	269	268	265	261	259	256
20	207	206	201	200	198	197	195	192	186	175
21	228	226	222	220	218	216	214	211	204	192
22	290	289	282	280	277	276	273	269	261	245
23	290	289	282	280	277	276	273	269	261	245
24	248	246	242	239	237	236	234	230	223	210
25	310	309	301	300	297	295	292	288	279	262
26	345	343	335	333	330	328	325	320	310	292
27	159	...	...	...	...	...	...	...	...	...
28	172	...	...	...	...	...	...	...	...	...
29	172	...	...	...	...	...	...	...	...	...
30	172	...	...	...	...	...	...	...	...	...
31	207	...	...	...	...	...	...	...	...	...
32	241	...	...	...	...	...	...	...	...	...
33	290	...	...	...	...	...	...	...	...	...
34	310	...	...	...	...	...	...	...	...	...
35	310	...	...	...	...	...	...	...	...	...
36	124	123	122	121	120	119	117	115	113	111
37	103	102	101	101	100	98.8	97.2	95.5	93.9	92.2
38	165	164	162	161	160	158	156	153	150	148
39	262	260	258	256	254	251	247	243	239	235
40	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
41	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
42	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Nonferrous Materials (Cont'd)	
1	...	...	...	...	...	...	...	...	...	...	
2	...	...	...	...	...	...	...	...	...	...	
3	...	...	...	...	...	...	...	...	...	...	
4	...	...	...	...	...	...	...	...	...	...	
5	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	(**13**)
14	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	(**13**)
17	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	(**13**)
19	...	...	...	...	...	...	...	...	...	...	(**13**)
20	159	135	100	56.6	...	...	...	...	...	...	
21	174	148	111	62.9	...	...	...	...	...	...	
22	223	189	140	79.3	...	...	...	...	...	...	(**13**)
23	223	189	140	79.3	...	...	...	...	...	...	(**13**)
24	191	162	120	68.4	...	...	...	...	...	...	
25	238	202	150	84.8	...	...	...	...	...	...	(**13**)
26	265	225	167	94.3	...	...	...	...	...	...	(**13**)
27	...	...	...	...	...	...	...	...	...	...	
28	...	...	...	...	...	...	...	...	...	...	
29	...	...	...	...	...	...	...	...	...	...	(**13**)
30	...	...	...	...	...	...	...	...	...	...	(**13**)
31	...	...	...	...	...	...	...	...	...	...	(**13**)
32	...	...	...	...	...	...	...	...	...	...	(**13**)
33	...	...	...	...	...	...	...	...	...	...	(**13**)
34	...	...	...	...	...	...	...	...	...	...	(**13**)
35	...	...	...	...	...	...	...	...	...	...	(**13**)
36	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	(**13**)
38	...	...	...	...	...	...	...	...	...	...	(**13**)
39	...	...	...	...	...	...	...	...	...	...	(**13**)
40	74.5	74.5	...	...	...	...	...	...	...	...	
41	74.5	74.5	...	...	...	...	...	...	...	...	
42	85.9	85.3	...	...	...	...	...	...	...	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Nonferrous Materials (Cont'd)					
	1	...	Plate	SB–171	...	C70600	M20
	2	...	Plate, sheet	SB–171	...	C70600	M20
	3	...	Plate	SB–171	...	C70600	O25
	4	...	Plate, sheet	SB–171	...	C70600	O25
	5	...	Smls. cond. tube	SB–111	...	C70600	O61
	6	...	Finned tube	SB–359	...	C70600	O61
	7	...	Smls. U–bend tube	SB–395	...	C70600	O61
	8	...	Wld. pipe	SB–467	...	C70600	WO61
	9	...	Wld. tube	SB–543	...	C70600	WO61
	10	...	Finned wld. tube	SB–956	...	C70600	WO61
	11	...	Wld. pipe	SB–467	...	C70600	WO61
	12	...	Smls. tube	SB–111	...	C70600	H55
(**13**)	13	...	Smls. pipe & tube	SB–466	...	C70600	H55
	14	...	Wld. tube	SB–543	...	C70600	WC55
	15	...	Finned wld. tube	SB–956	...	C70600	WC55
	16	...	Wld. pipe	SB–467	...	C70600	Wld. fr. cold rld. strip
	17	...	Plate, sheet	SB–171	...	C71500	O25
	18	...	Plate, sheet	SB–171	...	C71500	O25
	19	...	Smls. cond. tube	SB–111	...	C71500	O61
	20	...	Wld. tube	SB–543	...	C71500	WO61
	21	...	Finned wld. tube	SB–956	...	C71500	WO61
	22	...	Castings	SB–148	...	C95200	M01
	23	...	Castings	SB–271	...	C95200	M02
	24	...	Castings	SB–505	...	C95200	M07
	25	...	Castings	SB–148	...	C95400	M01
	26	...	Castings	SB–271	...	C95400	M02
(**13**)	27	99Ni	Bolting	SB–160	...	N02200	Annealed
	28	99Ni	Plate, sheet, strip	SB–162	...	N02200	As rolled
(**13**)	29	99Ni	Bolting	SB–160	...	N02200	Hot fin./ann.
(**13**)	30	99Ni	Bolting	SB–160	...	N02200	Cold drawn
	31	99Ni	Smls. pipe & tube	SB–161	...	N02200	Stress rel.
	32	99Ni	Smls. tube	SB–163	...	N02200	Stress rel.
	33	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed
	34	99Ni–Low C	Smls. & wld. fittings	SB–366	...	N02201	Annealed
	35	99Ni–Low C	Bar, rod	SB–160	...	N02201	Hot rolled/ann.
	36	99Ni–Low C	Smls. pipe & tube	SB–161	...	N02201	Annealed
	37	99Ni–Low C	Smls. tube	SB–163	...	N02201	Annealed
	38	99Ni–Low C	Plate, sheet, strip	SB–162	...	N02201	Hot rolled/ann.
	39	67Ni–30Cu	Bar	SB–164	...	N04400	Annealed
	40	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed
	41	67Ni–30Cu	Forgings	SB–564	...	N04400	Annealed
	42	67Ni–30Cu	Plate	SB–127	...	N04400	Annealed
	43	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Annealed
	44	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Annealed
	45	67Ni–30Cu	Smls. & wld. fittings	SB–366	...	N04400	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	275	100	...
2	≤64	275	100	...
3	...	275	100	...
4	≤64	275	100	...
5	...	275	100	...
6	...	275	100	...
7	...	275	100	...
8	≤114	275	100	...
9	...	275	100	...
10	...	275	100	...
11	≤114	310	205	...
12	...	310	240	...
13	...	310	240	...
14	...	310	240	...
15	...	310	240	...
16	≤114	370	310	...
17	$64 < t \leq 125$	310	125	...
18	≤64	345	140	...
19	...	360	125	...
20	...	360	125	...
21	...	360	125	...
22	...	450	170	...
23	...	450	170	...
24	...	470	180	...
25	...	515	205	...
26	...	515	205	...
27	...	380	100	...
28	...	380	140	...
29	...	415	100	...
30	...	450	275	...
31	...	450	275	...
32	...	450	275	...
33	>125 O.D.	345	69	...
34	...	345	69	...
35	...	345	69	...
36	≤125 O.D.	345	83	...
37	...	345	83	...
38	...	345	83	...
39	...	485	170	...
40	>125 O.D.	485	170	...
41	...	485	170	...
42	...	485	195	...
43	≤75	485	195	...
44	≤125 O.D.	485	195	...
45	...	485	195	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
2	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
3	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
4	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
5	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
6	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
7	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
8	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
9	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
10	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
11	207	201	195	191	187	183	180	177	175	173
12	241	235	228	223	218	213	210	206	204	202
13	241	235	228	223	218	213	210	206	204	202
14	241	235	228	223	218	213	210	206	204	202
15	241	235	228	223	218	213	210	206	204	202
16	310	301	293	286	280	275	270	266	262	260
17	124	120	117	114	112	109	107	105	103	102
18	138	133	129	126	124	122	119	117	115	113
19	124	120	117	114	112	109	107	105	103	102
20	124	120	117	114	112	109	107	105	103	102
21	124	120	117	114	112	109	107	105	103	102
22	172	162	156	153	150	148	147	146	146	146
23	172	162	156	153	150	148	147	146	146	146
24	179	169	162	158	156	154	152	152	152	152
25	207	197	193	192	192	192	192	192	192	192
26	207	197	193	192	192	192	192	192	192	192
27	100	100	100	100	100	100	100	98.6	95.7	92.0
28	138	138	138	138	138	138	138	136	132	127
29	100	100	100	100	100	100	100	98.6	95.7	92.0
30	276	267	265	264	264	264	264	262	260	257
31	276	267	265	264	264	264	264	262	260	257
32	276	267	265	264	264	264	264	262	260	257
33	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
34	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
35	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
36	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
37	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
38	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
39	172	159	149	144	141	138	136	136	136	136
40	172	159	149	144	141	138	136	136	136	136
41	172	159	149	144	141	138	136	136	136	136
42	193	178	167	162	157	155	153	152	152	152
43	193	178	167	162	157	155	153	152	152	152
44	193	178	167	162	157	155	153	152	152	152
45	193	178	167	162	157	155	153	152	152	152

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Nonferrous Materials (Cont'd)	
1	85.9	85.3	...	...	...	...	...	...	...	...	
2	85.9	85.3	...	...	...	...	...	...	...	...	
3	85.9	85.3	...	...	...	...	...	...	...	...	
4	85.9	85.3	...	...	...	...	...	...	...	...	
5	85.9	85.3	...	...	...	...	...	...	...	...	
6	85.9	85.3	...	...	...	...	...	...	...	...	
7	85.9	85.3	...	...	...	...	...	...	...	...	
8	85.9	85.3	...	...	...	...	...	...	...	...	
9	85.9	85.3	...	...	...	...	...	...	...	...	
10	85.9	85.3	...	...	...	...	...	...	...	...	
11	172	171	...	...	...	...	...	...	...	...	
12	201	199	...	...	...	...	...	...	...	...	
13	201	199	...	...	...	...	...	...	...	...	(**13**)
14	201	199	...	...	...	...	...	...	...	...	
15	201	199	...	...	...	...	...	...	...	...	
16	258	257	...	...	...	...	...	...	...	...	
17	100	98.8	97.7	97.1	...	...	...	...	...	...	
18	112	110	109	108	...	...	...	...	...	...	
19	100	98.8	97.7	97.1	...	...	...	...	...	...	
20	100	98.8	97.7	97.1	...	...	...	...	...	...	
21	100	98.8	97.7	97.1	...	...	...	...	...	...	
22	146	146	...	...	...	...	...	...	...	...	
23	146	146	...	...	...	...	...	...	...	...	
24	152	152	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	
27	88.4	84.1	...	...	...	...	...	...	...	...	(**13**)
28	122	116	...	...	...	...	...	...	...	...	
29	88.4	84.1	...	...	...	...	...	...	...	...	(**13**)
30	253	249	245	...	...	...	...	...	...	...	(**13**)
31	253	249	245	...	...	...	...	...	...	...	
32	253	249	245	...	...	...	...	...	...	...	
33	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3	
34	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3	
35	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3	
36	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4	
37	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4	
38	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4	
39	136	136	136	135	134	132	130	130	129	...	
40	136	136	136	135	134	132	130	130	129	...	
41	136	136	136	135	134	132	130	130	129	...	
42	152	152	152	151	150	148	146	146	145	...	
43	152	152	152	151	150	148	146	146	145	...	
44	152	152	152	151	150	148	146	146	145	...	
45	152	152	152	151	150	148	146	146	145	...	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
		Nonferrous Materials (Cont'd)					
(13)	1	...	...	...	...	...	...
	2	67Ni–30Cu	Plate	SB–127	...	N04400	As rolled
(13)	3	...	...	...	...	...	...
	4	67Ni–30Cu	Rounds	SB–164	...	N04400	Hot worked
	5	67Ni–30Cu	Rounds	SB–164	...	N04400	Hot worked
	6	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR
	7	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR
	8	67Ni–30Cu	Smls. tube	SB–163	...	N04400	Stress rel.
	9	67Ni–30Cu	Smls. pipe & tube	SB–165	...	N04400	Stress rel.
	10	67Ni–30Cu	Rounds	SB–164	...	N04400	CW & SR
	11	67Ni–30Cu	Rounds	SB–164	...	N04400	Cold worked
	12	67Ni–30Cu–S	Bar	SB–164	...	N04405	Annealed
	13	67Ni–30Cu–S	Bar	SB–164	...	N04405	Hot worked
	14	67Ni–28Cu–3Al	Bolting	SF–468	...	N05500	Ann./aged
	15	67Ni–28Cu–3Al	Bolting	SF–468	...	N05500	Ann./aged
	16	47Ni–22Cr–9Mo–18Fe	Plate	SB–435	...	N06002	Annealed
	17	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	...	N06002	Solution ann.
	18	47Ni–22Cr–9Mo–18Fe	Rod	SB–572	...	N06002	Annealed
	19	47Ni–22Cr–9Mo–18Fe	Smls. & wld. fittings	SB–366	...	N06002	Annealed
	20	47Ni–22Cr–9Mo–18Fe	Sheet	SB–435	...	N06002	Annealed
	21	47Ni–22Cr–9Mo–18Fe	Wld. pipe	SB–619	...	N06002	Solution ann.
	22	47Ni–22Cr–9Mo–18Fe	Smls. pipe & tube	SB–622	...	N06002	Solution ann.
	23	47Ni–22Cr–9Mo–18Fe	Wld. tube	SB–626	...	N06002	Solution ann.
	24	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
	25	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
	26	47Ni–22Cr–19Fe–6Mo	Smls. & wld. fittings	SB–366	...	N06007	Annealed
	27	47Ni–22Cr–19Fe–6Mo	Rod	SB–581	...	N06007	Solution ann.
	28	47Ni–22Cr–19Fe–6Mo	Plate, sheet, strip	SB–582	...	N06007	Solution ann.
	29	47Ni–22Cr–19Fe–6Mo	Wld. pipe	SB–619	...	N06007	Solution ann.
	30	47Ni–22Cr–19Fe–6Mo	Smls. pipe & tube	SB–622	...	N06007	Solution ann.
	31	47Ni–22Cr–19Fe–6Mo	Wld. tube	SB–626	...	N06007	Solution ann.
	32	55Ni–21Cr–13.5Mo	Smls. & wld. fittings	SB–366	...	N06022	Solution ann.
	33	55Ni–21Cr–13.5Mo	Forgings	SB–462	...	N06022	Solution ann.
	34	55Ni–21Cr–13.5Mo	Forgings	SB–564	...	N06022	Solution ann.
	35	55Ni–21Cr–13.5Mo	Rod	SB–574	...	N06022	Solution ann.
	36	55Ni–21Cr–13.5Mo	Plate, sheet, strip	SB–575	...	N06022	Solution ann.
	37	55Ni–21Cr–13.5Mo	Wld. pipe	SB–619	...	N06022	Solution ann.
	38	55Ni–21Cr–13.5Mo	Smls. pipe & tube	SB–622	...	N06022	Solution ann.
	39	55Ni–21Cr–13.5Mo	Wld. tube	SB–626	...	N06022	Solution ann.
	40	40Ni–29Cr–15Fe–5Mo	Smls. & wld. fittings	SB–366	...	N06030	Solution ann.
	41	40Ni–29Cr–15Fe–5Mo	Forgings	SB–462	...	N06030	Solution ann.
	42	40Ni–29Cr–15Fe–5Mo	Rod	SB–581	...	N06030	Solution ann.
	43	40Ni–29Cr–15Fe–5Mo	Plate, sheet, strip	SB–582	...	N06030	Solution ann.

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	...	...	...
2	...	515	275	...
3	...	...	...	...
4	300 < t ≤ 350	515	275	...
5	≤300	550	275	...
6	<13	580	345	...
7	89 < t ≤ 100	580	380	...
8	...	585	380	...
9	...	585	380	...
10	13 < t ≤ 89	600	415	...
11	<13	760	585	...
12	...	485	170	...
13	...	515	240	...
14	25–38	895	585	...
15	6–22	895	620	...
16	>5	655	240	...
17	≤5	655	240	...
18	...	655	240	...
19	...	690	275	...
20	1.5 < t ≤ 5	690	275	...
21	...	690	275	...
22	...	690	275	...
23	...	690	275	...
24	>19	585	205	...
25	>19	585	205	...
26	...	620	240	...
27	≤19	620	240	...
28	≤19	620	240	...
29	...	620	240	...
30	...	620	240	...
31	...	620	240	...
32	...	690	310	...
33	...	690	310	...
34	...	690	310	...
35	...	690	310	...
36	...	690	310	...
37	...	690	310	...
38	...	690	310	...
39	...	690	310	...
40	...	585	240	...
41	...	585	240	...
42	...	585	240	...
43	...	585	240	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	...	...	...	...	...	...	...	...	...	...
2	276	272	266	260	256	251	248	245	243	242
3	...	...	...	...	...	...	...	...	...	...
4	276	258	240	233	227	223	219	219	219	219
5	276	258	240	233	227	223	219	219	219	219
6	345	334	324	319	316	312	310	310	310	310
7	379	368	356	351	347	343	341	341	341	341
8	379	365	356	351	347	345	343	342	340	337
9	379	365	356	351	347	345	343	342	340	337
10	414	401	388	383	378	375	372	372	372	372
11	586	568	550	542	536	531	528	527	527	527
12	172	159	149	144	141	138	136	136	136	136
13	241	239	233	228	224	220	217	214	213	212
14	586	569	558	552	547	543	540	537	535	534
15	621	602	591	584	579	575	571	569	567	565
16	241	227	215	206	198	191	185	179	173	168
17	241	227	215	206	198	191	185	179	173	168
18	241	227	215	206	198	191	185	179	173	168
19	276	259	245	236	227	218	211	204	198	192
20	276	259	245	236	227	218	211	204	198	192
21	276	259	245	236	227	218	211	204	198	192
22	276	259	245	236	227	218	211	204	198	192
23	276	259	245	236	227	218	211	204	198	192
24	207	194	184	178	172	167	163	159	156	153
25	207	194	184	178	172	167	163	159	156	153
26	241	226	214	207	201	195	190	185	181	178
27	241	226	214	207	201	195	190	185	181	178
28	241	226	214	207	201	195	190	185	181	178
29	241	226	214	207	201	195	190	185	181	178
30	241	226	214	207	201	195	190	185	181	178
31	241	226	214	207	201	195	190	185	181	178
32	310	290	274	263	254	245	238	231	224	219
33	310	290	274	263	254	245	238	231	224	219
34	310	290	274	263	254	245	238	231	224	219
35	310	290	274	263	254	245	238	231	224	219
36	310	290	274	263	254	245	238	231	224	219
37	310	290	274	263	254	245	238	231	224	219
38	310	290	274	263	254	245	238	231	224	219
39	310	290	274	263	254	245	238	231	224	219
40	241	219	205	196	189	184	179	174	171	168
41	241	219	205	196	189	184	179	174	171	168
42	241	219	205	196	189	184	179	174	171	168
43	241	219	205	196	189	184	179	174	171	168

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Nonferrous Materials (Cont'd)	
1	...	...	...	...	...	...	...	...	...	...	(13)
2	240	239	237	234	231	227	223	219	215	...	
3	...	...	...	...	...	...	...	...	...	...	(13)
4	219	219	219	219	215	211	208	...	...	...	
5	219	219	219	219	215	211	208	...	...	...	
6	308	300	290	290	288	279	270	...	...	...	
7	339	329	319	319	316	307	297	...	...	...	
8	334	330	325	318	312	306	301	...	...	...	
9	334	330	325	318	312	306	301	...	...	...	
10	369	359	348	348	345	335	325	...	...	...	
11	523	508	493	493	489	475	460	...	...	...	
12	136	136	136	135	134	132	130	130	129	...	
13	210	208	207	205	202	199	195	192	189	...	
14	532	531	530	529	...	...	...	...	...	...	
15	564	562	561	560	...	...	...	...	...	...	
16	164	161	158	155	154	152	151	150	149	149	
17	164	161	158	155	154	152	151	150	149	149	
18	164	161	158	155	154	152	151	150	149	149	
19	188	184	180	178	176	174	173	172	171	170	
20	188	184	180	178	176	174	173	172	171	170	
21	188	184	180	178	176	174	173	172	171	170	
22	188	184	180	178	176	174	173	172	171	170	
23	188	184	180	178	176	174	173	172	171	170	
24	150	148	146	145	144	143	143	142	142	141	
25	150	148	146	145	144	143	143	142	142	141	
26	175	173	171	169	168	167	166	166	165	164	
27	175	173	171	169	168	167	166	166	165	164	
28	175	173	171	169	168	167	166	166	165	164	
29	175	173	171	169	168	167	166	166	165	164	
30	175	173	171	169	168	167	166	166	165	164	
31	175	173	171	169	168	167	166	166	165	164	
32	214	209	206	202	200	197	195	193	191	190	
33	214	209	206	202	200	197	195	193	191	190	
34	214	209	206	202	200	197	195	193	191	190	
35	214	209	206	202	200	197	195	193	191	190	
36	214	209	206	202	200	197	195	193	191	190	
37	214	209	206	202	200	197	195	193	191	190	
38	214	209	206	202	200	197	195	193	191	190	
39	214	209	206	202	200	197	195	193	191	190	
40	165	162	159	157	154	151	149	146	145	143	
41	165	162	159	157	154	151	149	146	145	143	
42	165	162	159	157	154	151	149	146	145	143	
43	165	162	159	157	154	151	149	146	145	143	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	40Ni–29Cr–15Fe–5Mo	Wld. pipe	SB–619	...	N06030	Solution ann.
2	40Ni–29Cr–15Fe–5Mo	Smls. pipe & tube	SB–622	...	N06030	Solution ann.
3	40Ni–29Cr–15Fe–5Mo	Wld. tube	SB–626	...	N06030	Solution ann.
4	58Ni–33Cr–8Mo	Smls. & wld. fittings	SB–366	...	N06035	Solution ann.
5	58Ni–33Cr–8Mo	Forgings	SB–462	...	N06035	Solution ann.
6	58Ni–33Cr–8Mo	Forgings	SB–564	...	N06035	Solution ann.
7	58Ni–33Cr–8Mo	Rod	SB–574	...	N06035	Solution ann.
8	58Ni–33Cr–8Mo	Plate, sheet, strip	SB–575	...	N06035	Solution ann.
9	58Ni–33Cr–8Mo	Wld. pipe	SB–619	...	N06035	Solution ann.
10	58Ni–33Cr–8Mo	Smls. pipe & tube	SB–622	...	N06035	Solution ann.
11	58Ni–33Cr–8Mo	Wld. tube	SB–626	...	N06035	Solution ann.
12	46Ni–27Cr–23Fe–2.75Si	Rod	SB–166	...	N06045	Solution ann.
13	46Ni–27Cr–23Fe–2.75Si	Smls. pipe & tube	SB–167	...	N06045	Solution ann.
14	46Ni–27Cr–23Fe–2.75Si	Plate, sheet, strip	SB–168	...	N06045	Solution ann.
15	46Ni–27Cr–23Fe–2.75Si	Smls. & wld. fittings	SB–366	...	N06045	Solution ann.
16	46Ni–27Cr–23Fe–2.75Si	Wld. tube	SB–516	...	N06045	Solution ann.
17	46Ni–27Cr–23Fe–2.75Si	Wld. pipe	SB–517	...	N06045	Solution ann.
18	46Ni–27Cr–23Fe–2.75Si	Forgings	SB–564	...	N06045	Solution ann.
19	59Ni–23Cr–16Mo	Fittings	SB–366	CR5923	N06059	Annealed
20	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923	N06059	Annealed
21	59Ni–23Cr–16Mo	Wld. fittings	SB–366	WP5923W	N06059	Annealed
22	59Ni–23Cr–16Mo	Fittings	SB–366	WP5923WX	N06059	Annealed
23	59Ni–23Cr–16Mo	Forgings	SB–564	...	N06059	Solution ann.
24	59Ni–23Cr–16Mo	Rod	SB–574	...	N06059	Solution ann.
25	59Ni–23Cr–16Mo	Plate, sheet, strip	SB–575	...	N06059	Solution ann.
26	59Ni–23Cr–16Mo	Wld. pipe	SB–619	...	N06059	Solution ann.
27	59Ni–23Cr–16Mo	Smls. pipe & tube	SB–622	...	N06059	Solution ann.
28	59Ni–23Cr–16Mo	Wld. tube	SB–626	...	N06059	Solution ann.
29	59Ni–23Cr–16Mo–1.6Cu	Fittings	SB–366	...	N06200	Solution ann.
30	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–462	...	N06200	Solution ann.
31	59Ni–23Cr–16Mo–1.6Cu	Forgings	SB–564	...	N06200	Solution ann.
32	59Ni–23Cr–16Mo–1.6Cu	Rod	SB–574	...	N06200	Solution ann.
33	59Ni–23Cr–16Mo–1.6Cu	Plate, sheet, strip	SB–575	...	N06200	Solution ann.
34	59Ni–23Cr–16Mo–1.6Cu	Wld. pipe	SB–619	...	N06200	Solution ann.
35	59Ni–23Cr–16Mo–1.6Cu	Smls. pipe & tube	SB–622	...	N06200	Solution ann.
36	59Ni–23Cr–16Mo–1.6Cu	Wld. tube	SB–626	...	N06200	Solution ann.
37	60Ni–19Cr–19Mo–1.8Ta	Smls. & wld. fittings	SB–366	...	N06210	Solution ann.
38	60Ni–19Cr–19Mo–1.8Ta	Forgings	SB–564	...	N06210	Solution ann.
39	60Ni–19Cr–19Mo–1.8Ta	Rod	SB–574	...	N06210	Solution ann.
40	60Ni–19Cr–19Mo–1.8Ta	Plate, sheet, strip	SB–575	...	N06210	Solution ann.
41	60Ni–19Cr–19Mo–1.8Ta	Wld. pipe	SB–619	...	N06210	Solution ann.
42	60Ni–19Cr–19Mo–1.8Ta	Smls. pipe & tube	SB–622	...	N06210	Solution ann.
43	60Ni–19Cr–19Mo–1.8Ta	Wld. tube	SB–626	...	N06210	Solution ann.

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	585	240	...
2	...	585	240	...
3	...	585	240	...
4	...	586	241	...
5	...	586	241	...
6	...	586	241	...
7	...	586	241	...
8	...	586	241	...
9	...	586	241	...
10	...	586	241	...
11	...	586	241	...
12	...	620	240	...
13	...	620	240	...
14	...	620	240	...
15	...	620	240	...
16	...	620	240	...
17	...	620	240	...
18	...	620	240	...
19	...	690	310	...
20	...	690	310	...
21	...	690	310	...
22	...	690	310	...
23	...	690	310	...
24	...	690	310	...
25	...	690	310	...
26	...	690	310	...
27	...	690	310	...
28	...	690	310	...
29	...	690	310	...
30	...	690	310	...
31	...	690	310	...
32	...	690	310	...
33	...	690	310	...
34	...	690	310	...
35	...	690	310	...
36	...	690	310	...
37	...	690	310	...
38	...	690	310	...
39	...	690	310	...
40	...	690	310	...
41	...	690	310	...
42	...	690	310	...
43	...	690	310	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	241	219	205	196	189	184	179	174	171	168
2	241	219	205	196	189	184	179	174	171	168
3	241	219	205	196	189	184	179	174	171	168
4	241	224	208	198	188	179	172	165	160	156
5	241	224	208	198	188	179	172	165	160	156
6	241	224	208	198	188	179	172	165	160	156
7	241	224	208	198	188	179	172	165	160	156
8	241	224	208	198	188	179	172	165	160	156
9	241	224	208	198	188	179	172	165	160	156
10	241	224	208	198	188	179	172	165	160	156
11	241	224	208	198	188	179	172	165	160	156
12	241	228	214	206	199	193	188	184	180	178
13	241	228	214	206	199	193	188	184	180	178
14	241	228	214	206	199	193	188	184	180	178
15	241	228	214	206	199	193	188	184	180	178
16	241	228	214	206	199	193	188	184	180	178
17	241	228	214	206	199	193	188	184	180	178
18	241	228	214	206	199	193	188	184	180	178
19	310	295	276	268	260	255	248	242	236	230
20	310	295	276	268	260	255	248	242	236	230
21	310	295	276	268	260	255	248	242	236	230
22	310	295	276	268	260	255	248	242	236	230
23	310	295	276	268	260	255	248	242	236	230
24	310	295	276	268	260	255	248	242	236	230
25	310	295	276	268	260	255	248	242	236	230
26	310	295	276	268	260	255	248	242	236	230
27	310	295	276	268	260	255	248	242	236	230
28	310	295	276	268	260	255	248	242	236	230
29	310	...	276	...	256	...	238	...	222	...
30	310	...	276	...	256	...	238	...	222	...
31	310	...	276	...	256	...	238	...	222	...
32	310	...	276	...	256	...	238	...	222	...
33	310	...	276	...	256	...	238	...	222	...
34	310	...	276	...	256	...	238	...	222	...
35	310	...	276	...	256	...	238	...	222	...
36	310	...	276	...	256	...	238	...	222	...
37	310	287	273	263	253	...	236	...	220	...
38	310	287	273	263	253	...	236	...	220	...
39	310	287	273	263	253	...	236	...	220	...
40	310	287	273	263	253	...	236	...	220	...
41	310	287	273	263	253	...	236	...	220	...
42	310	287	273	263	253	...	236	...	220	...
43	310	287	273	263	253	...	236	...	220	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	165	162	159	157	154	151	149	146	145	143
2	165	162	159	157	154	151	149	146	145	143
3	165	162	159	157	154	151	149	146	145	143
4	153	150	148	147	145	144	142	140	137	135
5	153	150	148	147	145	144	142	140	137	135
6	153	150	148	147	145	144	142	140	137	135
7	153	150	148	147	145	144	142	140	137	135
8	153	150	148	147	145	144	142	140	137	135
9	153	150	148	147	145	144	142	140	137	135
10	153	150	148	147	145	144	142	140	137	135
11	153	150	148	147	145	144	142	140	137	135
12	176	175	174	173	172	172	171	169	168	166
13	176	175	174	173	172	172	171	169	168	166
14	176	175	174	173	172	172	171	169	168	166
15	176	175	174	173	172	172	171	169	168	166
16	176	175	174	173	172	172	171	169	168	166
17	176	175	174	173	172	172	171	169	168	166
18	176	175	174	173	172	172	171	169	168	166
19	225	219	214	208	202	198	193	188	183	179
20	225	219	214	208	202	198	193	188	183	179
21	225	219	214	208	202	198	193	188	183	179
22	225	219	214	208	202	198	193	188	183	179
23	225	219	214	208	202	198	193	188	183	179
24	225	219	214	208	202	198	193	188	183	179
25	225	219	214	208	202	198	193	188	183	179
26	225	219	214	208	202	198	193	188	183	179
27	225	219	214	208	202	198	193	188	183	179
28	225	219	214	208	202	198	193	188	183	179
29	209	204	200	197	195	193	192	191	189	185
30	209	204	200	197	195	193	192	191	189	185
31	209	204	200	197	195	193	192	191	189	185
32	209	204	200	197	195	193	192	191	189	185
33	209	204	200	197	195	193	192	191	189	185
34	209	204	200	197	195	193	192	191	189	185
35	209	204	200	197	195	193	192	191	189	185
36	209	204	200	197	195	193	192	191	189	185
37	206	200	194	189	185	181	177	175	173	171
38	206	200	194	189	185	181	177	175	173	171
39	206	200	194	189	185	181	177	175	173	171
40	206	200	194	189	185	181	177	175	173	171
41	206	200	194	189	185	181	177	175	173	171
42	206	200	194	189	185	181	177	175	173	171
43	206	200	194	189	185	181	177	175	173	171

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	57Ni–22Cr–14W–2Mo–La	Plate, sheet, strip	SB–435	...	N06230	Solution ann.
2	57Ni–22Cr–14W–2Mo–La	Forgings	SB–564	...	N06230	Solution ann.
3	57Ni–22Cr–14W–2Mo–La	Bar	SB–572	...	N06230	Solution ann.
4	57Ni–22Cr–14W–2Mo–La	Wld. pipe	SB–619	...	N06230	Solution ann.
5	57Ni–22Cr–14W–2Mo–La	Smls. pipe & tube	SB–622	...	N06230	Solution ann.
6	57Ni–22Cr–14W–2Mo–La	Wld. tube	SB–626	...	N06230	Solution ann.
7	61Ni–16Mo–16Cr	Smls. & wld. fittings	SB–366	...	N06455	Annealed
8	61Ni–16Mo–16Cr	Rod	SB–574	...	N06455	Solution ann.
9	61Ni–16Mo–16Cr	Plate, sheet, strip	SB–575	...	N06455	Solution ann.
10	61Ni–16Mo–16Cr	Wld. pipe	SB–619	...	N06455	Solution ann.
11	61Ni–16Mo–16Cr	Smls. pipe & tube	SB–622	...	N06455	Solution ann.
12	61Ni–16Mo–16Cr	Wld. tube	SB–626	...	N06455	Solution ann.
13	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
14	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
15	72Ni–15Cr–8Fe	Smls. & wld. fittings	SB–366	...	N06600	Annealed
16	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Cold drawn/ann.
17	72Ni–15Cr–8Fe	Smls. pipe & tube	SB–167	...	N06600	Hot fin./ann.
18	72Ni–15Cr–8Fe	Smls. tube	SB–163	...	N06600	Annealed
19	72Ni–15Cr–8Fe	Bar	SB–166	...	N06600	Annealed
20	72Ni–15Cr–8Fe	Plate	SB–168	...	N06600	Annealed
21	72Ni–15Cr–8Fe	Wld. tube	SB–516	...	N06600	Annealed
22	72Ni–15Cr–8Fe	Forgings	SB–564	...	N06600	...
23	72Ni–15Cr–8Fe	Pipe, tube	SB–167	...	N06600	Cold drawn/ann.
24	72Ni–15Cr–8Fe	Wld. pipe	SB–517	...	N06600	Cold drawn/ann.
25	72Ni–15Cr–8Fe	Smls. tube	SB–163	...	N06600	...
26	72Ni–15Cr–8Fe	Bar, rod	SB–166	...	N06600	Hot worked
27	72Ni–15Cr–8Fe	Plate, sheet, strip	SB–168	...	N06600	Hot rolled
28	72Ni–15Cr–8Fe	Rounds	SB–166	...	N06600	Hot worked
29	72Ni–15Cr–8Fe	Rounds	SB–166	...	N06600	Hot worked
30	60Ni–23Cr–Fe	Smls. tube	SB–163	...	N06601	Annealed
31	60Ni–23Cr–Fe	Bar	SB–166	...	N06601	Annealed
32	60Ni–23Cr–Fe	Smls. pipe & tube	SB–167	...	N06601	Annealed
33	60Ni–23Cr–Fe	Plate, sheet, strip	SB–168	...	N06601	Annealed
34	52Ni–22Cr–13Co–9Mo	Bar, rod	SB–166	...	N06617	Annealed
35	52Ni–22Cr–13Co–9Mo	Smls. pipe & tube	SB–167	...	N06617	Annealed
36	52Ni–22Cr–13Co–9Mo	Plate, sheet, strip	SB–168	...	N06617	Annealed
37	52Ni–22Cr–13Co–9Mo	Forgings	SB–564	...	N06617	Annealed
38	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	2	N06625	Solution ann.
39	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe & tube	SB–444	2	N06625	Solution ann.
40	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	2	N06625	Solution ann.
41	60Ni–22Cr–9Mo–3.5Cb	Smls. & wld. fittings	SB–366	...	N06625	Annealed
42	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed
43	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	760	310	...
2	...	760	310	...
3	...	760	310	...
4	...	760	310	...
5	...	760	310	...
6	...	760	310	...
7	...	690	275	...
8	...	690	275	...
9	...	690	275	...
10	...	690	275	...
11	...	690	275	...
12	...	690	275	...
13	>125	515	170	...
14	>125	550	205	...
15	...	550	205	...
16	>125	550	205	...
17	≤125	550	205	...
18	≤75	550	240	...
19	...	550	240	...
20	...	550	240	...
21	...	550	240	...
22	...	550	240	...
23	≤125	550	240	...
24	...	550	240	...
25	...	550	275	...
26	>75	585	240	...
27	...	585	240	...
28	$13 < t \le 75$	620	275	...
29	$6 < t \le 13$	655	310	...
30	≤75 O.D.	552	207	...
31	...	552	207	...
32	...	552	207	...
33	...	552	207	...
34	...	655	240	...
35	...	655	240	...
36	...	655	240	...
37	...	655	240	...
38	...	690	275	...
39	...	690	275	...
40	...	690	275	...
41	...	760	345	...
42	$100 < t \le 250$	760	345	...
43	$100 < t \le 250$	760	345	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	310	301	289	281	273	264	256	249	242	235
2	310	301	289	281	273	264	256	249	242	235
3	310	301	289	281	273	264	256	249	242	235
4	310	301	289	281	273	264	256	249	242	235
5	310	301	289	281	273	264	256	249	242	235
6	310	301	289	281	273	264	256	249	242	235
7	276	264	252	244	238	231	226	221	217	213
8	276	264	252	244	238	231	226	221	217	213
9	276	264	252	244	238	231	226	221	217	213
10	276	264	252	244	238	231	226	221	217	213
11	276	264	252	244	238	231	226	221	217	213
12	276	264	252	244	238	231	226	221	217	213
13	172	168	163	160	157	154	151	148	146	143
14	207	201	196	192	189	185	181	178	175	172
15	207	201	196	192	189	185	181	178	175	172
16	207	201	196	192	189	185	181	178	175	172
17	207	201	196	192	189	185	181	178	175	172
18	241	226	220	217	215	213	212	211	209	208
19	241	226	220	217	215	213	212	211	209	208
20	241	226	220	217	215	213	212	211	209	208
21	241	226	220	217	215	213	212	211	209	208
22	241	226	220	217	215	213	212	211	209	208
23	241	226	220	217	215	213	212	211	209	208
24	241	226	220	217	215	213	212	211	209	208
25	276	263	251	247	245	244	242	241	240	238
26	241	233	228	225	223	221	220	220	220	220
27	241	233	228	225	223	221	220	220	220	220
28	276	268	261	258	255	253	251	251	251	251
29	310	302	294	290	287	285	283	282	282	282
30	207	192	183	177	171	166	161	157	154	151
31	207	192	183	177	171	166	161	157	154	151
32	207	192	183	177	171	166	161	157	154	151
33	207	192	183	177	171	166	161	157	154	151
34	241	227	212	205	199	193	188	183	180	177
35	241	227	212	205	199	193	188	183	180	177
36	241	227	212	205	199	193	188	183	180	177
37	241	227	212	205	199	193	188	183	180	177
38	276	262	253	247	242	237	233	229	225	222
39	276	262	253	247	242	237	233	229	225	222
40	276	262	253	247	242	237	233	229	225	222
41	345	337	331	327	322	318	314	310	306	302
42	345	337	331	327	322	318	314	310	306	302
43	345	337	331	327	322	318	314	310	306	302

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	230	225	222	220	218	217	216	216	216	216
2	230	225	222	220	218	217	216	216	216	216
3	230	225	222	220	218	217	216	216	216	216
4	230	225	222	220	218	217	216	216	216	216
5	230	225	222	220	218	217	216	216	216	216
6	230	225	222	220	218	217	216	216	216	216
7	210	207	205	202	200	198	196	193	191	189
8	210	207	205	202	200	198	196	193	191	189
9	210	207	205	202	200	198	196	193	191	189
10	210	207	205	202	200	198	196	193	191	189
11	210	207	205	202	200	198	196	193	191	189
12	210	207	205	202	200	198	196	193	191	189
13	141	139	137	135	133	132	130	129	127	...
14	169	167	164	162	160	158	156	154	152	...
15	169	167	164	162	160	158	156	154	152	...
16	169	167	164	162	160	158	156	154	152	...
17	169	167	164	162	160	158	156	154	152	...
18	207	206	204	202	201	198	195	190	185	...
19	207	206	204	202	201	198	195	190	185	...
20	207	206	204	202	201	198	195	190	185	...
21	207	206	204	202	201	198	195	190	185	...
22	207	206	204	202	201	198	195	190	185	...
23	207	206	204	202	201	198	195	190	185	...
24	207	206	204	202	201	198	195	190	185	...
25	237	235	233	231	229	226	224	...	...	...
26	220	219	218	217	215	212	208	204	201	197
27	220	219	218	217	215	212	208	204	201	197
28	251	250	249	247	244	240	236	...	...	...
29	282	281	280	278	274	270	266	...	...	...
30	148	146	145	144	143	143	142	142	142	142
31	148	146	145	144	143	143	142	142	142	142
32	148	146	145	144	143	143	142	142	142	142
33	148	146	145	144	143	143	142	142	142	142
34	174	171	169	167	166	164	164	162	162	161
35	174	171	169	167	166	164	164	162	162	161
36	174	171	169	167	166	164	164	162	162	161
37	174	171	169	167	166	164	164	162	162	161
38	219	217	214	212	210	208	207	205	204	203
39	219	217	214	212	210	208	207	205	204	203
40	219	217	214	212	210	208	207	205	204	203
41	298	295	291	288	286	284	281	279	278	276
42	298	295	291	288	286	284	281	279	278	276
43	298	295	291	288	286	284	281	279	278	276

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed
2	60Ni–22Cr–9Mo–3.5Cb	Plate, sheet, strip	SB–443	1	N06625	Annealed
3	60Ni–22Cr–9Mo–3.5Cb	Smls. pipe	SB–444	1	N06625	Annealed
4	60Ni–22Cr–9Mo–3.5Cb	Bar	SB–446	1	N06625	Annealed
5	60Ni–22Cr–9Mo–3.5Cb	Forgings	SB–564	...	N06625	Annealed
6	60Ni–22Cr–9Mo–3.5Cb	Wld. tube	SB–704	...	N06625	Annealed
7	60Ni–22Cr–9Mo–3.5Cb	Wld. pipe	SB–705	...	N06625	Annealed
8	Ni–Cr–Mo–W	Forgings	SB–564	...	N06686	Solution ann.
9	Ni–Cr–Mo–W	Rod	SB–574	...	N06686	Solution ann.
10	Ni–Cr–Mo–W	Plate, sheet, strip	SB–575	...	N06686	Solution ann.
11	Ni–Cr–Mo–W	Wld. pipe	SB–619	...	N06686	Solution ann.
12	Ni–Cr–Mo–W	Smls. pipe & tube	SB–622	...	N06686	Solution ann.
13	Ni–Cr–Mo–W	Wld. tube	SB–626	...	N06686	Solution ann.
14	58Ni–29Cr–9Fe	Smls. tube	SB–163	...	N06690	Annealed
15	58Ni–29Cr–9Fe	Bar, rod	SB–166	...	N06690	Annealed
16	58Ni–29Cr–9Fe	Smls. pipe & tube	SB–167	...	N06690	Annealed
17	58Ni–29Cr–9Fe	Plate, sheet, strip	SB–168	...	N06690	Annealed
18	58Ni–29Cr–9Fe	Forgings	SB–564	...	N06690	Annealed
19	58Ni–29Cr–9Fe	Smls. tube	SB–163	...	N06690	Annealed
(13) 20	49Ni–25Cr–18Fe–6Mo	Bolting	SB–581	...	N06975	Solution ann.
21	49Ni–25Cr–18Fe–6Mo	Plate, sheet, strip	SB–582	...	N06975	Solution ann.
22	49Ni–25Cr–18Fe–6Mo	Wld. pipe	SB–619	...	N06975	Solution ann.
23	49Ni–25Cr–18Fe–6Mo	Smls. pipe & tube	SB–622	...	N06975	Solution ann.
24	49Ni–25Cr–18Fe–6Mo	Wld. tube	SB–626	...	N06975	Solution ann.
25	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
26	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
27	47Ni–22Cr–20Fe–7Mo	Smls. & wld. fittings	SB–366	...	N06985	Annealed
28	47Ni–22Cr–20Fe–7Mo	Rod	SB–581	...	N06985	Annealed
29	47Ni–22Cr–20Fe–7Mo	Plate, sheet, strip	SB–582	...	N06985	Annealed
30	47Ni–22Cr–20Fe–7Mo	Wld. pipe	SB–619	...	N06985	Annealed
31	47Ni–22Cr–20Fe–7Mo	Smls. pipe & tube	SB–622	...	N06985	Annealed
32	47Ni–22Cr–20Fe–7Mo	Wld. tube	SB–626	...	N06985	Annealed
33	35Ni–35Fe–20Cr–Cb	Forgings	SB–462	...	N08020	Annealed
34	35Ni–35Fe–20Cr–Cb	Plate	SB–463	...	N08020	Annealed
35	35Ni–35Fe–20Cr–Cb	Bar	SB–473	...	N08020	Annealed
36	35Ni–35Fe–20Cr–Cb	Smls. pipe & tube	SB–729	...	N08020	Annealed
37	35Ni–35Fe–20Cr–Cb	Wld. pipe	SB–464	...	N08020	Wld. ann.
38	35Ni–35Fe–20Cr–Cb	Wld. tube	SB–468	...	N08020	Wld. ann.
39	35Ni–35Fe–20Cr–Cb	Smls. & wld. fittings	SB–366	...	N08020	Annealed
40	37Ni–33Fe–23Cr–4Mo–Cu	Plate, sheet, strip	SB–463	...	N08024	Annealed
41	37Ni–33Fe–23Cr–4Mo–Cu	Wld. pipe	SB–464	...	N08024	Wld. ann.
42	37Ni–33Fe–23Cr–4Mo–Cu	Wld. tube	SB–468	...	N08024	Wld. ann.

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	760	380	...
2	...	825	415	...
3	...	825	415	...
4	≤100	825	415	...
5	≤100	825	415	...
6	...	825	415	...
7	...	825	415	...
8	...	689	310	...
9	...	689	310	...
10	...	689	310	...
11	≤203.2	689	310	...
12	...	689	310	...
13	≤88.9	689	310	...
14	...	585	240	...
15	...	585	240	...
16	...	585	240	...
17	...	585	240	...
18	...	585	240	...
19	...	585	275	...
20	...	585	220	...
21	...	585	220	...
22	...	585	220	...
23	...	585	220	...
24	...	585	220	...
25	>19	585	205	...
26	>19	585	205	...
27	...	620	240	...
28	≤19	620	240	...
29	≤19	620	240	...
30	...	620	240	...
31	...	620	240	...
32	...	620	240	...
33	...	550	240	...
34	...	550	240	...
35	...	550	240	...
36	...	550	240	...
37	...	550	240	...
38	...	550	240	...
39	...	585	275	...
40	...	550	240	...
41	...	550	240	...
42	...	550	240	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	379	371	364	359	354	350	345	340	336	332
2	414	405	397	391	387	382	377	372	367	362
3	414	405	397	391	387	382	377	372	367	362
4	414	405	397	391	387	382	377	372	367	362
5	414	405	397	391	387	382	377	372	367	362
6	414	405	397	391	387	382	377	372	367	362
7	414	405	397	391	387	382	377	372	367	362
8	310	272	255	...	241	...	233	...	225	...
9	310	272	255	...	241	...	233	...	225	...
10	310	272	255	...	241	...	233	...	225	...
11	310	272	255	...	241	...	233	...	225	...
12	310	272	255	...	241	...	233	...	225	...
13	310	272	255	...	241	...	233	...	225	...
14	241	227	217	211	205	201	198	195	193	192
15	241	227	217	211	205	201	198	195	193	192
16	241	227	217	211	205	201	198	195	193	192
17	241	227	217	211	205	201	198	195	193	192
18	241	227	217	211	205	201	198	195	193	192
19	276	262	247	240	235	230	226	223	221	219
20	221	208	201	196	191	186	182	177	173	168
21	221	208	201	196	191	186	182	177	173	168
22	221	208	201	196	191	186	182	177	173	168
23	221	208	201	196	191	186	182	177	173	168
24	221	208	201	196	191	186	182	177	173	168
25	207	193	182	175	167	161	155	150	145	141
26	207	193	182	175	167	161	155	150	145	141
27	241	226	213	203	195	188	181	175	169	165
28	241	226	213	203	195	188	181	175	169	165
29	241	226	213	203	195	188	181	175	169	165
30	241	226	213	203	195	188	181	175	169	165
31	241	226	213	203	195	188	181	175	169	165
32	241	226	213	203	195	188	181	175	169	165
33	241	221	212	208	204	200	196	193	189	186
34	241	221	212	208	204	200	196	193	189	186
35	241	221	212	208	204	200	196	193	189	186
36	241	221	212	208	204	200	196	193	189	186
37	241	221	212	208	204	200	196	193	189	186
38	241	221	212	208	204	200	196	193	189	186
39	276	253	243	237	233	228	225	221	217	213
40	241	222	211	204	198	193	188	183	178	173
41	241	222	211	204	198	193	188	183	178	173
42	241	222	211	204	198	193	188	183	178	173

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	328	324	320	317	314	312	309	307	306	304
2	358	354	350	346	343	340	338	335	333	331
3	358	354	350	346	343	340	338	335	333	331
4	358	354	350	346	343	340	338	335	333	331
5	358	354	350	346	343	340	338	335	333	331
6	358	354	350	346	343	340	338	335	333	331
7	358	354	350	346	343	340	338	335	333	331
8	217	214	210	208	206	205	205	205	205	205
9	217	214	210	208	206	205	205	205	205	205
10	217	214	210	208	206	205	205	205	205	205
11	217	214	210	208	206	205	205	205	205	205
12	217	214	210	208	206	205	205	205	205	205
13	217	214	210	208	206	205	205	205	205	205
14	191	190	190	190	190	190	190	190	189	188
15	191	190	190	190	190	190	190	190	189	188
16	191	190	190	190	190	190	190	190	189	188
17	191	190	190	190	190	190	190	190	189	188
18	191	190	190	190	190	190	190	190	189	188
19	218	217	217	217	217	217	217	...	...	...
20	164	160	157	155	153	152	151	151	151	151 (**13**)
21	164	160	157	155	153	152	151	151	151	151
22	164	160	157	155	153	152	151	151	151	151
23	164	160	157	155	153	152	151	151	151	151
24	164	160	157	155	153	152	151	151	151	151
25	138	135	132	129	127	124	122	120	118	116
26	138	135	132	129	127	124	122	120	118	116
27	161	157	154	151	147	145	142	140	137	135
28	161	157	154	151	147	145	142	140	137	135
29	161	157	154	151	147	145	142	140	137	135
30	161	157	154	151	147	145	142	140	137	135
31	161	157	154	151	147	145	142	140	137	135
32	161	157	154	151	147	145	142	140	137	135
33	184	182	180	179	178	174	170	...	...	...
34	184	182	180	179	178	174	170	...	...	...
35	184	182	180	179	178	174	170	...	...	...
36	184	182	180	179	178	174	170	...	...	...
37	184	182	180	179	178	174	170	...	...	...
38	184	182	180	179	178	174	170	...	...	...
39	210	208	207	205	203	199	195	...	...	...
40	169	164	160	156	153	150	149	147	146	144
41	169	164	160	156	153	150	149	147	146	144
42	169	164	160	156	153	150	149	147	146	144

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	35Ni–30Fe–24Cr–6Mo–Cu	Plate, sheet, strip	SB–463	...	N08026	Annealed
2	35Ni–30Fe–24Cr–6Mo–Cu	Wld. pipe	SB–464	...	N08026	Wld. ann.
3	35Ni–30Fe–24Cr–6Mo–Cu	Wld. tube	SB–468	...	N08026	Wld. ann.
4	31Ni–31Fe–29Cr–Mo	Smls. tube	SB–668	...	N08028	Annealed
5	31Ni–31Fe–29Cr–Mo	Plate, sheet, strip	SB–709	...	N08028	Annealed
6	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. & wld. fittings	SB–366	...	N08031	Solution ann.
7	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Forgings	SB–564	...	N08031	Solution ann.
8	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Rod	SB–581	...	N08031	Solution ann.
9	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. pipe	SB–619	...	N08031	Solution ann.
10	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Smls. pipe & tube	SB–622	...	N08031	Solution ann.
11	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08031	Solution ann.
12	31Ni–33Fe–27Cr–6.5Mo–Cu–N	Wld. tube	SB–626	...	N08031	Solution ann.
13	37Ni–33Fe–25Cr	Condenser tubes	SB–163	...	N08120	Solution ann.
14	37Ni–33Fe–25Cr	Smls. & wld. fittings	SB–366	...	N08120	Solution ann.
15	37Ni–33Fe–25Cr	Smls. pipe & tube	SB–407	...	N08120	Solution ann.
16	37Ni–33Fe–25Cr	Bar, rod	SB–408	...	N08120	Solution ann.
17	37Ni–33Fe–25Cr	Plate, sheet, strip	SB–409	...	N08120	Solution ann.
18	37Ni–33Fe–25Cr	Wld. pipe	SB–514	...	N08120	Solution ann.
19	37Ni–33Fe–25Cr	Wld. tube	SB–515	...	N08120	Solution ann.
20	37Ni–33Fe–25Cr	Forgings	SB–564	...	N08120	Solution ann.
21	26Ni–43Fe–22Cr–5Mo	Wld. pipe	SB–619	...	N08320	Solution ann.
22	26Ni–43Fe–22Cr–5Mo	Plate, sheet, strip	SB–620	...	N08320	Solution ann.
23	26Ni–43Fe–22Cr–5Mo	Rod	SB–621	...	N08320	Solution ann.
24	26Ni–43Fe–22Cr–5Mo	Smls. pipe & tube	SB–622	...	N08320	Solution ann.
25	26Ni–43Fe–22Cr–5Mo	Wld. tube	SB–626	...	N08320	Solution ann.
26	35Ni–19Cr–1 1/4Si	Bar	SB–511	...	N08330	...
27	35Ni–19Cr–1 1/4Si	Pipe	SB–535	...	N08330	...
28	35Ni–19Cr–1 1/4Si	Plate	SB–536	...	N08330	...
29	35Ni–19Cr–1 1/4Si	Smls. & wld. fittings	SB–366	...	N08330	Annealed
30	35Ni–19Cr–1 1/4Si	Smls. & wld. pipe	SB–535	...	N08330	Annealed
31	35Ni–19Cr–1 1/4Si	Plate, sheet, strip	SB–536	...	N08330	Annealed
32	35Ni–19Cr–1 1/4Si	Wld. pipe	SB–710	...	N08330	Annealed
33	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–462	...	N08367	Solution ann.
34	46Fe–24Ni–21Cr–6Mo–Cu–N	Forgings	SB–564	...	N08367	Solution ann.
35	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
36	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
37	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.
38	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
39	46Fe–24Ni–21Cr–6Mo–Cu–N	Bar, rod, wire	SB–691	...	N08367	Solution ann.
40	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
41	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–675	...	N08367	Solution ann.
42	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. tube	SB–676	...	N08367	Solution ann.
43	46Fe–24Ni–21Cr–6Mo–Cu–N	Plate, sheet, strip	SB–688	...	N08367	Solution ann.

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	550	240	...
2	...	550	240	...
3	...	550	240	...
4	...	505	215	...
5	...	505	215	...
6	...	650	275	...
7	...	650	275	...
8	...	650	275	...
9	...	650	275	...
10	...	650	275	...
11	...	650	275	...
12	...	650	275	...
13	...	621	276	...
14	...	621	276	...
15	...	621	276	...
16	...	621	276	...
17	...	621	276	...
18	...	621	276	...
19	...	621	276	...
20	...	621	276	...
21	...	515	195	...
22	...	515	195	...
23	...	515	195	...
24	...	515	195	...
25	...	515	195	...
26	...	485	205	...
27	...	485	205	...
28	...	485	205	...
29	...	485	205	...
30	...	485	205	...
31	...	485	205	...
32	...	485	205	...
33	...	655	310	...
34	...	655	310	...
35	>5	655	310	...
36	>5	655	310	...
37	>5	655	310	...
38	>5	655	310	...
39	...	655	310	...
40	>5	655	310	...
41	≤5	690	310	...
42	≤5	690	310	...
43	≤5	690	310	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	241	225	212	203	195	189	182	176	170	166
2	241	225	212	203	195	189	182	176	170	166
3	241	225	212	203	195	189	182	176	170	166
4	214	203	194	188	182	177	172	166	162	157
5	214	203	194	188	182	177	172	166	162	157
6	276	250	224	212	204	197	190	184	180	176
7	276	250	224	212	204	197	190	184	180	176
8	276	250	224	212	204	197	190	184	180	176
9	276	250	224	212	204	197	190	184	180	176
10	276	250	224	212	204	197	190	184	180	176
11	276	250	224	212	204	197	190	184	180	176
12	276	250	224	212	204	197	190	184	180	176
13	276	258	242	232	223	215	207	200	195	189
14	276	258	242	232	223	215	207	200	195	189
15	276	258	242	232	223	215	207	200	195	189
16	276	258	242	232	223	215	207	200	195	189
17	276	258	242	232	223	215	207	200	195	189
18	276	258	242	232	223	215	207	200	195	189
19	276	258	242	232	223	215	207	200	195	189
20	276	258	242	232	223	215	207	200	195	189
21	193	184	177	173	169	164	160	156	152	148
22	193	184	177	173	169	164	160	156	152	148
23	193	184	177	173	169	164	160	156	152	148
24	193	184	177	173	169	164	160	156	152	148
25	193	184	177	173	169	164	160	156	152	148
26	207	191	181	175	170	165	161	157	153	150
27	207	191	181	175	170	165	161	157	153	150
28	207	191	181	175	170	165	161	157	153	150
29	207	191	181	175	170	165	161	157	153	150
30	207	191	181	175	170	165	161	157	153	150
31	207	191	181	175	170	165	161	157	153	150
32	207	191	181	175	170	165	161	157	153	150
33	310	285	268	256	246	236	228	221	215	209
34	310	285	268	256	246	236	228	221	215	209
35	310	285	268	256	246	236	228	221	215	209
36	310	285	268	256	246	236	228	221	215	209
37	310	285	268	256	246	236	228	221	215	209
38	310	285	268	256	246	236	228	221	215	209
39	310	285	268	256	246	236	228	221	215	209
40	310	285	268	256	246	236	228	221	215	209
41	310	285	268	256	246	236	228	221	215	209
42	310	285	268	256	246	236	228	221	215	209
43	310	285	268	256	246	236	228	221	215	209

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	161	157	153	150	147	144	142	140	139	138
2	161	157	153	150	147	144	142	140	139	138
3	161	157	153	150	147	144	142	140	139	138
4	152	148	144	139	136	132	129	126	123	120
5	152	148	144	139	136	132	129	126	123	120
6	173	169	165	162	160	157	155	153	152	...
7	173	169	165	162	160	157	155	153	152	...
8	173	169	165	162	160	157	155	153	152	...
9	173	169	165	162	160	157	155	153	152	...
10	173	169	165	162	160	157	155	153	152	...
11	173	169	165	162	160	157	155	153	152	...
12	173	169	165	162	160	157	155	153	152	...
13	185	181	178	176	174	172	171	170	170	169
14	185	181	178	176	174	172	171	170	170	169
15	185	181	178	176	174	172	171	170	170	169
16	185	181	178	176	174	172	171	170	170	169
17	185	181	178	176	174	172	171	170	170	169
18	185	181	178	176	174	172	171	170	170	169
19	185	181	178	176	174	172	171	170	170	169
20	185	181	178	176	174	172	171	170	170	169
21	145	142	139	136	134	132	130	...	...	...
22	145	142	139	136	134	132	130	...	...	...
23	145	142	139	136	134	132	130	...	...	...
24	145	142	139	136	134	132	130	...	...	...
25	145	142	139	136	134	132	130	...	...	...
26	147	144	141	138	136	133	131	128	126	124
27	147	144	141	138	136	133	131	128	126	124
28	147	144	141	138	136	133	131	128	126	124
29	147	144	141	138	136	133	131	128	126	124
30	147	144	141	138	136	133	131	128	126	124
31	147	144	141	138	136	133	131	128	126	124
32	147	144	141	138	136	133	131	128	126	124
33	204	199	196	192	189	186	184	181	179	...
34	204	199	196	192	189	186	184	181	179	...
35	204	199	196	192	189	186	184	181	179	...
36	204	199	196	192	189	186	184	181	179	...
37	204	199	196	192	189	186	184	181	179	...
38	204	199	196	192	189	186	184	181	179	...
39	204	199	196	192	189	186	184	181	179	...
40	204	199	196	192	189	186	184	181	179	...
41	204	199	196	192	189	186	184	181	179	...
42	204	199	196	192	189	186	184	181	179	...
43	204	199	196	192	189	186	184	181	179	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	46Fe–24Ni–21Cr–6Mo–Cu–N	Smls. pipe & tube	SB–690	...	N08367	Solution ann.
2	46Fe–24Ni–21Cr–6Mo–Cu–N	Wld. pipe	SB–804	...	N08367	Solution ann.
3	46Fe–24Ni–21Cr–6Mo–Cu–N	Castings	SA–351	CN3MN	J94651	Solution ann.
4	25Ni–47Fe–21Cr–5Mo	Plate, sheet, strip	SB–599	...	N08700	Solution ann.
5	25Ni–47Fe–21Cr–5Mo	Bar, wire	SB–672	...	N08700	Solution ann.
6	32Ni–45Fe–20Cr–Cb	Castings	SA–351	CT15C	...	As cast
7	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Annealed
8	33Ni–42Fe–21Cr	Smls. & wld. fittings	SB–366	...	N08800	Annealed
9	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08800	Annealed
10	33Ni–42Fe–21Cr	Bar	SB–408	...	N08800	Annealed
11	33Ni–42Fe–21Cr	Plate	SB–409	...	N08800	Annealed
12	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08800	Annealed
13	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08800	Annealed
14	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08800	Annealed
15	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Annealed
16	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08800	Cold worked
17	32Ni–44Fe–21Cr	Smls. tube	SB–163	...	N08801	Ann./stabilized
18	32Ni–44Fe–21Cr	Smls. pipe & tube	SB–407	...	N08801	Ann./stabilized
19	33Ni–42Fe–21Cr	Smls. tube	SB–163	...	N08810	Annealed
20	33Ni–42Fe–21Cr	Smls. pipe & tube	SB–407	...	N08810	Annealed
21	33Ni–42Fe–21Cr	Bar	SB–408	...	N08810	Annealed
22	33Ni–42Fe–21Cr	Plate	SB–409	...	N08810	Annealed
23	33Ni–42Fe–21Cr	Wld. pipe	SB–514	...	N08810	Annealed
24	33Ni–42Fe–21Cr	Wld. tube	SB–515	...	N08810	Annealed
25	33Ni–42Fe–21Cr	Forgings	SB–564	...	N08810	Annealed
26	42Ni–21.5Cr–3Mo–2.3Cu	Smls. tube	SB–163	...	N08825	Annealed
27	42Ni–21.5Cr–3Mo–2.3Cu	Smls. & wld. fittings	SB–366	...	N08825	Annealed
28	42Ni–21.5Cr–3Mo–2.3Cu	Smls. pipe & tube	SB–423	...	N08825	Cold worked/ann.
29	42Ni–21.5Cr–3Mo–2.3Cu	Plate	SB–424	...	N08825	Annealed
30	42Ni–21.5Cr–3Mo–2.3Cu	Bar, rod	SB–425	...	N08825	Annealed
31	42Ni–21.5Cr–3Mo–2.3Cu	Forgings	SB–564	...	N08825	Annealed
32	42Ni–21.5Cr–3Mo–2.3Cu	Wld. tube	SB–704	...	N08825	Annealed
33	42Ni–21.5Cr–3Mo–2.3Cu	Wld. pipe	SB–705	...	N08825	Annealed
34	44Fe–25Ni–21Cr–Mo	Fittings	SB–366	...	N08904	Annealed
35	44Fe–25Ni–21Cr–Mo	Plate, sheet, strip	SB–625	...	N08904	Annealed
36	44Fe–25Ni–21Cr–Mo	Bar, wire	SB–649	...	N08904	Annealed
37	44Fe–25Ni–21Cr–Mo	Wld. pipe	SB–673	...	N08904	Annealed
38	44Fe–25Ni–21Cr–Mo	Wld. tube	SB–674	...	N08904	Annealed
39	44Fe–25Ni–21Cr–Mo	Smls. pipe & tube	SB–677	...	N08904	Annealed
40	25Ni–20Cr–6Mo–Cu–N	Plate, sheet, strip	SB–625	...	N08925	Annealed
41	25Ni–20Cr–6Mo–Cu–N	Bar, wire	SB–649	...	N08925	Annealed
42	25Ni–20Cr–6Mo–Cu–N	Wld. pipe	SB–673	...	N08925	Annealed
43	25Ni–20Cr–6Mo–Cu–N	Wld. tube	SB–674	...	N08925	Annealed
44	25Ni–20Cr–6Mo–Cu–N	Smls. pipe & tube	SB–677	...	N08925	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	≤5	690	310	...
2	≤5	690	310	...
3	...	550	260	...
4	...	550	240	...
5	...	550	240	...
6	...	435	170	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	515	205	...
11	...	515	205	...
12	...	515	205	...
13	...	515	205	...
14	...	515	205	...
15	...	515	275	...
16	...	570	325	...
17	...	450	170	...
18	...	450	170	...
19	...	450	170	...
20	...	450	170	...
21	...	450	170	...
22	...	450	170	...
23	...	450	170	...
24	...	450	170	...
25	...	450	170	...
26	...	585	240	...
27	...	585	240	...
28	...	585	240	...
29	...	585	240	...
30	...	585	240	...
31	...	585	240	...
32	...	585	240	...
33	...	585	240	...
34	...	490	215	...
35	...	490	215	...
36	...	490	215	...
37	...	490	215	...
38	...	490	215	...
39	...	490	215	...
40	...	600	295	...
41	...	600	295	...
42	...	600	295	...
43	...	600	295	...
44	...	600	295	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	310	285	268	256	246	236	228	221	215	209
2	310	285	268	256	246	236	228	221	215	209
3	262	237	217	205	194	184	176	169	164	160
4	241	228	215	205	196	189	184	181	178	176
5	241	228	215	205	196	189	184	181	178	176
6	172	166	162	160	158	157	155	153	151	149
7	207	197	190	186	183	181	178	176	174	172
8	207	197	190	186	183	181	178	176	174	172
9	207	197	190	186	183	181	178	176	174	172
10	207	197	190	186	183	181	178	176	174	172
11	207	197	190	186	183	181	178	176	174	172
12	207	197	190	186	183	181	178	176	174	172
13	207	197	190	186	183	181	178	176	174	172
14	207	197	190	186	183	181	178	176	174	172
15	276	265	253	248	245	241	238	235	232	229
16	324	311	297	292	287	283	279	276	273	270
17	172	164	157	153	149	145	141	138	134	131
18	172	164	157	153	149	145	141	138	134	131
19	172	164	157	153	149	145	141	138	134	131
20	172	164	157	153	149	145	141	138	134	131
21	172	164	157	153	149	145	141	138	134	131
22	172	164	157	153	149	145	141	138	134	131
23	172	164	157	153	149	145	141	138	134	131
24	172	164	157	153	149	145	141	138	134	131
25	172	164	157	153	149	145	141	138	134	131
26	241	228	220	214	210	205	201	197	193	189
27	241	228	220	214	210	205	201	197	193	189
28	241	228	220	214	210	205	201	197	193	189
29	241	228	220	214	210	205	201	197	193	189
30	241	228	220	214	210	205	201	197	193	189
31	240	227	218	...	209	...	200	...	192	...
32	241	228	220	214	210	205	201	197	193	189
33	241	228	220	214	210	205	201	197	193	189
34	214	185	171	163	156	150	144	139	133	129
35	214	185	171	163	156	150	144	139	133	129
36	214	185	171	163	156	150	144	139	133	129
37	214	185	171	163	156	150	144	139	133	129
38	214	185	171	163	156	150	144	139	133	129
39	214	185	171	163	156	150	144	139	133	129
40	296	256	237	227	220	213	205	198	192	186
41	296	256	237	227	220	213	205	198	192	186
42	296	256	237	227	220	213	205	198	192	186
43	296	256	237	227	220	213	205	198	192	186
44	296	256	237	227	220	213	205	198	192	186

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	204	199	196	192	189	186	184	181	179	...
2	204	199	196	192	189	186	184	181	179	...
3	156	153	151	150	148	148	146	146	145	145
4	173	168	163	...	...	...	...	...	...	...
5	173	168	163	...	...	...	...	...	...	...
6	147	145	144	142	140	137	135	134	132	130
7	170	168	166	164	162	160	158	157	155	153
8	170	168	166	164	162	160	158	157	155	153
9	170	168	166	164	162	160	158	157	155	153
10	170	168	166	164	162	160	158	157	155	153
11	170	168	166	164	162	160	158	157	155	153
12	170	168	166	164	162	160	158	157	155	153
13	170	168	166	164	162	160	158	157	155	153
14	170	168	166	164	162	160	158	157	155	153
15	226	224	221	219	216	214	211	...	...	...
16	268	267	267	...	...	...	...	...	...	...
17	128	125	123	120	118	115	113	112	110	108
18	128	125	123	120	118	115	113	112	110	108
19	128	125	123	120	118	115	113	112	110	108
20	128	125	123	120	118	115	113	112	110	108
21	128	125	123	120	118	115	113	112	110	108
22	128	125	123	120	118	115	113	112	110	108
23	128	125	123	120	118	115	113	112	110	108
24	128	125	123	120	118	115	113	112	110	108
25	128	125	123	120	118	115	113	112	110	108
26	186	183	181	179	177	177	175	175	174	172
27	186	183	181	179	177	177	175	175	174	172
28	186	183	181	179	177	177	175	175	174	172
29	186	183	181	179	177	177	175	175	174	172
30	186	183	181	179	177	177	175	175	174	172
31	185	...	180	178	176	175	175	174	173	171
32	186	183	181	179	177	177	175	175	174	172
33	186	183	181	179	177	177	175	175	174	172
34	125	122	119	118	...	...	...	...	...	...
35	125	122	119	118	...	...	...	...	...	...
36	125	122	119	118	...	...	...	...	...	...
37	125	122	119	118	...	...	...	...	...	...
38	125	122	119	118	...	...	...	...	...	...
39	125	122	119	118	...	...	...	...	...	...
40	181	177	175	174	174	174	174	...	...	...
41	181	177	175	174	174	174	174	...	...	...
42	181	177	175	174	174	174	174	...	...	...
43	181	177	175	174	174	174	174	...	...	...
44	181	177	175	174	174	174	174	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	62Ni–28Mo–5Fe	Plate	SB–333	...	N10001	Annealed
2	62Ni–28Mo–5Fe	Smls. & wld. fittings	SB–366	...	N10001	Annealed
3	62Ni–28Mo–5Fe	Wld. pipe	SB–619	...	N10001	Solution ann.
4	62Ni–28Mo–5Fe	Smls. pipe & tube	SB–622	...	N10001	Solution ann.
5	62Ni–28Mo–5Fe	Wld. tube	SB–626	...	N10001	Solution ann.
(13) 6	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
(13) 7	62Ni–28Mo–5Fe	Rod	SB–335	...	N10001	Annealed
8	62Ni–28Mo–5Fe	Sheet, strip	SB–333	...	N10001	Annealed
9	70Ni–16Mo–7Cr–5Fe	Smls. & wld. fittings	SB–366	...	N10003	Annealed
10	70Ni–16Mo–7Cr–5Fe	Plate, sheet, strip	SB–434	...	N10003	Annealed
11	70Ni–16Mo–7Cr–5Fe	Rod	SB–573	...	N10003	Annealed
12	62Ni–25Mo–8Cr–2Fe	Smls. & wld. fittings	SB–366	...	N10242	Annealed
13	62Ni–25Mo–8Cr–2Fe	Plate, sheet, strip	SB–434	...	N10242	Annealed
14	62Ni–25Mo–8Cr–2Fe	Forgings	SB–564	...	N10242	Annealed
15	62Ni–25Mo–8Cr–2Fe	Rod	SB–573	...	N10242	Annealed
16	62Ni–25Mo–8Cr–2Fe	Wld. pipe	SB–619	...	N10242	Solution ann.
17	62Ni–25Mo–8Cr–2Fe	Smls. pipe & tube	SB–622	...	N10242	Solution ann.
18	62Ni–25Mo–8Cr–2Fe	Wld. tube	SB–626	...	N10242	Solution ann.
19	54Ni–16Mo–15Cr	Smls. & wld. fittings	SB–366	...	N10276	Solution ann.
20	54Ni–16Mo–15Cr	Forgings	SB–462	...	N10276	Solution ann.
21	54Ni–16Mo–15Cr	Forgings	SB–564	...	N10276	Solution ann.
22	54Ni–16Mo–15Cr	Rod	SB–574	...	N10276	Solution ann.
23	54Ni–16Mo–15Cr	Plate, sheet, strip	SB–575	...	N10276	Solution ann.
24	54Ni–16Mo–15Cr	Wld. pipe	SB–619	...	N10276	Solution ann.
25	54Ni–16Mo–15Cr	Smls. pipe & tube	SB–622	...	N10276	Solution ann.
26	54Ni–16Mo–15Cr	Wld. tube	SB–626	...	N10276	Solution ann.
27	Ni–28Mo–3Fe–1.3Cr–0.25Al	Plate, sheet, strip	SB–333	...	N10629	Solution ann.
28	Ni–28Mo–3Fe–1.3Cr–0.25Al	Rod	SB–335	...	N10629	Solution ann.
29	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. & wld. fittings	SB–366	...	N10629	Solution ann.
30	Ni–28Mo–3Fe–1.3Cr–0.25Al	Forgings	SB–564	...	N10629	Solution ann.
31	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. pipe	SB–619	...	N10629	Solution ann.
32	Ni–28Mo–3Fe–1.3Cr–0.25Al	Smls. pipe & tube	SB–622	...	N10629	Solution ann.
33	Ni–28Mo–3Fe–1.3Cr–0.25Al	Wld. tube	SB–626	...	N10629	Solution ann.
34	65Ni–28Mo–2Fe	Smls. & wld. fittings	SB–366	...	N10665	Annealed
35	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Annealed
36	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Annealed
37	65Ni–28Mo–2Fe	Plate, sheet, strip	SB–333	...	N10665	Solution ann.
38	65Ni–28Mo–2Fe	Rod	SB–335	...	N10665	Solution ann.
39	65Ni–28Mo–2Fe	Forgings	SB–462	...	N10665	Solution ann.
40	65Ni–28Mo–2Fe	Forgings	SB–564	...	N10665	Solution ann.
41	65Ni–28Mo–2Fe	Wld. pipe	SB–619	...	N10665	Solution ann.
42	65Ni–28Mo–2Fe	Smls. pipe & tube	SB–622	...	N10665	Solution ann.
43	65Ni–28Mo–2Fe	Wld. tube	SB–626	...	N10665	Solution ann.

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	690	310	...
2	...	690	310	...
3	...	690	310	...
4	...	690	310	...
5	...	690	310	...
6	>38.1	690	315	...
7	7.94 < t ≤ 38.1	795	315	...
8	...	795	345	...
9	...	690	275	...
10	...	690	275	...
11	...	690	275	...
12	...	725	310	...
13	...	725	310	...
14	...	725	310	...
15	...	725	310	...
16	...	725	310	...
17	...	725	310	...
18	...	725	310	...
19	...	690	285	...
20	...	690	285	...
21	...	690	285	...
22	...	690	285	...
23	...	690	285	...
24	...	690	285	...
25	...	690	285	...
26	...	690	285	...
27	...	760	350	...
28	...	760	350	...
29	...	760	350	...
30	...	760	350	...
31	...	760	350	...
32	...	760	350	...
33	...	760	350	...
34	...	760	350	...
35	...	760	350	...
36	...	760	350	...
37	...	760	350	...
38	...	760	350	...
39	...	760	350	...
40	...	760	350	...
41	...	760	350	...
42	...	760	350	...
43	...	760	350	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	310	291	279	272	266	260	255	251	247	243
2	310	291	279	272	266	260	255	251	247	243
3	310	291	279	272	266	260	255	251	247	243
4	310	291	279	272	266	260	255	251	247	243
5	310	291	279	272	266	260	255	251	247	243
6	317	297	286	278	271	266	261	256	252	249
7	317	297	286	278	271	266	261	256	252	249
8	345	324	310	302	295	289	284	278	275	270
9	276	264	251	243	234	226	219	213	208	204
10	276	264	251	243	234	226	219	213	208	204
11	276	264	251	243	234	226	219	213	208	204
12	310	302	289	279	270	262	256	251	248	246
13	310	302	289	279	270	262	256	251	248	246
14	310	302	289	279	270	262	256	251	248	246
15	310	302	289	279	270	262	256	251	248	246
16	310	302	289	279	270	262	256	251	248	246
17	310	302	289	279	270	262	256	251	248	246
18	310	302	289	279	270	262	256	251	248	246
19	283	268	255	246	237	229	222	215	208	202
20	283	268	255	246	237	229	222	215	208	202
21	283	268	255	246	237	229	222	215	208	202
22	283	268	255	246	237	229	222	215	208	202
23	283	268	255	246	237	229	222	215	208	202
24	283	268	255	246	237	229	222	215	208	202
25	283	268	255	246	237	229	222	215	208	202
26	283	268	255	246	237	229	222	215	208	202
27	352	338	322	313	306	299	292	286	281	277
28	352	338	322	313	306	299	292	286	281	277
29	352	338	322	313	306	299	292	286	281	277
30	352	338	322	313	306	299	292	286	281	277
31	352	338	322	313	306	299	292	286	281	277
32	352	338	322	313	306	299	292	286	281	277
33	352	338	322	313	306	299	292	286	281	277
34	352	339	328	320	313	306	300	295	291	287
35	352	339	328	320	313	306	300	295	291	287
36	352	339	328	320	313	306	300	295	291	287
37	352	339	328	320	313	306	300	295	291	287
38	352	339	328	320	313	306	300	295	291	287
39	352	339	328	320	313	306	300	295	291	287
40	352	339	328	320	313	306	300	295	291	287
41	352	339	328	320	313	306	300	295	291	287
42	352	339	328	320	313	306	300	295	291	287
43	352	339	328	320	313	306	300	295	291	287

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	300	325	350	375	400	425	450	475	500	525	
										Nonferrous Materials (Cont'd)	
1	240	237	235	233	230	229	228	...	...	...	
2	240	237	235	233	230	229	228	...	...	...	
3	240	237	235	233	230	229	228	...	...	...	
4	240	237	235	233	230	229	228	...	...	...	
5	240	237	235	233	230	229	228	...	...	...	
6	245	242	240	238	236	234	232	...	...	...	(**13**)
7	245	242	240	238	236	234	232	...	...	...	(**13**)
8	267	264	261	258	256	255	253	...	...	...	
9	201	199	197	196	194	191	188	183	177	169	
10	201	199	197	196	194	191	188	183	177	169	
11	201	199	197	196	194	191	188	183	177	169	
12	245	245	244	242	240	237	233	229	225	223	
13	245	245	244	242	240	237	233	229	225	223	
14	245	245	244	242	240	237	233	229	225	223	
15	245	245	244	242	240	237	233	229	225	223	
16	245	245	244	242	240	237	233	229	225	223	
17	245	245	244	242	240	237	233	229	225	223	
18	245	245	244	242	240	237	233	229	225	223	
19	196	191	187	183	180	177	175	173	172	171	
20	196	191	187	183	180	177	175	173	172	171	
21	196	191	187	183	180	177	175	173	172	171	
22	196	191	187	183	180	177	175	173	172	171	
23	196	191	187	183	180	177	175	173	172	171	
24	196	191	187	183	180	177	175	173	172	171	
25	196	191	187	183	180	177	175	173	172	171	
26	196	191	187	183	180	177	175	173	172	171	
27	273	269	266	264	261	260	258	257	256	255	
28	273	269	266	264	261	260	258	257	256	255	
29	273	269	266	264	261	260	258	257	256	255	
30	273	269	266	264	261	260	258	257	256	255	
31	273	269	266	264	261	260	258	257	256	255	
32	273	269	266	264	261	260	258	257	256	255	
33	273	269	266	264	261	260	258	257	256	255	
34	283	280	277	274	271	267	263	258	254	249	
35	283	280	277	274	271	267	263	258	254	249	
36	283	280	277	274	271	267	263	258	254	249	
37	283	280	277	274	271	267	263	258	254	249	
38	283	280	277	274	271	267	263	258	254	249	
39	283	280	277	274	271	267	263	258	254	249	
40	283	280	277	274	271	267	263	258	254	249	
41	283	280	277	274	271	267	263	258	254	249	
42	283	280	277	274	271	267	263	258	254	249	
43	283	280	277	274	271	267	263	258	254	249	

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	65Ni–29.5Mo–2Fe–2Cr	Plate, sheet, strip	SB–333	...	N10675	Solution ann.
2	65Ni–29.5Mo–2Fe–2Cr	Rod	SB–335	...	N10675	Solution ann.
3	65Ni–29.5Mo–2Fe–2Cr	Smls. & wld. fittings	SB–366	...	N10675	Solution ann.
4	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–462	...	N10675	Solution ann.
5	65Ni–29.5Mo–2Fe–2Cr	Forgings	SB–564	...	N10675	Solution ann.
6	65Ni–29.5Mo–2Fe–2Cr	Wld. pipe	SB–619	...	N10675	Solution ann.
7	65Ni–29.5Mo–2Fe–2Cr	Smls. pipe & tube	SB–622	...	N10675	Solution ann.
8	65Ni–29.5Mo–2Fe–2Cr	Wld. tube	SB–626	...	N10675	Solution ann.
9	37Ni–30Co–28Cr–2.7Si	Plate, sheet, strip	SB–435	...	N12160	Solution ann.
10	37Ni–30Co–28Cr–2.7Si	Forgings	SB–564	...	N12160	Solution ann.
11	37Ni–30Co–28Cr–2.7Si	Bar	SB–572	...	N12160	Solution ann.
12	37Ni–30Co–28Cr–2.7Si	Wld. pipe	SB–619	...	N12160	Solution ann.
13	37Ni–30Co–28Cr–2.7Si	Smls. pipe & tube	SB–622	...	N12160	Solution ann.
14	37Ni–30Co–28Cr–2.7Si	Wld. tube	SB–626	...	N12160	Solution ann.
15	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. & wld. fittings	SB–366	...	R20033	Solution ann.
16	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Forgings	SB–564	...	R20033	Solution ann.
17	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. pipe	SB–619	...	R20033	Solution ann.
18	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Smls. pipe & tube	SB–622	...	R20033	Solution ann.
19	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Plate, sheet, strip	SB–625	...	R20033	Solution ann.
20	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Wld. tube	SB–626	...	R20033	Solution ann.
21	33Cr–31Ni–32Fe–1.5Mo–0.6Cu–N	Rod	SB–649	...	R20033	Solution ann.
22	21Ni–30Fe–22Cr–18Co–3Mo–3W	Plate, sheet, strip	SB–435	...	R30556	Annealed
23	21Ni–30Fe–22Cr–18Co–3Mo–3W	Rod	SB–572	...	R30556	Annealed
24	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. pipe	SB–619	...	R30556	Annealed
25	21Ni–30Fe–22Cr–18Co–3Mo–3W	Smls. pipe & tube	SB–622	...	R30556	Annealed
26	21Ni–30Fe–22Cr–18Co–3Mo–3W	Wld. tube	SB–626	...	R30556	Annealed
27	Co–26Cr–9Ni–5Mo–3Fe–2W	Rod	SB–815	...	R31233	Solution ann.
28	Co–26Cr–9Ni–5Mo–3Fe–2W	Plate, sheet, strip	SB–818	...	R31233	Solution ann.
29	Ti	Plate, sheet, strip	SB–265	1	R50250	Annealed
30	Ti	Smls. & wld. tube	SB–338	1	R50250	Annealed
31	Ti	Bar, billet	SB–348	1	R50250	Annealed
32	Ti	Forgings	SB–381	F–1	R50250	Annealed
33	Ti	Smls. pipe	SB–861	1	R50250	Annealed
34	Ti	Wld. pipe	SB–862	1	R50250	Annealed
35	Ti	Castings	SB–367	C–2	R50400	...
36	Ti	Plate, sheet, strip	SB–265	2	R50400	Annealed
37	Ti	Smls. & wld. tube	SB–338	2	R50400	Annealed
38	Ti	Bar, billet	SB–348	2	R50400	Annealed
39	Ti	Forgings	SB–381	F–2	R50400	Annealed
40	Ti	Smls. pipe	SB–861	2	R50400	Annealed
41	Ti	Wld. pipe	SB–862	2	R50400	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	760	350	...
2	...	760	350	...
3	...	760	350	...
4	...	760	350	...
5	...	760	350	...
6	...	760	350	...
7	...	760	350	...
8	...	760	350	...
9	...	620	240	...
10	...	620	240	...
11	...	620	240	...
12	...	620	240	...
13	...	620	240	...
14	...	620	240	...
15	...	750	380	...
16	...	750	380	...
17	...	750	380	...
18	...	750	380	...
19	...	750	380	...
20	...	750	380	...
21	...	750	380	...
22	...	690	310	...
23	...	690	310	...
24	...	690	310	...
25	...	690	310	...
26	...	690	310	...
27	...	896	379	...
28	...	896	379	...
29	...	240	138	...
30	...	240	138	...
31	...	240	138	...
32	...	240	138	...
33	...	240	138	...
34	...	240	138	...
35	...	345	275	...
36	...	345	275	...
37	...	345	275	...
38	...	345	275	...
39	...	345	275	...
40	...	345	275	...
41	...	345	275	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	352	340	327	320	313	306	299	292	286	280
2	352	340	327	320	313	306	299	292	286	280
3	352	340	327	320	313	306	299	292	286	280
4	352	340	327	320	313	306	300	292	286	280
5	352	340	327	320	313	306	299	292	286	280
6	352	340	327	320	313	306	299	292	286	280
7	352	340	327	320	313	306	299	292	286	280
8	352	340	327	320	313	306	299	292	286	280
9	241	227	209	199	189	180	172	164	157	152
10	241	227	209	199	189	180	172	164	157	152
11	241	227	209	199	189	180	172	164	157	152
12	241	227	209	199	189	180	172	164	157	152
13	241	227	209	199	189	180	172	164	157	152
14	241	227	209	199	189	180	172	164	157	152
15	379	347	314	300	290	280	272	264	258	253
16	379	347	314	300	290	280	272	264	258	253
17	379	347	314	300	290	280	272	264	258	253
18	379	347	314	300	290	280	272	264	258	253
19	379	347	314	300	290	280	272	264	258	253
20	379	347	314	300	290	280	272	264	258	253
21	379	347	314	300	290	280	272	264	258	253
22	310	282	261	249	239	229	222	215	210	206
23	310	282	261	249	239	229	222	215	210	206
24	310	282	261	249	239	229	222	215	210	206
25	310	282	261	249	239	229	222	215	210	206
26	310	282	261	249	239	229	222	215	210	206
27	379	352	328	...	294	...	266	...	245	...
28	379	352	328	...	294	...	266	...	245	...
29	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
30	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
31	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
32	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
33	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
34	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
35	276	238	213	194	176	157	138	121	108	93.3
36	276	238	213	194	176	157	138	121	108	93.3
37	276	238	213	194	176	157	138	121	108	93.3
38	276	238	213	194	176	157	138	121	108	93.3
39	276	238	213	194	176	157	138	121	108	93.3
40	276	238	213	194	176	157	138	121	108	93.3
41	276	238	213	194	176	157	138	121	108	93.3

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	275	270	266	262	259	257	255	254	253	251
2	275	270	266	262	259	257	255	254	253	251
3	275	270	266	262	259	257	255	254	253	251
4	275	270	266	262	259	257	255	254	253	251
5	275	270	266	262	259	257	255	254	253	251
6	275	270	266	262	259	257	255	254	253	251
7	275	270	266	262	259	257	255	254	253	251
8	275	270	266	262	259	257	255	254	253	251
9	148	144	142	140	140	140	140	140	140	140
10	148	144	142	140	140	140	140	140	140	140
11	148	144	142	140	140	140	140	140	140	140
12	148	144	142	140	140	140	140	140	140	140
13	148	144	142	140	140	140	140	140	140	140
14	148	144	142	140	140	140	140	140	140	140
15	248	245	242	239	236	234	232	230	227	...
16	248	245	242	239	236	234	232	230	227	...
17	248	245	242	239	236	234	232	230	227	...
18	248	245	242	239	236	234	232	230	227	...
19	248	245	242	239	236	234	232	230	227	...
20	248	245	242	239	236	234	232	230	227	...
21	248	245	242	239	236	234	232	230	227	...
22	201	198	195	193	190	188	187	185	183	182
23	201	198	195	193	190	188	187	185	183	182
24	201	198	195	193	190	188	187	185	183	182
25	201	198	195	193	190	188	187	185	183	182
26	201	198	195	193	190	188	187	185	183	182
27	231	226	222	219	216	213	209	204	198	190
28	231	226	222	219	216	213	209	204	198	190
29	37.8	35.5	...	...	...	...	...	...	...	...
30	37.8	35.5	...	...	...	...	...	...	...	...
31	37.8	35.5	...	...	...	...	...	...	...	...
32	37.8	35.5	...	...	...	...	...	...	...	...
33	37.8	35.5	...	...	...	...	...	...	...	...
34	37.8	35.5	...	...	...	...	...	...	...	...
35	82.6	76.0	...	...	...	...	...	...	...	...
36	82.6	76.0	...	...	...	...	...	...	...	...
37	82.6	76.0	...	...	...	...	...	...	...	...
38	82.6	76.0	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	82.6	76.0	...	...	...	...	...	...	...	...
41	82.6	76.0	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	Ti	Plate, sheet, strip	SB–265	2H	R50400	Annealed
2	Ti	Smls. & wld. tube	SB–338	2H	R50400	Annealed
3	Ti	Bar, billet	SB–348	2H	R50400	Annealed
4	Ti	Smls. fittings	SB–363	WPT2H	R50400	Annealed
5	Ti	Wld. fittings	SB–363	WPT2HW	R50400	Annealed
6	Ti	Forgings	SB–381	F–2H	R50400	Annealed
7	Ti	Smls. pipe	SB–861	2H	R50400	Annealed
8	Ti	Wld. pipe	SB–862	2H	R50400	Annealed
9	Ti	Plate, sheet, strip	SB–265	3	R50550	Annealed
10	Ti	Smls. & wld. tube	SB–338	3	R50550	Annealed
11	Ti	Bar, billet	SB–348	3	R50550	Annealed
12	Ti	Castings	SB–367	C–3	R50550	Annealed
13	Ti	Forgings	SB–381	F–3	R50550	Annealed
14	Ti	Smls. pipe	SB–861	3	R50550	Annealed
15	Ti	Wld. pipe	SB–862	3	R50550	Annealed
16	Ti–Pd	Plate, sheet, strip	SB–265	11	R52250	Annealed
17	Ti–Pd	Plate, sheet, strip	SB–265	17	R52252	Annealed
18	Ti–Ru	Plate, sheet, strip	SB–265	27	R52254	Annealed
19	Ti–Pd	Plate, sheet, strip	SB–265	7	R52400	Annealed
20	Ti–Pd	Smls. & wld. tube	SB–338	7	R52400	Annealed
21	Ti–Pd	Bar, billet	SB–348	7	R52400	Annealed
22	Ti–Pd	Forgings	SB–381	F–7	R52400	Annealed
23	Ti–Pd	Smls. pipe	SB–861	7	R52400	Annealed
24	Ti–Pd	Wld. pipe	SB–862	7	R52400	Annealed
25	Ti–0.15Pd	Plate, sheet, strip	SB–265	7H	R52400	Annealed
26	Ti–0.15Pd	Smls. & wld. tube	SB–338	7H	R52400	Annealed
27	Ti–0.15Pd	Bar, billet	SB–348	7H	R52400	Annealed
28	Ti–0.15Pd	Smls. fittings	SB–363	WPT7H	R52400	Annealed
29	Ti–0.15Pd	Wld. fittings	SB–363	WPT7HW	R52400	Annealed
30	Ti–0.15Pd	Forgings	SB–381	F–7H	R52400	Annealed
31	Ti–0.15Pd	Smls. pipe	SB–861	7H	R52400	Annealed
32	Ti–0.15Pd	Wld. pipe	SB–862	7H	R52400	Annealed
33	Ti–0.05Pd	Plate, sheet, strip	SB–265	16H	R52402	Annealed
34	Ti–0.05Pd	Smls. & wld. tube	SB–338	16H	R52402	Annealed
35	Ti–0.05Pd	Bar, billet	SB–348	16H	R52402	Annealed
36	Ti–0.05Pd	Smls. fittings	SB–363	WPT16H	R52402	Annealed
37	Ti–0.05Pd	Wld. fittings	SB–363	WPT16HW	R52402	Annealed
38	Ti–0.05Pd	Forgings	SB–381	F–16H	R52402	Annealed
39	Ti–0.05Pd	Smls. pipe	SB–861	16H	R52402	Annealed
40	Ti–0.05Pd	Wld. pipe	SB–862	16H	R52402	Annealed
41	Ti–Ru	Plate, sheet, strip	SB–265	26	R52404	Annealed
42	Ti–Ru	Smls. & wld. tube	SB–338	26	R52404	Annealed
43	Ti–Ru	Bar, billet	SB–348	26	R52404	Annealed
44	Ti–Ru	Smls. fittings	SB–363	WPT26	R52404	Annealed
45	Ti–Ru	Wld. fittings	SB–363	WPT26W	R52404	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	400	275	...
2	...	400	275	...
3	...	400	275	...
4	...	400	275	...
5	...	400	275	...
6	...	400	275	...
7	...	400	275	...
8	...	400	275	...
9	...	450	380	...
10	...	450	380	...
11	...	450	380	...
12	...	450	380	...
13	...	450	380	...
14	...	450	380	...
15	...	450	380	...
16	...	240	138	...
17	...	240	138	...
18	...	240	138	...
19	...	345	275	...
20	...	345	275	...
21	...	345	275	...
22	...	345	275	...
23	...	345	275	...
24	...	345	275	...
25	...	400	275	...
26	...	400	275	...
27	...	400	275	...
28	...	400	275	...
29	...	400	275	...
30	...	400	275	...
31	...	400	275	...
32	...	400	275	...
33	...	400	275	...
34	...	400	275	...
35	...	400	275	...
36	...	400	275	...
37	...	400	275	...
38	...	400	275	...
39	...	400	275	...
40	...	400	275	...
41	...	345	275	...
42	...	345	275	...
43	...	345	275	...
44	...	345	275	...
45	...	345	275	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	276	238	212	194	176	157	139	122	107	95.1
2	276	238	212	194	176	157	139	122	107	95.1
3	276	238	212	194	176	157	139	122	107	95.1
4	276	238	212	194	176	157	139	122	107	95.1
5	276	238	212	194	176	157	139	122	107	95.1
6	276	238	212	194	176	157	139	122	107	95.1
7	276	238	212	194	176	157	139	122	107	95.1
8	276	238	212	194	176	157	139	122	107	95.1
9	379	334	297	270	245	222	201	181	162	145
10	379	334	297	270	245	222	201	181	162	145
11	379	334	297	270	245	222	201	181	162	145
12	379	334	297	270	245	222	201	181	162	145
13	379	334	297	270	245	222	201	181	162	145
14	379	334	297	270	245	222	201	181	162	145
15	379	334	297	270	245	222	201	181	162	145
16	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
17	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
18	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
19	276	238	213	194	176	157	138	121	108	93.3
20	276	238	213	194	176	157	138	121	108	93.3
21	276	238	213	194	176	157	138	121	108	93.3
22	276	238	213	194	176	157	138	121	108	93.3
23	276	238	213	194	176	157	138	121	108	93.3
24	276	238	213	194	176	157	138	121	108	93.3
25	276	238	212	194	176	157	139	122	107	95.1
26	276	238	212	194	176	157	139	122	107	95.1
27	276	238	212	194	176	157	139	122	107	95.1
28	276	238	212	194	176	157	139	122	107	95.1
29	276	238	212	194	176	157	139	122	107	95.1
30	276	238	212	194	176	157	139	122	107	95.1
31	276	238	212	194	176	157	139	122	107	95.1
32	276	238	212	194	176	157	139	122	107	95.1
33	276	238	212	194	176	157	139	122	107	95.1
34	276	238	212	194	176	157	139	122	107	95.1
35	276	238	212	194	176	157	139	122	107	95.1
36	276	238	212	194	176	157	139	122	107	95.1
37	276	238	212	194	176	157	139	122	107	95.1
38	276	238	212	194	176	157	139	122	107	95.1
39	276	238	212	194	176	157	139	122	107	95.1
40	276	238	212	194	176	157	139	122	107	95.1
41	276	238	213	194	176	157	138	121	108	93.3
42	276	238	213	194	176	157	138	121	108	93.3
43	276	238	213	194	176	157	138	121	108	93.3
44	276	238	213	194	176	157	138	121	108	93.3
45	276	238	213	194	176	157	138	121	108	93.3

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	86.6	80.8	...	...	...	...	...	...	...	...
2	86.6	80.8	...	...	...	...	...	...	...	...
3	86.6	80.8	...	...	...	...	...	...	...	...
4	86.6	80.8	...	...	...	...	...	...	...	...
5	86.6	80.8	...	...	...	...	...	...	...	...
6	86.6	80.8	...	...	...	...	...	...	...	...
7	86.6	80.8	...	...	...	...	...	...	...	...
8	86.6	80.8	...	...	...	...	...	...	...	...
9	128	112	...	...	...	...	...	...	...	...
10	128	112	...	...	...	...	...	...	...	...
11	128	112	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	128	112	...	...	...	...	...	...	...	...
14	128	112	...	...	...	...	...	...	...	...
15	128	112	...	...	...	...	...	...	...	...
16	37.8	35.5	...	...	...	...	...	...	...	...
17	37.8	35.5	...	...	...	...	...	...	...	...
18	37.8	35.5	...	...	...	...	...	...	...	...
19	82.6	76.0	...	...	...	...	...	...	...	...
20	82.6	76.0	...	...	...	...	...	...	...	...
21	82.6	76.0	...	...	...	...	...	...	...	...
22	82.6	76.0	...	...	...	...	...	...	...	...
23	82.6	76.0	...	...	...	...	...	...	...	...
24	82.6	76.0	...	...	...	...	...	...	...	...
25	86.6	80.8	...	...	...	...	...	...	...	...
26	86.6	80.8	...	...	...	...	...	...	...	...
27	86.6	80.8	...	...	...	...	...	...	...	...
28	86.6	80.8	...	...	...	...	...	...	...	...
29	86.6	80.8	...	...	...	...	...	...	...	...
30	86.6	80.8	...	...	...	...	...	...	...	...
31	86.6	80.8	...	...	...	...	...	...	...	...
32	86.6	80.8	...	...	...	...	...	...	...	...
33	86.6	80.8	...	...	...	...	...	...	...	...
34	86.6	80.8	...	...	...	...	...	...	...	...
35	86.6	80.8	...	...	...	...	...	...	...	...
36	86.6	80.8	...	...	...	...	...	...	...	...
37	86.6	80.8	...	...	...	...	...	...	...	...
38	86.6	80.8	...	...	...	...	...	...	...	...
39	86.6	80.8	...	...	...	...	...	...	...	...
40	86.6	80.8	...	...	...	...	...	...	...	...
41	82.6	76.0	...	...	...	...	...	...	...	...
42	82.6	76.0	...	...	...	...	...	...	...	...
43	82.6	76.0	...	...	...	...	...	...	...	...
44	82.6	76.0	...	...	...	...	...	...	...	...
45	82.6	76.0	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Designation/UNS No.	Class/Condition/Temper
	Nonferrous Materials (Cont'd)					
1	Ti–Ru	Forgings	SB–381	F–26	R52404	Annealed
2	Ti–Ru	Smls. pipe	SB–861	26	R52404	Annealed
3	Ti–Ru	Wld. pipe	SB–862	26	R52404	Annealed
4	Ti–0.10Ru	Plate, sheet, strip	SB–265	26H	R52404	Annealed
5	Ti–0.10Ru	Smls. & wld. tube	SB–338	26H	R52404	Annealed
6	Ti–0.10Ru	Bar, billet	SB–348	26H	R52404	Annealed
7	Ti–0.10Ru	Smls. fittings	SB–363	WPT26H	R52404	Annealed
8	Ti–0.10Ru	Wld. fittings	SB–363	WPT26HW	R52404	Annealed
9	Ti–0.10Ru	Forgings	SB–381	F–26H	R52404	Annealed
10	Ti–0.10Ru	Smls. pipe	SB–861	26H	R52404	Annealed
11	Ti–0.10Ru	Wld. pipe	SB–862	26H	R52404	Annealed
12	Ti–0.3Mo–0.8Ni	Plate, sheet, strip	SB–265	12	R53400	Annealed
13	Ti–0.3Mo–0.8Ni	Smls. & wld. tube	SB–338	12	R53400	Annealed
14	Ti–0.3Mo–0.8Ni	Bar, billet	SB–348	12	R53400	Annealed
15	Ti–0.3Mo–0.8Ni	Forgings	SB–381	F–12	R53400	Annealed
16	Ti–0.3Mo–0.8Ni	Smls. pipe	SB–861	12	R53400	Annealed
17	Ti–0.3Mo–0.8Ni	Wld. pipe	SB–862	12	R53400	Annealed
18	Ti–3Al–2.5V	Plate, sheet, strip	SB–265	9	R56320	Annealed
19	Ti–3Al–2.5V	Smls. & wld. tube	SB–338	9	R56320	Annealed
20	Ti–3Al–2.5V	Bar, billet	SB–348	9	R56320	Annealed
21	Ti–3Al–2.5V	Smls. fittings	SB–363	WPT9	R56320	Annealed
22	Ti–3Al–2.5V	Wld. fittings	SB–363	WPT9W	R56320	Annealed
23	Ti–3Al–2.5V	Forgings	SB–381	F–9	R56320	Annealed
24	Ti–3Al–2.5V	Smls. pipe	SB–861	9	R56320	Annealed
25	Ti–3Al–2.5V	Wld. pipe	SB–862	9	R56320	Annealed
26	Ti–3Al–2.5V–0.1Ru	Plate, sheet, strip	SB–265	28	R56323	Annealed
27	Ti–3Al–2.5V–0.1Ru	Smls. & wld. tube	SB–338	28	R56323	Annealed
28	Ti–3Al–2.5V–0.1Ru	Bar, billet	SB–348	28	R56323	Annealed
29	Ti–3Al–2.5V–0.1Ru	Smls. fittings	SB–363	WPT28	R56323	Annealed
30	Ti–3Al–2.5V–0.1Ru	Wld. fittings	SB–363	WPT28W	R56323	Annealed
31	Ti–3Al–2.5V–0.1Ru	Forgings	SB–381	F–28	R56323	Annealed
32	Ti–3Al–2.5V–0.1Ru	Smls. pipe	SB–861	28	R56323	Annealed
33	Ti–3Al–2.5V–0.1Ru	Wld. pipe	SB–862	28	R56323	Annealed
34	99.2Zr	Forgings	SB–493	...	R60702	Annealed
35	99.2Zr	Smls. & wld. tube	SB–523	...	R60702	Annealed
36	99.2Zr	Bar, wire	SB–550	...	R60702	Annealed
37	99.2Zr	Plate, sheet, strip	SB–551	...	R60702	Annealed
38	99.2Zr	Smls. fittings	SB–653	PZ–2	R60702	Annealed
39	99.2Zr	Wld. fittings	SB–653	PZ–2W	R60702	Annealed
40	99.2Zr	Smls. & wld. pipe	SB–658	...	R60702	Annealed

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Size/Thickness, mm	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Notes
				Nonferrous Materials (Cont'd)
1	...	345	275	...
2	...	345	275	...
3	...	345	275	...
4	...	400	275	...
5	...	400	275	...
6	...	400	275	...
7	...	400	275	...
8	...	400	275	...
9	...	400	275	...
10	...	400	275	...
11	...	400	275	...
12	...	485	345	...
13	...	485	345	...
14	...	485	345	...
15	...	485	345	...
16	...	485	345	...
17	...	485	345	...
18	...	620	485	...
19	...	620	485	...
20	...	620	485	...
21	...	620	485	...
22	...	620	485	...
23	...	620	485	...
24	...	620	485	...
25	...	620	485	...
26	...	620	485	...
27	...	620	485	...
28	...	620	485	...
29	...	620	485	...
30	...	620	485	...
31	...	620	485	...
32	...	620	485	...
33	...	620	485	...
34	...	380	205	...
35	...	380	205	...
36	...	380	205	...
37	...	380	205	...
38	...	380	205	...
39	...	380	205	...
40	...	380	205	...

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	−30 to 40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	276	238	213	194	176	157	138	121	108	93.3
2	276	238	213	194	176	157	138	121	108	93.3
3	276	238	213	194	176	157	138	121	108	93.3
4	276	238	212	194	176	157	139	122	107	95.1
5	276	238	212	194	176	157	139	122	107	95.1
6	276	238	212	194	176	157	139	122	107	95.1
7	276	238	212	194	176	157	139	122	107	95.1
8	276	238	212	194	176	157	139	122	107	95.1
9	276	238	212	194	176	157	139	122	107	95.1
10	276	238	212	194	176	157	139	122	107	95.1
11	276	238	212	194	176	157	139	122	107	95.1
12	345	311	281	259	241	223	205	194	183	174
13	345	311	281	259	241	223	205	194	183	174
14	345	311	281	259	241	223	205	194	183	174
15	345	311	281	259	241	223	205	194	183	174
16	345	311	281	259	241	223	205	194	183	174
17	345	311	281	259	241	223	205	194	183	174
18	483	449	416	398	381	363	346	328	313	304
19	483	449	416	398	381	363	346	328	313	304
20	483	449	416	398	381	363	346	328	313	304
21	483	449	416	398	381	363	346	328	313	304
22	483	449	416	398	381	363	346	328	313	304
23	483	449	416	398	381	363	346	328	313	304
24	483	449	416	398	381	363	346	328	313	304
25	483	449	416	398	381	363	346	328	313	304
26	483	449	416	398	381	363	346	328	313	304
27	483	449	416	398	381	363	346	328	313	304
28	483	449	416	398	381	363	346	328	313	304
29	483	449	416	398	381	363	346	328	313	304
30	483	449	416	398	381	363	346	328	313	304
31	483	449	416	398	381	363	346	328	313	304
32	483	449	416	398	381	363	346	328	313	304
33	483	449	416	398	381	363	346	328	313	304
34	207	178	155	138	123	110	98.5	88.2	79.1	71.5
35	207	178	155	138	123	110	98.5	88.2	79.1	71.5
36	207	178	155	138	123	110	98.5	88.2	79.1	71.5
37	207	178	155	138	123	110	98.5	88.2	79.1	71.5
38	207	178	155	138	123	110	98.5	88.2	79.1	71.5
39	207	178	155	138	123	110	98.5	88.2	79.1	71.5
40	207	178	155	138	123	110	98.5	88.2	79.1	71.5

Table Y-1 (Cont'd)
Yield Strength Values S_y for Ferrous and Nonferrous Materials

Line No.	Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
	300	325	350	375	400	425	450	475	500	525
										Nonferrous Materials (Cont'd)
1	82.6	76.0	...	...	...	...	...	...	...	...
2	82.6	76.0	...	...	...	...	...	...	...	...
3	82.6	76.0	...	...	...	...	...	...	...	...
4	86.6	80.8	...	...	...	...	...	...	...	...
5	86.6	80.8	...	...	...	...	...	...	...	...
6	86.6	80.8	...	...	...	...	...	...	...	...
7	86.6	80.8	...	...	...	...	...	...	...	...
8	86.6	80.8	...	...	...	...	...	...	...	...
9	86.6	80.8	...	...	...	...	...	...	...	...
10	86.6	80.8	...	...	...	...	...	...	...	...
11	86.6	80.8	...	...	...	...	...	...	...	...
12	168	164	...	...	...	...	...	...	...	...
13	168	164	...	...	...	...	...	...	...	...
14	168	164	...	...	...	...	...	...	...	...
15	168	164	...	...	...	...	...	...	...	...
16	168	164	...	...	...	...	...	...	...	...
17	168	164	...	...	...	...	...	...	...	...
18	293	280	...	...	...	...	...	...	...	...
19	293	280	...	...	...	...	...	...	...	...
20	293	280	...	...	...	...	...	...	...	...
21	293	280	...	...	...	...	...	...	...	...
22	293	280	...	...	...	...	...	...	...	...
23	293	280	...	...	...	...	...	...	...	...
24	293	280	...	...	...	...	...	...	...	...
25	293	280	...	...	...	...	...	...	...	...
26	293	280	...	...	...	...	...	...	...	...
27	293	280	...	...	...	...	...	...	...	...
28	293	280	...	...	...	...	...	...	...	...
29	293	280	...	...	...	...	...	...	...	...
30	293	280	...	...	...	...	...	...	...	...
31	293	280	...	...	...	...	...	...	...	...
32	293	280	...	...	...	...	...	...	...	...
33	293	280	...	...	...	...	...	...	...	...
34	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
35	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
36	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
37	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
38	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
39	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
40	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...

NOTES TO TABLE Y-1

GENERAL NOTES

(**13**) (a) The following abbreviations are used: ann., annealed; cond., condenser; CW, cold worked; extr., extruded; fin., finished; fr., from; Norm. & temp., Normalized and tempered; rel., relieved; rld., rolled; Smls., Seamless; Sol., Solution; SR, stress relieved; treat., treated; and Wld., Welded.

(b) The tabulated values of yield strength are those which the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room temperature yield strength. The yield strength values do not correspond exactly to "minimum" or "average" as these terms are applied to a statistical treatment of a homogeneous set of data. Neither the ASME Material Specifications nor the rules of Section I, Section III, or Section VIII require elevated temperature testing for yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

(c) Notes limiting applications of these materials appear in Tables 1A, 1B, 2A, 2B, 3, 4, 5A, and 5B.

(d) These values represent yield strength design values that are appropriate for use in any section of the ASME Boiler & Pressure Vessel Code in which the material is permitted and not otherwise restricted by applicability temperature limits, application limits, or notes.

(e) Where specifications, grades, classes, and types are listed in this Table, and where the material specification in Section II, Part A or Part B is a dual–unit specification (e.g., SA–516/SA–516M), the values listed in this Table shall be applicable to either the U.S. customary version of the material specification or the SI units version of the material specification. For example, the values listed for SA–516 Grade 70 shall be used when SA–516M Grade 485 is used in construction.

(f) The values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(**13**) (g) Where a size limit appears in the Size/Thickness column, the limit applies to the dimension appropriate to the product form: wall thickness of tubing, pipe, pipe fittings, and hollow forgings; thickness of plate, flat bar and forgings, and polygonal bar; diameter of solid bar and bolting; and thickest cross–section of other pressure parts, e.g., castings and forgings.

NOTES FOR SECTION VIII, DIVISION 3 APPLICATIONS

(1) This material is permitted only in wire form when used for wire–wound vessels and wire–wound frames as described in Article KD–9 of Section VIII, Division 3.

(2) Strength values for intermediate thickness may be interpolated.

(3) This material is permitted only when used as an inner layer in a vessel whose design meets the leak–before–burst criteria of KD–141 of Section VIII, Division 3.

(4) No welding is permitted on this material.

(5) This material has reduced toughness at room temperature after exposure at high temperature. The degree of embrittlement depends on composition, heat treatment, time, and temperature. The lowest temperature of concern is about 300°C. See Nonmandatory Appendix A, A–207.

(6) For all design temperatures, the maximum hardness shall be Rockwell C35 immediately under thread roots. The hardness shall be taken on a flat area at least 3 mm across, prepared by removing threads; no more material than necessary shall be removed to prepare the flat area. Hardness determinations shall be made at the same frequency as tensile tests.

(13)

Table Y-2
Factors for Limiting Permanent Strain in Austenitic Stainless Steels, High-Nickel Alloy Steels, Nickel, and Nickel Alloys

Strain, %	Factors
0.10	0.90
0.09	0.89
0.08	0.88
0.07	0.86
0.06	0.83
0.05	0.80
0.04	0.77
0.03	0.73
0.02	0.69
0.01	0.63

GENERAL NOTE: This Table lists multiplying factors that, when applied to the yield strength values shown in Table Y-1, will give a value that will result in lower levels of permanent strain. If this value is less than the maximum allowable stress value listed in Tables 1A, 1B, 5A, or 5B, or the design stress intensity value listed in Tables 2A or 2B, the lower value shall be used.

SUBPART 2
PHYSICAL PROPERTIES TABLES

INTRODUCTION

(13)

Subpart 2 of Section II, Part D provides, to the extent possible, physical properties for most of the alloys used in Code construction. Included in this Subpart are tables of thermal expansion (instantaneous, mean, and linear), thermal conductivity and thermal diffusivity, and modulus of elasticity. These values are all listed as a function of temperature from 20°C to as high as 1000°C. Subpart 2 also contains tables of density and Poisson's ratio for ferrous and nonferrous alloys.

All of the properties provided in Subpart 2 are considered typical. They are neither average nor minimum. Thermal–physical properties such as thermal expansion, thermal conductivity, and thermal diffusivity are affected more by alloy content than by crystal structure or heat treatment. Due to the permitted range for elements comprising alloys (specification ranges of chemical compositions), the thermal–physical properties described in Tables TE-1 through TE-5 and Table TCD should be considered to have an associated uncertainty of ±10%.

Moduli of elasticity and Poisson's ratio are also typical values, but the values of modulus of elasticity, shown as a function of temperature in Tables TM-1 through TM-5, tend to be closer to average values since their temperature dependency is factored against an "average" room-temperature value.

The physical properties listed in this Subpart are for information only, unless invoked by a Boiler & Pressure Vessel Code (Sections I, III, IV, VIII, X, XI, and XII). When a user of the Code has data supporting the use of values different from those in this Subpart, such other values may be used in lieu of the values in this Subpart.

For those alloys for which physical properties are not yet addressed in Subpart 2, the user of the Code may use other authoritative sources for the needed information. In those instances, or when alternative values are used, the user is encouraged to submit the values and supporting data to the attention of the ASME Boiler and Pressure Vessel Committee II on Materials for its consideration in improving and revising the values in Subpart 2. Information should be directed to:

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

Table TE-1
Thermal Expansion for Ferrous Materials

(13)

Temperature, °C	Coefficients for Carbon and Low Alloy Steels (Group 1) [Note (1)]			Coefficients for Other Low Alloy Steels (Group 2) [Note (2)]			Coefficients for 5Cr–1Mo and 29Cr–7Ni–2Mo–N Steels		
	A	B	C	A	B	C	A	B	C
20	11.5	11.5	0	12.6	12.6	0	11.5	11.5	0
50	12.0	11.8	0.4	13.0	12.8	0.4	12.0	11.8	0.4
75	12.3	11.9	0.7	13.3	13.0	0.7	12.3	12.0	0.7
100	12.7	12.1	1.0	13.5	13.1	1.0	12.6	12.1	1.0
125	12.9	12.3	1.3	13.8	13.2	1.4	12.8	12.3	1.3
150	13.2	12.4	1.6	14.0	13.4	1.7	12.9	12.4	1.6
175	13.5	12.6	2.0	14.2	13.5	2.1	13.0	12.5	1.9
200	13.8	12.7	2.3	14.4	13.6	2.4	13.2	12.6	2.3
225	14.0	12.9	2.6	14.6	13.7	2.8	13.3	12.6	2.6
250	14.3	13.0	3.0	14.8	13.8	3.2	13.4	12.7	2.9
275	14.6	13.2	3.4	15.0	13.9	3.6	13.5	12.8	3.3
300	14.9	13.3	3.7	15.1	14.0	3.9	13.6	12.8	3.6
325	15.1	13.4	4.1	15.3	14.1	4.3	13.7	12.9	3.9
350	15.4	13.6	4.5	15.4	14.2	4.7	13.8	13.0	4.3
375	15.7	13.7	4.9	15.5	14.3	5.1	14.0	13.0	4.6
400	15.9	13.8	5.3	15.7	14.4	5.5	14.1	13.1	5.0
425	16.1	14.0	5.7	15.8	14.5	5.9	14.2	13.2	5.3
450	16.4	14.1	6.1	15.9	14.6	6.3	14.4	13.2	5.7
475	16.5	14.2	6.5	16.0	14.6	6.7	14.5	13.3	6.1
500	16.7	14.4	6.9	16.1	14.7	7.1	14.6	13.4	6.4
525	16.8	14.5	7.3	16.2	14.8	7.5	14.7	13.4	6.8
550	16.9	14.6	7.7	16.2	14.8	7.9	14.8	13.5	7.2
575	17.0	14.7	8.2	16.3	14.9	8.3	14.9	13.6	7.5
600	17.0	14.8	8.6	16.4	15.0	8.7	15.0	13.6	7.9
625	17.1	14.9	9.0	16.4	15.0	9.1	15.1	13.7	8.3
650	17.1	15.0	9.4	16.4	15.1	9.5	15.2	13.7	8.7
675	17.1	15.1	9.9	16.4	15.1	9.9	15.3	13.8	9.0
700	17.1	15.1	10.3	16.4	15.2	10.3	15.4	13.9	9.4
725	17.1	15.2	10.7	16.3	15.2	10.7	15.6	13.9	9.8
750	17.2	15.3	11.1	16.3	15.3	11.1	15.9	14.0	10.2
775	17.4	15.3	11.6	16.2	15.3	11.1	16.3	14.0	10.6
800	17.7	15.4	12.0	16.0	15.3	11.5	16.8	14.1	11.0
825	18.1	15.5	12.5	15.8	15.3	11.9	17.4	14.2	11.4

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

	Coefficients for 9Cr–1Mo Steels (Including Grades 9, 91, 911, and 92)			Coefficients for 5Ni–¼Mo Steels			Coefficients for 8Ni and 9Ni Steels		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	10.5	10.5	0	11.2	11.2	0	9.9	9.9	0
50	10.8	10.6	0.3	11.6	11.4	0.3	10.5	10.2	0.3
75	11.0	10.7	0.6	12.0	11.6	0.6	11.1	10.5	0.6
100	11.2	10.9	0.9	12.3	11.8	0.9	11.5	10.7	0.9
125	11.4	11.0	1.2	12.5	11.9	1.3	11.9	11.0	1.2
150	11.6	11.1	1.4	12.7	12.0	1.6	12.2	11.2	1.5
175	11.8	11.2	1.7	13.0	12.2	1.9	12.4	11.4	1.8
200	12.0	11.3	2.0	13.2	12.3	2.2	12.6	11.5	2.1
225	12.2	11.4	2.3	13.4	12.4	2.5	12.7	11.7	2.4
250	12.4	11.5	2.6	13.6	12.5	2.9	12.8	11.8	2.7
275	12.5	11.6	3.0	13.8	12.7	3.2	12.9	11.9	3.0
300	12.7	11.7	3.3	14.0	12.8	3.6	12.9	12.0	3.4
325	12.8	11.8	3.6	14.3	12.9	3.9	13.1	12.0	3.7
350	13.0	11.9	3.9	14.5	13.0	4.3	13.2	12.1	4.0
375	13.1	11.9	4.2	14.6	13.1	4.7	13.4	12.2	4.3
400	13.3	12.0	4.6	14.8	13.2	5.0	13.6	12.3	4.7
425	13.4	12.1	4.9	15.0	13.3	5.4	13.7	12.4	5.0
450	13.6	12.2	5.2	15.1	13.4	5.8	13.8	12.5	5.4
475	13.7	12.3	5.6	15.3	13.5	6.1	13.7	12.5	5.7
500	13.8	12.3	5.9	15.4	13.6	6.5	13.4	12.6	6.0
525	14.0	12.4	6.3	15.6	13.7	6.9	12.7	12.6	6.4
550	14.2	12.5	6.6	15.8	13.8	7.3	11.6	12.6	6.7
575	14.4	12.6	7.0	16.0	13.9	7.7	...	...	...
600	14.6	12.7	7.3	16.4	14.0	8.1	...	...	...
625	14.9	12.7	7.7	16.9	14.1	8.5	...	...	...
650	15.2	12.8	8.1	17.5	14.2	9.0	...	...	...
675	15.5	12.9	8.5	...	...	...	...	...	...
700	16.0	13.0	8.9	...	...	...	...	...	...
725	16.5	13.1	9.3	...	...	...	...	...	...
750	17.1	13.3	9.7	...	...	...	...	...	...
775	17.9	13.4	10.1	...	...	...	...	...	...
800	18.8	13.6	10.6	...	...	...	...	...	...
825	19.9	13.8	11.1	...	...	...	...	...	...

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

	Coefficients for 12Cr, 12Cr–1Al, 13Cr, and 13Cr–4Ni Steels			Coefficients for 15Cr and 17Cr Steels			Coefficients for 27Cr Steels		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	10.6	10.6	0	9.6	9.6	0	9.0	9.0	0
50	11.1	10.9	0.3	9.9	9.7	0.3	9.3	9.2	0.3
75	11.3	11.0	0.6	10.1	9.9	0.5	9.4	9.2	0.5
100	11.5	11.1	0.9	10.3	10.0	0.8	9.5	9.3	0.7
125	11.7	11.3	1.2	10.5	10.1	1.1	9.6	9.4	1.0
150	11.8	11.4	1.5	10.7	10.2	1.3	9.7	9.4	1.2
175	11.9	11.4	1.8	10.9	10.3	1.6	9.8	9.5	1.5
200	12.0	11.5	2.1	11.1	10.4	1.9	9.9	9.5	1.7
225	12.1	11.6	2.4	11.2	10.5	2.2	10.0	9.6	2.0
250	12.1	11.6	2.7	11.4	10.6	2.4	10.1	9.6	2.2
275	12.2	11.7	3.0	11.5	10.7	2.7	10.2	9.7	2.5
300	12.3	11.7	3.3	11.7	10.8	3.0	10.3	9.7	2.7
325	12.4	11.8	3.6	11.8	10.8	3.3	10.5	9.8	3.0
350	12.5	11.8	3.9	11.9	10.9	3.6	10.6	9.9	3.3
375	12.6	11.9	4.2	12.0	11.0	3.9	10.8	9.9	3.5
400	12.7	11.9	4.5	12.0	11.0	4.2	10.9	10.0	3.8
425	12.8	12.0	4.9	12.1	11.1	4.5	11.1	10.0	4.1
450	12.9	12.0	5.2	12.2	11.2	4.8	11.2	10.1	4.3
475	13.0	12.1	5.5	12.2	11.2	5.1	11.3	10.2	4.6
500	13.1	12.1	5.8	12.2	11.3	5.4	11.4	10.2	4.9
525	13.2	12.2	6.2	12.3	11.3	5.7	11.5	10.3	5.2
550	13.3	12.2	6.5	12.3	11.4	6.0	11.6	10.4	5.5
575	13.3	12.3	6.8	12.4	11.4	6.3	11.6	10.4	5.8
600	13.3	12.3	7.2	12.5	11.5	6.6	11.7	10.5	6.1
625	13.4	12.4	7.5	12.5	11.5	7.0	11.7	10.5	6.4
650	13.4	12.4	7.8	12.7	11.5	7.3	11.8	10.6	6.7
675	13.4	12.5	8.2	12.8	11.6	7.6	11.9	10.6	7.0
700	13.4	12.5	8.5	13.0	11.6	7.9	12.0	10.7	7.2
725	13.4	12.5	8.8	13.3	11.7	8.2	12.2	10.7	7.6
750	13.4	12.5	9.2	13.6	11.7	8.6	12.4	10.8	7.9
775	13.5	12.6	9.5	14.0	11.8	8.9	12.9	10.8	8.2
800	13.6	12.6	9.8	14.5	11.9	9.3	13.4	10.9	8.5
825	13.8	12.6	10.2	15.2	12.0	9.6	14.2	11.0	8.8

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

	Coefficients for Austenitic Stainless Steels (Group 3) [Note (3)]			Coefficients for Other Austenitic Stainless Steels (Group 4) [Note (4)]			Coefficients for Ductile Cast Iron		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	15.3	15.3	0	14.7	14.7	0	10.3	10.3	0
50	16.0	15.6	0.5	15.2	15.0	0.4	10.7	10.5	0.3
75	16.5	15.9	0.9	15.6	15.2	0.8	11.1	10.7	0.6
100	17.0	16.2	1.3	16.0	15.4	1.2	11.6	10.9	0.9
125	17.4	16.4	1.7	16.3	15.6	1.6	12.1	11.1	1.2
150	17.8	16.6	2.2	16.5	15.7	2.0	12.5	11.3	1.5
175	18.1	16.8	2.6	16.8	15.9	2.5	13.0	11.6	1.8
200	18.4	17.0	3.1	16.9	16.0	2.9	13.3	11.8	2.1
225	18.6	17.2	3.5	17.1	16.1	3.3	13.6	12.0	2.5
250	18.8	17.4	4.0	17.3	16.3	3.7	13.9	12.2	2.8
275	18.9	17.5	4.5	17.4	16.4	4.2	14.1	12.4	3.1
300	19.1	17.7	4.9	17.6	16.5	4.6	14.2	12.5	3.5
325	19.2	17.8	5.4	17.7	16.6	5.0	14.2	12.6	3.9
350	19.3	17.9	5.9	17.8	16.6	5.5	14.3	12.8	4.2
375	19.4	18.0	6.4	18.0	16.7	5.9	14.3	12.9	4.6
400	19.5	18.1	6.9	18.1	16.8	6.4	14.4	13.0	4.9
425	19.6	18.2	7.4	18.3	16.9	6.8	14.5	13.1	5.3
450	19.8	18.3	7.9	18.4	17.0	7.3	14.6	13.2	5.7
475	20.0	18.4	8.3	18.6	17.1	7.8	14.9	13.2	6.0
500	20.2	18.4	8.9	18.8	17.2	8.2	15.1	13.3	6.4
525	20.4	18.5	9.4	19.0	17.2	8.7	15.5	13.4	6.8
550	20.6	18.6	9.9	19.2	17.3	9.2	16.0	13.5	7.2
575	20.9	18.7	10.4	19.4	17.4	9.7	...	...	...
600	21.1	18.8	10.9	19.6	17.5	10.2	...	...	...
625	21.4	18.9	11.4	19.8	17.6	10.6	...	...	...
650	21.6	19.0	12.0	20.0	17.7	11.1	...	...	...
675	21.7	19.1	12.5	20.3	17.8	11.7	...	...	...
700	21.7	19.2	13.1	20.5	17.9	12.2	...	...	...
725	21.5	19.3	13.6	20.7	18.0	12.7	...	...	...
750	21.2	19.4	14.1	20.9	18.1	13.2	...	...	...
775	20.6	19.4	14.7	21.2	18.2	13.7	...	...	...
800	19.7	19.4	15.2	21.4	18.3	14.3	...	...	...
825	18.4	19.4	15.6	21.6	18.4	14.8	...	...	...

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

	Coefficients for Precipitation Hardened 17Cr–4Ni–4Cu Stainless Steels, Condition 1075			Coefficients for Precipitation Hardened 17Cr–4Ni–4Cu Stainless Steels, Condition 1150		
Temperature, °C	A	B	C	A	B	C
20	11.1	11.1	0	11.5	11.5	0
50	11.3	11.2	0.3	11.8	11.6	0.3
75	11.4	11.3	0.6	12.0	11.8	0.6
100	11.6	11.4	0.9	12.3	11.9	1.0
125	11.7	11.4	1.2	12.5	12.0	1.3
150	11.8	11.5	1.5	12.7	12.1	1.6
175	12.0	11.6	1.8	12.9	12.2	1.9
200	12.1	11.6	2.1	13.1	12.3	2.2
225	12.2	11.7	2.4	13.2	12.4	2.6
250	12.3	11.8	2.7	13.4	12.5	2.9
275	12.5	11.8	3.0	13.5	12.6	3.2
300	12.6	11.9	3.3	13.5	12.7	3.6
325	12.7	11.9	3.6	13.6	12.8	3.9
350	12.8	12.0	4.0	13.6	12.8	4.2
375	12.9	12.1	4.3	13.6	12.9	4.6
400	13.0	12.1	4.6	13.6	12.9	4.9
425	13.0	12.2	4.9	13.7	13.0	5.3
450	13.1	12.2	5.3	13.8	13.0	5.6
475	13.1	12.3	5.6	13.9	13.1	5.9
500	...	...	...	14.3	13.1	6.3
525	...	...	...	14.8	13.2	6.7
550	...	...	...	15.6	13.3	7.0
575	...	...	...	...	...	...
600	...	...	...	...	...	...
625	...	...	...	...	...	...
650	...	...	...	...	...	...
675	...	...	...	...	...	...
700	...	...	...	...	...	...
725	...	...	...	...	...	...
750	...	...	...	...	...	...
775	...	...	...	...	...	...
800	...	...	...	...	...	...
825	...	...	...	...	...	...

GENERAL NOTE: Coefficient A is the instantaneous coefficient of thermal expansion × 10^{-6} (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion × 10^{-6} (mm/mm/°C) in going from 20°C to indicated temperature. Coefficient C is the linear thermal expansion (mm/m) in going from 20°C to indicated temperature.

NOTES:

(1) Group 1 alloys (by nominal composition):

Carbon steel
C–Mn–Cb
C–Mn–Si–Cb
C–Mn–Si–V
C–Mn–Ti
C–Si–Ti
C–¼Mo
C–½Mo
½Cr–⅕Mo
½Cr–⅕Mo–V
½Cr–¼Mo–Si
½Cr–½Mo
¾Cr–½Ni–Cu
¾Cr–¾Ni–Cu–Al
1Cr–⅕Mo
1Cr–⅕Mo–Si
1Cr–½Mo
1Cr–½Mo–V
1¼Cr–½Mo
1¼Cr–½Mo–Si
1¾Cr–½Mo–Cu
1¾Cr–½Mo–Ti
2Cr–½Mo
2¼Cr–1Mo
3Cr–1Mo
3Cr–1Mo–¼V–Cb–Ca
3Cr–1Mo–¼V–Ti–B
½Ni–½Cr–¼Mo
½Ni–½Cr–¼Mo–V
½Ni–½Mo–V
¾Ni–½Cr–½Mo–V
¾Ni–½Cu–Mo
¾Ni–½Mo–⅓Cr–V
¾Ni–½Mo–Cr–V
¾Ni–1Mo–¾Cr
1Ni–½Cr–½Mo
1¼Ni–1Cr–½Mo
1¾Ni–¾Cr–¼Mo
2Ni–¾Cr–¼Mo
2Ni–¾Cr–⅓Mo
2Ni–1½Cr–¼Mo–V
2½Ni
2¾Ni–1½Cr–½Mo–V
3½Ni
3½Ni–1¾Cr–½Mo–V
4Ni–1½Cr–½Mo–V

NOTES (CONT'D):

(2) Group 2 alloys (by nominal composition):

Mn–¼Mo	Mn–½Mo–¾Ni	22Cr–5Ni–3Mo–N
Mn–½Mo	Mn–V	23Cr–4Ni–Mo–Cu
Mn–½Mo–¼Ni	18Cr–5Ni–3Mo–N	25Cr–7Ni–4Mo–N
Mn–½Mo–½Ni	22Cr–2Ni–Mo–N	

(3) Group 3 alloys (by nominal composition):

16Cr–12Ni–2Mo	18Cr–8Ni–N	18Cr–13Ni–3Mo
16Cr–12Ni–2Mo–N	18Cr–10Ni–Cb	18Cr–18Ni–2Si
16Cr–12Ni–2Mo–Ti	18Cr–10Ni–Ti	19Cr–9Ni–Mo–W
18Cr–8Ni	18Cr–11Ni	21Cr–11Ni–N

(4) Group 4 alloys (by nominal composition):

25Ni–15Cr–2Ti	23Cr–12Ni	25Cr–20Ni–2Mo
29Ni–20Cr–3Cu–2Mo	25Cr–12Ni	31Ni–31Fe–29Cr–Mo
20Cr–18Ni–6Mo	25Cr–20Ni	44Fe–25Ni–21Cr–Mo
22Cr–13Ni–5Mn		

Table TE-2
Thermal Expansion for Aluminum Alloys

	Coefficients for Aluminum Alloys		
Temperature, °C	A	B	C
20	21.7	21.7	0
50	23.3	22.6	0.7
75	23.9	23.1	1.3
100	24.3	23.4	1.9
125	24.7	23.7	2.5
150	25.2	23.9	3.1
175	25.7	24.2	3.7
200	26.4	24.4	4.4
225	27.0	24.7	5.1
250	27.5	25.0	5.7
275	27.7	25.2	6.4
300	27.6	25.5	7.1
325	27.1	25.6	7.8

GENERAL NOTES:

(a) Aluminum alloys represented by these thermal expansion coefficients include:

A03560	A93003	A95254
A24430	A93004	A95454
A91060	A95052	A95456
A91100	A95083	A95652
A92014	A95086	A96061
A92024	A95154	A96063

(b) Coefficient A is the instantaneous coefficient of thermal expansion × 10^{-6} (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion × 10^{-6} (mm/mm/°C) in going from 20°C to indicated temperature. Coefficient C is the linear thermal expansion (mm/m) in going from 20°C to indicated temperature.

Table TE-3
Thermal Expansion for Copper Alloys

Temperature, °C	Coefficients for Copper Alloys C1XXXX Series			Coefficients for Bronze Alloys			Coefficients for Brass Alloys			Coefficients for Copper–Nickel (70Cu–30Ni)			Coefficients for Copper–Nickel (90Cu–10Ni)		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
20	16.7	16.7	0	17.2	17.2	0	16.7	16.7	0	14.5	14.5	0	...	...	...
50	17.2	17.0	0.5	18.0	17.6	0.5	17.5	17.1	0.5	15.3	14.9	0.4	...	...	...
75	17.4	17.2	0.9	18.3	17.9	1.0	17.9	17.4	1.0	15.6	15.2	0.8	...	...	...
100	17.6	17.3	1.4	18.5	18.0	1.4	18.3	17.6	1.4	15.9	15.3	1.2	...	...	...
125	17.8	17.4	1.8	18.6	18.2	1.9	18.6	17.8	1.9	16.2	15.5	1.6	...	...	...
150	18.0	17.5	2.3	18.7	18.2	2.4	19.0	18.0	2.3	16.5	15.7	2.0	...	...	...
175	18.2	17.6	2.7	18.8	18.3	2.8	19.4	18.2	2.8	16.8	15.8	2.5	...	...	...
200	18.4	17.7	3.2	18.9	18.4	3.3	19.9	18.4	3.3	17.1	16.0	2.9	...	...	...
225	18.5	17.8	3.6	19.1	18.5	3.8	20.3	18.6	3.8	17.4	16.1	3.3	...	...	...
250	18.6	17.8	4.1	19.3	18.5	4.3	20.6	18.8	4.3	17.5	16.3	3.7	...	...	...
275	18.6	17.9	4.6	19.5	18.6	4.7	20.9	19.0	4.8	17.4	16.4	4.2	17.1	17.1	4.4
300	18.6	18.0	5.0	19.7	18.7	5.2	21.0	19.2	5.4	17.2	16.5	4.6	...	...	...
325	18.9	18.0	5.5	19.9	18.8	5.7	21.2	19.3	5.9	17.0	16.5	5.0	...	...	...
350	...	...	...	20.0	18.9	6.2	21.5	19.5	6.4	16.7	16.6	5.5	...	...	...
375	...	...	...	20.0	19.0	6.7	22.1	19.6	7.0	...	...	...	...	...	...
400	...	...	...	20.0	19.0	7.2	23.4	19.8	7.5	...	...	...	...	...	...
425	...	...	...	...	...	...	25.9	20.1	8.2	...	...	...	...	...	...

GENERAL NOTE: Coefficient A is the instantaneous coefficient of thermal expansion × 10^{-6} (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion × 10^{-6} (mm/mm/°C) in going from 20°C to indicated temperature. Coefficient C is the linear thermal expansion (mm/m) in going from 20°C to indicated temperature.

Table TE-4
Thermal Expansion for Nickel Alloys

	Coefficients for N02200 and N02201			Coefficients for N04400 and N04405			Coefficients for N06002		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	11.9	11.9	0	13.8	13.8	0	13.1	13.1	0
50	12.8	12.4	0.4	14.4	14.1	0.4	13.5	13.3	0.4
75	13.5	12.7	0.7	14.9	14.4	0.8	13.7	13.4	0.7
100	13.9	13.0	1.0	15.3	14.6	1.2	13.9	13.5	1.1
125	14.3	13.3	1.4	15.6	14.8	1.6	14.0	13.6	1.4
150	14.6	13.5	1.8	15.9	15.0	1.9	14.2	13.7	1.8
175	14.8	13.7	2.1	16.1	15.1	2.3	14.3	13.8	2.1
200	15.0	13.9	2.5	16.3	15.3	2.8	14.5	13.9	2.5
225	15.2	14.0	2.9	16.4	15.4	3.2	14.6	14.0	2.9
250	15.3	14.2	3.3	16.5	15.5	3.6	14.8	14.0	3.2
275	15.5	14.3	3.6	16.6	15.6	4.0	15.0	14.1	3.6
300	15.7	14.4	4.0	16.7	15.7	4.4	15.3	14.2	4.0
325	15.8	14.5	4.4	16.8	15.8	4.8	15.5	14.3	4.4
350	16.0	14.6	4.8	16.8	15.9	5.2	15.8	14.4	4.8
375	16.2	14.7	5.2	16.9	16.0	5.7	16.1	14.5	5.2
400	16.4	14.8	5.6	16.9	16.0	6.1	16.3	14.6	5.6
425	16.6	14.9	6.0	17.0	16.1	6.5	16.6	14.7	6.0
450	16.8	15.0	6.5	17.0	16.1	6.9	16.9	14.9	6.4
475	16.9	15.1	6.9	17.1	16.2	7.4	17.1	15.0	6.8
500	17.0	15.2	7.3	17.1	16.2	7.8	17.4	15.1	7.2
525	17.1	15.3	7.7	17.2	16.3	8.2	17.6	15.2	7.7
550	17.2	15.4	8.2	17.3	16.3	8.6	17.8	15.3	8.1
575	17.3	15.5	8.6	17.4	16.4	9.1	18.0	15.5	8.6
600	17.3	15.6	9.0	17.4	16.4	9.5	18.2	15.6	9.0
625	17.4	15.6	9.5	17.5	16.5	10.0	18.3	15.7	9.5
650	17.5	15.7	9.9	17.6	16.5	10.4	18.5	15.8	9.9
675	17.6	15.8	10.3	17.7	16.5	10.8	18.7	15.9	10.4
700	17.9	15.9	10.8	17.8	16.6	11.3	18.9	16.0	10.9
725	18.3	15.9	11.2	17.9	16.6	11.7	19.1	16.1	11.4
750	18.9	16.0	11.7	18.0	16.7	12.2	19.5	16.2	11.8
775	19.7	16.1	12.2	18.1	16.7	12.6	19.9	16.3	12.3
800	...	...	...	18.1	16.8	13.1	20.5	16.5	12.8
825	...	...	...	18.1	16.8	13.5	21.3	16.6	13.4

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N06007			Coefficients for N06022			Coefficients for N06030		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	13.3	13.3	0	12.4	12.4	0	12.0	12.0	0
50	13.5	13.4	0.4	12.4	12.4	0.4	12.7	12.4	0.4
75	13.6	13.5	0.7	12.4	12.4	0.7	13.3	12.7	0.7
100	13.7	13.5	1.1	12.4	12.4	1.0	13.7	12.9	1.0
125	13.8	13.6	1.4	12.4	12.4	1.3	14.2	13.2	1.4
150	13.9	13.6	1.8	12.4	12.4	1.6	14.5	13.4	1.7
175	14.1	13.7	2.1	12.5	12.4	1.9	14.8	13.6	2.1
200	14.3	13.8	2.5	12.6	12.4	2.2	15.1	13.8	2.5
225	14.6	13.9	2.8	12.8	12.5	2.6	15.3	14.0	2.9
250	14.9	14.0	3.2	13.0	12.5	2.9	15.5	14.1	3.2
275	15.2	14.1	3.6	13.2	12.6	3.2	15.6	14.2	3.6
300	15.6	14.2	4.0	13.5	12.6	3.5	15.8	14.4	4.0
325	16.0	14.3	4.4	13.8	12.7	3.9	15.9	14.5	4.4
350	16.4	14.4	4.8	14.2	12.8	4.2	16.1	14.6	4.8
375	16.8	14.6	5.2	14.6	12.9	4.6	16.2	14.7	5.2
400	17.2	14.8	5.6	15.0	13.0	5.0	16.5	14.8	5.6
425	17.6	14.9	6.0	15.4	13.2	5.3	16.7	14.9	6.0
450	17.9	15.1	6.5	15.8	13.3	5.7	16.9	15.0	6.5
475	18.2	15.2	6.9	16.2	13.5	6.1	17.2	15.2	6.9
500	18.4	15.4	7.4	16.6	13.6	6.5	17.5	15.3	7.3
525	18.5	15.6	7.9	17.0	13.8	7.0	17.8	15.4	7.8
550	18.6	15.7	8.3	17.4	13.9	7.4	18.1	15.5	8.2
575	18.7	15.8	8.8	17.7	14.1	7.8	18.3	15.6	8.7
600	18.7	16.0	9.3	18.1	14.3	8.3	18.4	15.7	9.1
625	18.6	16.1	9.7	18.4	14.4	8.7	18.4	15.9	9.6
650	18.6	16.2	10.2	18.7	14.6	9.2	18.1	16.0	10.1
675	18.7	16.3	10.7	18.9	14.8	9.7	17.6	16.0	10.5
700	18.8	16.4	11.1	19.2	14.9	10.1	16.7	16.1	10.9
725	19.1	16.4	11.6	19.5	15.1	10.6	15.4	16.1	11.3
750	19.7	16.5	12.1	19.9	15.2	11.1	13.5	16.0	11.7
775	20.6	16.7	12.6	20.4	15.4	11.6	11.0	15.9	12.0
800	22.0	16.8	13.1	21.0	15.6	12.1	...	...	...
825	24.0	17.0	13.7	21.7	15.7	12.7	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N06045			Coefficients for N06059 and N06686			Coefficients for N06230		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	11.0	11.0	0	11.7	11.7	0	12.4	12.4	0
50	12.6	11.8	0.4	11.8	11.7	0.4	12.5	12.5	0.4
75	13.7	12.4	0.7	11.9	11.8	0.6	12.7	12.5	0.7
100	14.5	13.0	1.0	12.1	11.8	0.9	12.8	12.6	1.0
125	15.1	13.4	1.4	12.3	11.9	1.3	12.9	12.7	1.3
150	15.5	13.8	1.8	12.5	12.0	1.6	13.1	12.7	1.7
175	15.8	14.1	2.2	12.7	12.1	1.9	13.3	12.8	2.0
200	15.9	14.3	2.6	12.8	12.2	2.2	13.4	12.9	2.3
225	16.0	14.5	3.0	12.9	12.3	2.5	13.6	13.0	2.7
250	16.0	14.7	3.4	13.0	12.4	2.8	13.8	13.0	3.0
275	16.0	14.8	3.8	13.1	12.4	3.2	14.0	13.1	3.3
300	16.1	14.9	4.2	13.1	12.5	3.5	14.3	13.2	3.7
325	16.1	15.0	4.6	13.1	12.5	3.8	14.5	13.3	4.1
350	16.2	15.1	5.0	13.2	12.6	4.2	14.7	13.4	4.4
375	16.4	15.2	5.4	13.3	12.6	4.5	14.9	13.5	4.8
400	16.6	15.3	5.8	13.4	12.7	4.8	15.2	13.6	5.2
425	16.8	15.4	6.2	13.5	12.7	5.2	15.4	13.7	5.6
450	17.1	15.5	6.6	13.7	12.8	5.5	15.6	13.8	5.9
475	17.4	15.6	7.1	13.8	12.8	5.8	15.7	13.9	6.3
500	17.7	15.7	7.5	13.8	12.9	6.2	15.9	14.0	6.7
525	18.0	15.8	8.0	13.8	12.9	6.5	16.0	14.1	7.1
550	18.4	15.9	8.4	13.5	13.0	6.9	16.2	14.2	7.5
575	18.7	16.0	8.9	13.0	13.0	7.2	16.3	14.3	7.9
600	19.0	16.1	9.3	...	...	...	16.4	14.4	8.3
625	19.2	16.2	9.8	...	...	...	16.5	14.5	8.8
650	19.4	16.4	10.3	...	...	...	16.5	14.5	9.2
675	19.6	16.5	10.8	...	...	...	16.7	14.6	9.6
700	19.7	16.6	11.3	...	...	...	16.8	14.7	10.0
725	19.8	16.7	11.8	...	...	...	17.0	14.8	10.4
750	19.9	16.8	12.3	...	...	...	17.2	14.9	10.8
775	19.9	16.9	12.8	...	...	...	...	...	...
800	19.9	17.0	13.3	...	...	...	...	...	...
825	19.9	17.1	13.8	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N06455			Coefficients for N06600			Coefficients for N06625		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	10.4	10.4	0	12.3	12.3	0	12.0	12.0	0
50	11.0	10.7	0.3	12.7	12.5	0.4	12.7	12.4	0.4
75	11.4	10.9	0.6	13.0	12.7	0.7	13.1	12.6	0.7
100	11.8	11.1	0.9	13.4	12.8	1.0	13.3	12.8	1.0
125	12.3	11.4	1.2	13.7	13.0	1.4	13.4	12.9	1.4
150	12.6	11.6	1.5	14.0	13.2	1.7	13.4	13.0	1.7
175	13.0	11.8	1.8	14.2	13.3	2.1	13.5	13.1	2.0
200	13.3	12.0	2.2	14.5	13.5	2.4	13.5	13.2	2.4
225	13.5	12.1	2.5	14.7	13.6	2.8	13.5	13.2	2.7
250	13.7	12.3	2.8	14.9	13.7	3.2	13.5	13.2	3.0
275	13.9	12.4	3.2	15.0	13.8	3.5	13.6	13.3	3.4
300	14.0	12.6	3.5	15.2	14.0	3.9	13.8	13.3	3.7
325	14.1	12.7	3.9	15.4	14.1	4.3	14.0	13.3	4.1
350	14.2	12.8	4.2	15.5	14.2	4.7	14.2	13.4	4.4
375	14.2	12.9	4.6	15.7	14.3	5.1	14.5	13.5	4.8
400	14.2	13.0	4.9	15.9	14.4	5.5	14.8	13.5	5.1
425	14.2	13.1	5.3	16.1	14.5	5.9	15.1	13.6	5.5
450	14.2	13.1	5.6	16.3	14.6	6.3	15.5	13.7	5.9
475	14.2	13.2	6.0	16.5	14.7	6.7	15.9	13.8	6.3
500	14.3	13.2	6.4	16.7	14.8	7.1	16.3	14.0	6.7
525	14.3	13.3	6.7	17.0	14.9	7.5	16.7	14.1	7.1
550	14.4	13.4	7.1	17.2	15.0	7.9	17.0	14.2	7.5
575	14.4	13.4	7.4	17.5	15.1	8.4	17.3	14.3	8.0
600	14.5	13.4	7.8	17.8	15.2	8.8	17.7	14.5	8.4
625	14.6	13.5	8.2	18.1	15.3	9.3	17.9	14.6	8.8
650	14.6	13.5	8.5	18.5	15.4	9.7	18.2	14.8	9.3
675	14.6	13.6	8.9	18.8	15.6	10.2	18.4	14.9	9.8
700	14.6	13.6	9.3	19.1	15.7	10.7	18.6	15.0	10.2
725	14.5	13.6	9.6	19.4	15.8	11.1	18.8	15.1	10.7
750	14.3	13.7	10.0	19.6	15.9	11.6	19.1	15.3	11.2
775	14.0	13.7	10.3	19.8	16.1	12.1	19.5	15.4	11.6
800	13.4	13.7	10.7	19.9	16.2	12.6	20.0	15.6	12.1
825	12.7	13.7	11.0	20.0	16.3	13.1	20.6	15.7	12.6

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N06690			Coefficients for N07718			Coefficients for N07750		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	13.9	13.9	0	12.8	12.8	0	12.1	12.1	0
50	14.2	14.0	0.4	12.9	12.9	0.4	12.5	12.3	0.4
75	14.3	14.1	0.8	13.1	12.9	0.7	12.9	12.5	0.7
100	14.3	14.2	1.1	13.3	13.0	1.0	13.3	12.7	1.0
125	14.4	14.2	1.5	13.5	13.1	1.4	13.6	12.8	1.3
150	14.6	14.3	1.9	13.7	13.2	1.7	13.9	13.0	1.7
175	14.8	14.3	2.2	13.9	13.3	2.1	14.0	13.2	2.0
200	15.0	14.4	2.6	14.1	13.4	2.4	14.1	13.3	2.4
225	15.2	14.5	3.0	14.3	13.5	2.8	14.0	13.4	2.7
250	15.5	14.6	3.4	14.4	13.6	3.1	14.0	13.4	3.1
275	15.6	14.7	3.7	14.6	13.7	3.5	13.9	13.5	3.4
300	15.7	14.8	4.1	14.7	13.8	3.9	13.9	13.5	3.8
325	15.7	14.8	4.5	14.8	13.9	4.2	14.0	13.6	4.1
350	15.5	14.9	4.9	15.0	13.9	4.6	14.2	13.6	4.5
375	15.3	14.9	5.3	15.1	14.0	5.0	14.7	13.7	4.8
400	14.9	15.0	5.7	15.3	14.1	5.4	15.6	13.8	5.2
425	...	...	...	15.4	14.2	5.7	...	...	...
450	...	...	...	15.6	14.2	6.1	...	...	...
475	...	...	...	15.8	14.3	6.5	...	...	...
500	...	...	...	16.0	14.4	6.9	...	...	...
525	...	...	...	16.2	14.5	7.3	...	...	...
550	...	...	...	16.5	14.6	7.7	...	...	...
575	...	...	...	...	...	...	...	...	...
600	...	...	...	...	...	...	...	...	...
625	...	...	...	...	...	...	...	...	...
650	...	...	...	...	...	...	...	...	...
675	...	...	...	...	...	...	...	...	...
700	...	...	...	...	...	...	...	...	...
725	...	...	...	...	...	...	...	...	...
750	...	...	...	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N08031			Coefficients for N08330			Coefficients for N08800, N08801, N08810, and N08811		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	13.8	13.8	0	14.6	14.6	0	14.2	14.2	0
50	14.1	14.0	0.4	14.8	14.7	0.4	14.9	14.6	0.4
75	14.4	14.1	0.8	15.2	14.8	0.8	15.4	14.9	0.8
100	14.6	14.2	1.1	15.5	15.0	1.2	15.8	15.1	1.2
125	14.9	14.4	1.5	15.7	15.1	1.6	16.1	15.3	1.6
150	15.1	14.5	1.9	15.9	15.3	2.0	16.4	15.5	2.0
175	15.4	14.6	2.3	16.1	15.4	2.4	16.6	15.6	2.4
200	15.5	14.7	2.7	16.2	15.5	2.8	16.7	15.8	2.8
225	15.7	14.8	3.0	16.3	15.6	3.2	16.9	15.9	3.3
250	15.8	14.9	3.4	16.4	15.7	3.6	17.0	16.0	3.7
275	16.0	15.0	3.8	16.6	15.7	4.0	17.1	16.1	4.1
300	16.1	15.1	4.2	16.9	15.8	4.4	17.2	16.2	4.5
325	16.2	15.2	4.6	17.2	15.9	4.9	17.3	16.3	5.0
350	16.3	15.3	5.0	17.5	16.0	5.3	17.4	16.4	5.4
375	16.4	15.4	5.5	17.8	16.2	5.7	17.6	16.5	5.8
400	16.6	15.4	5.9	17.8	16.3	6.2	17.7	16.5	6.3
425	16.7	15.5	6.3	...	...	...	17.9	16.6	6.7
450	16.8	15.6	6.7	...	...	...	18.0	16.7	7.2
475	16.9	15.6	7.1	...	...	...	18.2	16.8	7.6
500	16.9	15.7	7.5	...	...	...	18.3	16.8	8.1
525	16.8	15.8	8.0	...	...	...	18.5	16.9	8.5
550	16.6	15.8	8.4	...	...	...	18.6	17.0	9.0
575	16.2	15.8	8.8	...	...	...	18.8	17.1	9.5
600	15.6	15.8	9.2	...	...	...	19.0	17.2	9.9
625	...	...	...	...	...	...	19.2	17.2	10.4
650	...	...	...	...	...	...	19.4	17.3	10.9
675	...	...	...	...	...	...	19.6	17.4	11.4
700	...	...	...	...	...	...	19.9	17.5	11.9
725	...	...	...	...	...	...	20.3	17.6	12.4
750	...	...	...	...	...	...	20.7	17.7	12.9
775	...	...	...	...	...	...	21.2	17.8	13.4
800	...	...	...	...	...	...	21.8	17.9	14.0
825	...	...	...	...	...	...	22.6	18.0	14.5

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N08825			Coefficients for N10001			Coefficients for N10003		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	13.5	13.5	0	10.8	10.8	0	11.1	11.1	0
50	13.8	13.6	0.4	11.2	11.0	0.3	11.4	11.3	0.3
75	14.1	13.7	0.8	11.5	11.2	0.6	11.7	11.4	0.6
100	14.4	13.9	1.1	11.6	11.3	0.9	12.0	11.6	0.9
125	14.6	14.0	1.5	11.6	11.4	1.2	12.3	11.7	1.2
150	14.8	14.2	1.8	11.7	11.4	1.5	12.4	11.8	1.5
175	14.8	14.3	2.2	11.7	11.5	1.8	12.5	11.9	1.8
200	14.9	14.4	2.6	11.7	11.5	2.1	12.6	12.0	2.2
225	15.0	14.4	3.0	11.8	11.5	2.4	12.7	12.1	2.5
250	15.2	14.5	3.3	11.9	11.6	2.7	12.8	12.2	2.8
275	15.4	14.6	3.7	12.0	11.6	3.0	12.9	12.2	3.1
300	15.8	14.7	4.1	12.2	11.6	3.3	13.1	12.3	3.4
325	16.2	14.8	4.5	12.4	11.7	3.6	13.4	12.4	3.8
350	16.6	14.9	4.9	12.7	11.8	3.9	13.7	12.5	4.1
375	16.6	15.0	5.3	13.0	11.8	4.2	14.0	12.6	4.5
400	15.9	15.1	5.7	13.3	11.9	4.5	14.1	12.7	4.8
425	...	...	...	13.6	12.0	4.9	...	...	...
450	...	...	...	13.9	12.1	5.2	...	...	...
475	...	...	...	14.2	12.2	5.6	...	...	...
500	...	...	...	14.5	12.3	5.9	...	...	...
525	...	...	...	14.7	12.4	6.3	...	...	...
550	...	...	...	14.9	12.6	6.7	...	...	...
575	...	...	...	15.1	12.7	7.0	...	...	...
600	...	...	...	15.3	12.8	7.4	...	...	...
625	...	...	...	15.5	12.9	7.8	...	...	...
650	...	...	...	15.7	13.0	8.2	...	...	...
675	...	...	...	15.9	13.1	8.6	...	...	...
700	...	...	...	16.2	13.2	9.0	...	...	...
725	...	...	...	16.7	13.3	9.4	...	...	...
750	...	...	...	17.3	13.4	9.8	...	...	...
775	...	...	...	18.2	13.6	10.3	...	...	...
800	...	...	...	19.4	13.8	10.7	...	...	...
825	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N10242			Coefficients for N10276			Coefficients for N10629		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	10.4	10.4	0	10.8	10.8	0	9.8	9.8	0
50	10.7	10.5	0.3	11.2	11.0	0.3	10.2	10.0	0.3
75	10.9	10.7	0.6	11.6	11.2	0.6	10.5	10.2	0.6
100	11.2	10.8	0.9	11.9	11.4	0.9	10.7	10.3	0.8
125	11.5	10.9	1.1	12.3	11.6	1.2	10.9	10.4	1.1
150	11.8	11.1	1.4	12.6	11.7	1.5	11.1	10.5	1.4
175	12.1	11.2	1.7	12.9	11.9	1.8	11.2	10.6	1.6
200	12.3	11.3	2.0	13.2	12.0	2.2	11.4	10.7	1.9
225	12.4	11.5	2.4	13.5	12.2	2.5	11.6	10.8	2.2
250	12.5	11.6	2.7	13.7	12.4	2.8	11.7	10.9	2.5
275	12.6	11.7	3.0	13.9	12.5	3.2	11.9	11.0	2.8
300	12.6	11.8	3.3	14.1	12.6	3.5	12.0	11.1	3.1
325	12.6	11.8	3.6	14.3	12.8	3.9	12.1	11.2	3.4
350	12.6	11.9	3.9	14.5	12.9	4.3	12.2	11.2	3.7
375	12.6	11.9	4.2	14.7	13.0	4.6	12.3	11.3	4.0
400	12.5	12.0	4.6	14.8	13.1	5.0	12.4	11.4	4.3
425	12.5	12.0	4.9	15.0	13.2	5.4	12.5	11.4	4.6
450	12.5	12.0	5.2	15.1	13.3	5.7	12.5	11.5	4.9
475	12.6	12.1	5.5	15.3	13.4	6.1	12.5	11.6	5.3
500	12.8	12.1	5.8	15.4	13.5	6.5	12.5	11.6	5.6
525	13.0	12.1	6.1	15.6	13.6	6.9	12.6	11.7	5.9
550	13.4	12.2	6.5	15.7	13.7	7.3	12.6	11.7	6.2
575	13.9	12.3	6.8	15.8	13.8	7.7	12.7	11.7	6.5
600	14.5	12.3	7.2	16.0	13.9	8.1	12.8	11.8	6.8
625	15.3	12.5	7.5	16.1	14.0	8.5	13.1	11.8	7.2
650	16.3	12.6	7.9	16.3	14.1	8.9	...	...	...
675	17.5	12.7	8.4	16.4	14.2	9.3	...	...	...
700	18.9	12.9	8.8	16.5	14.3	9.7	...	...	...
725	20.5	13.2	9.3	16.6	14.3	10.1	...	...	...
750	22.3	13.5	9.8	16.6	14.4	10.5	...	...	...
775	24.5	13.8	10.4	16.7	14.5	10.9	...	...	...
800	26.8	14.2	11.1	16.6	14.6	11.4	...	...	...
825	29.5	14.6	11.8	16.5	14.6	11.8	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

	Coefficients for N10665			Coefficients for N10675			Coefficients for N12160		
Temperature, °C	A	B	C	A	B	C	A	B	C
20	9.5	9.5	0	10.3	10.3	0	12.4	12.4	0
50	10.2	9.9	0.3	10.4	10.3	0.3	12.9	12.6	0.4
75	10.6	10.1	0.6	10.6	10.4	0.6	13.2	12.8	0.7
100	10.9	10.3	0.8	10.8	10.5	0.8	13.6	13.0	1.0
125	11.1	10.5	1.1	11.0	10.6	1.1	13.9	13.2	1.4
150	11.2	10.6	1.4	11.3	10.7	1.4	14.2	13.4	1.7
175	11.4	10.7	1.7	11.5	10.8	1.7	14.5	13.5	2.1
200	11.5	10.8	1.9	11.7	10.9	2.0	14.8	13.7	2.5
225	11.6	10.9	2.2	12.0	11.0	2.3	15.0	13.8	2.8
250	11.7	11.0	2.5	12.1	11.1	2.6	15.2	14.0	3.2
275	11.9	11.1	2.8	12.3	11.3	2.9	15.3	14.1	3.6
300	12.0	11.2	3.1	12.4	11.3	3.2	15.4	14.2	4.0
325	12.2	11.2	3.4	12.5	11.4	3.5	15.5	14.3	4.4
350	12.4	11.3	3.7	12.5	11.5	3.8	15.6	14.4	4.7
375	12.6	11.4	4.0	12.5	11.6	4.1	15.6	14.5	5.1
400	12.8	11.5	4.4	12.4	11.6	4.4	15.7	14.6	5.5
425	12.9	11.6	4.7	12.3	11.7	4.7	15.8	14.6	5.9
450	13.0	11.6	5.0	12.2	11.7	5.0	16.0	14.7	6.3
475	13.1	11.7	5.3	12.1	11.7	5.3	16.1	14.8	6.7
500	13.1	11.8	5.7	12.1	11.8	5.6	16.4	14.9	7.1
525	13.1	11.8	6.0	12.0	11.8	5.9	16.6	14.9	7.5
550	13.0	11.9	6.3	12.1	11.8	6.2	17.0	15.0	8.0
575	12.9	12.0	6.6	12.2	11.8	6.6	17.3	15.1	8.4
600	12.7	12.0	7.0	12.4	11.8	6.9	17.8	15.2	8.8
625	12.6	12.0	7.3	12.9	11.9	7.2	18.2	15.3	9.3
650	12.4	12.0	7.6	13.5	11.9	7.5	18.7	15.5	9.7
675	12.3	12.1	7.9	14.4	12.0	7.9	19.1	15.6	10.2
700	12.3	12.1	8.2	15.6	12.1	8.2	19.5	15.7	10.7
725	12.5	12.1	8.5	17.2	12.2	8.6	19.9	15.9	11.2
750	12.9	12.1	8.8	19.3	12.5	9.1	20.1	16.0	11.7
775	13.6	12.1	9.2	...	...	...	20.2	16.2	12.2
800	14.8	12.2	9.5	...	...	...	20.0	16.3	12.7
825	16.5	12.3	9.9	...	...	...	19.4	16.4	13.2

Table TE-4
Thermal Expansion for Nickel Alloys
(Cont'd)

	Coefficients for R20033		
Temperature, °C	A	B	C
20	14.1	14.1	0
50	14.5	14.3	0.4
75	14.9	14.4	0.8
100	15.3	14.6	1.2
125	15.6	14.8	1.6
150	15.7	15.0	1.9
175	15.8	15.1	2.3
200	15.7	15.2	2.7
225	15.6	15.3	3.1
250	15.6	15.3	3.5
275	15.6	15.3	3.9
300	15.7	15.3	4.3
325	16.0	15.4	4.7
350	16.4	15.4	5.1
375	16.9	15.5	5.5
400	17.5	15.6	5.9
425	17.9	15.8	6.4
450	17.9	15.9	6.8
475	...	...	...
500	...	...	...
525	...	...	...
550	...	...	...
575	...	...	...
600	...	...	...
625	...	...	...
650	...	...	...
675	...	...	...
700	...	...	...
725	...	...	...
750	...	...	...
775	...	...	...
800	...	...	...
825	...	...	...

GENERAL NOTE: Coefficient A is the instantaneous coefficient of thermal expansion × 10^{-6} (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion × 10^{-6} (mm/mm/°C) in going from 20°C to indicated temperature. Coefficient C is the linear thermal expansion (mm/m) in going from 20°C to indicated temperature.

(13)

Table TE-5
Thermal Expansion for Titanium Alloys

Temperature, °C	Coefficients for Titanium Alloy, Grades 1, 2, 2H, 3, 7, 7H, 11, 12, 16, 16H, 17, 26, 26H, and 27			Coefficients for Titanium Alloy, Grades 9 and 28			Coefficients for Titanium Alloy, Grade 38		
	A	B	C	A	B	C	A	B	C
20	8.3	8.3	0	8.4	8.4	0	8.7	8.7	0
50	8.5	8.4	0.3	8.6	8.6	0.3	8.8	8.7	0.3
75	8.6	8.5	0.5	8.8	8.6	0.5	8.9	8.7	0.5
100	8.7	8.5	0.7	8.9	8.7	0.7	9.0	8.7	0.7
125	8.7	8.6	0.9	9.2	8.8	0.9	9.1	8.8	0.9
150	8.7	8.6	1.1	9.4	8.9	1.2	9.2	8.9	1.2
175	8.8	8.6	1.3	9.5	9.0	1.4	9.2	8.9	1.4
200	8.9	8.7	1.6	9.6	9.0	1.6	9.3	9.0	1.6
225	9.0	8.7	1.8	9.5	9.1	1.9	9.4	9.0	1.8
250	9.1	8.7	2.0	9.5	9.2	2.1	9.5	9.1	2.1
275	9.1	8.8	2.2	9.7	9.2	2.3	9.5	9.1	2.3
300	9.2	8.8	2.5	10.4	9.3	2.6	9.6	9.2	2.6

Table TE-5
Thermal Expansion for Titanium Alloys (Cont'd)

Temperature, °C	Coefficients for Titanium Alloy, Grades 1, 2, 2H, 3, 7, 7H, 11, 12, 16, 16H, 17, 26, 26H, and 27			Coefficients for Titanium Alloy, Grades 9 and 28			Coefficients for Titanium Alloy, Grade 38		
	A	B	C	A	B	C	A	B	C
325	9.3	8.8	2.7	...	...	...	9.7	9.2	2.8
350	9.5	8.9	2.9	...	...	...	9.7	9.2	3.0
375	9.9	8.9	3.2	...	...	...	9.8	9.3	3.3
400	10.6	9.0	3.4	...	...	...	9.8	9.3	3.5
425	11.8	9.2	3.7	...	...	...	9.9	9.3	3.8

GENERAL NOTE: Coefficient A is the instantaneous coefficient of thermal expansion × 10^{-6} (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion × 10^{-6} (mm/mm/°C) in going from 20°C to indicated temperature. Coefficient C is the linear thermal expansion (mm/m) in going from 20°C to indicated temperature.

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD)

(13)

	Carbon and Low Alloy Steels		Carbon and Low Alloy Steels		Carbon and Low Alloy Steels		Carbon and Low Alloy Steels		Carbon and Low Alloy Steels	
	Material Group A [Note (1)] Plain Carbon		Material Group B [Note (2)]		Material Group C [Note (3)]		Material Group D [Note (4)]		Material Group E [Note (5)]	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	60.4	18.10	47.3	13.66	41.0	11.87	36.3	10.53	27.4	8.02
50	59.8	17.03	47.9	13.23	40.8	11.47	36.5	10.23	28.4	8.05
75	58.9	16.27	48.0	12.85	40.7	11.16	36.7	10.03	29.2	8.07
100	58.0	15.60	47.9	12.47	40.6	10.88	36.9	9.86	29.8	8.07
125	57.0	15.00	47.6	12.10	40.5	10.60	37.0	9.71	30.3	8.05
150	55.9	14.43	47.2	11.74	40.4	10.33	37.1	9.56	30.8	8.01
175	54.7	13.90	46.7	11.39	40.3	10.08	37.2	9.41	31.2	7.95
200	53.6	13.40	46.1	11.05	40.1	9.82	37.2	9.25	31.5	7.87
225	52.5	12.90	45.5	10.73	39.8	9.57	37.2	9.08	31.7	7.76
250	51.4	12.42	44.8	10.42	39.5	9.32	37.1	8.89	31.9	7.63
275	50.3	11.95	44.2	10.11	39.1	9.07	36.9	8.70	32.0	7.49
300	49.2	11.48	43.5	9.81	38.7	8.82	36.7	8.49	32.1	7.34
325	48.1	11.01	42.9	9.50	38.3	8.57	36.5	8.27	32.1	7.17
350	47.0	10.55	42.2	9.20	37.8	8.32	36.2	8.05	32.0	7.00
375	45.9	10.10	41.5	8.89	37.3	8.06	35.8	7.82	32.0	6.82
400	44.9	9.65	40.9	8.57	36.8	7.81	35.4	7.59	31.9	6.64
425	43.8	9.20	40.2	8.25	36.3	7.55	35.0	7.35	31.7	6.46
450	42.7	8.77	39.4	7.93	35.8	7.29	34.6	7.11	31.6	6.27
475	41.6	8.34	38.6	7.60	35.3	7.03	34.2	6.87	31.4	6.09
500	40.5	7.92	37.8	7.27	34.8	6.77	33.7	6.62	31.2	5.90
525	39.3	7.51	36.9	6.96	34.4	6.50	33.3	6.37	30.9	5.70
550	38.2	7.10	36.0	6.65	33.9	6.24	32.8	6.11	30.7	5.50
575	37.0	6.71	35.0	6.36	33.4	5.97	32.4	5.84	30.4	5.29
600	35.8	6.31	34.0	6.10	32.8	5.69	32.0	5.55	30.1	5.06
625	34.7	5.93	33.0	5.88	32.2	5.42	31.5	5.25	29.8	4.82
650	33.5	5.54	31.9	5.69	31.6	5.14	31.1	4.93	29.4	4.55
675	32.3	5.11	30.8	5.56	30.7	4.78	30.6	4.58	29.1	4.26
700	31.2	4.59	29.8	5.50	29.1	4.37	30.1	4.21	28.6	3.94
725	30.1	3.84	28.8	5.52	27.6	3.83	28.7	3.69	28.2	3.59
750	29.1	2.42	27.8	1.71	26.7	2.69	27.4	2.62	27.6	3.36
775	...	3.07	26.9	3.17	...	1.26	26.8	1.64	27.1	3.29
800	...	4.19	26.1	4.37	...	5.06	26.7	4.59	26.9	4.02
825	...	4.82	...	4.59	...	7.74	...	7.51	...	4.36
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	Carbon and Low Alloy Steels (Cont'd)				High Chrome Steels		High Chrome Steels		High Alloy Steels		High Alloy Steels	
	Material Group F [Note (6)]		Ductile Cast Iron		Material Group G [Note (7)]		Material Group H [Note (8)]		Material Group I [Note (9)]		Material Group J [Note (10)]	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	22.3	6.61	37.50	11.44	24.6	7.12	20.1	5.70	17.3	4.80	14.8	3.90
50	23.1	6.67	38.50	11.59	24.7	6.93	20.2	5.65	17.6	4.84	15.3	3.94
75	23.8	6.71	39.18	11.56	24.7	6.80	20.2	5.59	18.0	4.85	15.8	3.99
100	24.4	6.74	39.73	11.51	24.8	6.69	20.3	5.51	18.4	4.86	16.2	4.04
125	25.0	6.76	40.15	11.44	24.9	6.58	20.4	5.44	18.9	4.87	16.6	4.08
150	25.5	6.76	40.45	11.36	24.9	6.48	20.5	5.37	19.3	4.87	17.0	4.14
175	25.9	6.75	40.64	11.26	25.0	6.37	20.5	5.30	19.8	4.87	17.5	4.19
200	26.3	6.71	40.73	11.13	25.0	6.26	20.6	5.24	20.2	4.88	17.9	4.24
225	26.6	6.66	40.73	10.99	25.1	6.14	20.7	5.18	20.7	4.88	18.3	4.30
250	26.9	6.58	40.64	10.83	25.1	6.02	20.8	5.12	21.1	4.88	18.6	4.35
275	27.2	6.49	40.47	10.65	25.2	5.90	20.9	5.07	21.5	4.87	19.0	4.41
300	27.4	6.39	40.23	10.44	25.2	5.78	21.0	5.02	21.9	4.86	19.4	4.46
325	27.5	6.27	39.93	10.22	25.2	5.65	21.1	4.95	22.2	4.84	19.8	4.52
350	27.7	6.15	...	...	25.3	5.53	21.2	4.89	22.5	4.81	20.1	4.57
375	27.8	6.01	...	...	25.3	5.41	21.3	4.81	22.8	4.77	20.5	4.63
400	27.9	5.87	...	...	25.3	5.29	21.4	4.72	23.0	4.71	20.8	4.69
425	27.9	5.72	...	...	25.4	5.18	21.5	4.62	23.3	4.63	21.2	4.74
450	27.9	5.56	...	...	25.4	5.07	21.6	4.51	23.5	4.54	21.5	4.80
475	27.9	5.40	...	...	25.4	4.95	21.7	4.39	23.6	4.43	21.9	4.85
500	27.9	5.22	...	...	25.4	4.84	21.8	4.26	23.8	4.30	22.2	4.91
525	27.9	5.04	...	...	25.5	4.72	21.9	4.13	23.9	4.15	22.6	4.97
550	27.8	4.85	...	...	25.5	4.59	22.1	4.01	24.1	3.99	22.9	5.02
575	27.7	4.64	...	...	25.5	4.44	22.2	3.90	24.2	3.81	23.3	5.08
600	27.6	4.42	...	...	25.5	4.26	22.4	3.84	24.4	3.64	23.6	5.13
625	27.5	4.18	...	...	25.5	4.06	22.5	3.94	24.5	3.46	24.0	5.19
650	27.3	3.91	...	...	25.6	3.83	22.7	4.12	24.7	3.34	24.3	5.24
675	27.2	3.62	...	...	25.6	3.55	22.9	4.32	24.9	3.52	24.7	5.30
700	27.0	3.30	...	...	25.6	3.23	23.1	4.52	25.1	3.85	25.0	5.35
725	26.8	2.99	...	...	25.6	2.88	23.3	4.68	25.4	4.25	25.4	5.40
750	26.5	3.52	...	...	25.6	4.57	23.5	4.83	25.7	4.62	25.7	5.45
775	...	4.08	...	...	...	4.39	...	4.95	...	4.88	...	...
800	...	4.41	...	...	...	3.57	...	5.06	...	5.02	...	...
825	...	4.54	...	...	...	...	...	5.17	...	5.20	...	...
850	...	...	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Alloy Steels (Cont'd)		High Alloy Steels		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	Material Group K [Note (11)]		Material Group L [Note (12)]		Nickel N02200		Low C–Nickel N02201		Ni–Cu N04400	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	14.1	3.57	11.1	2.95	...	...	70.9	...	21.8	5.76
50	14.6	3.64	11.6	3.02	...	...	73.3	...	22.7	5.95
75	15.0	3.69	12.0	3.08	...	...	73.8	...	23.5	6.10
100	15.4	3.75	12.5	3.14	66.8	...	73.3	...	24.3	6.25
125	15.7	3.80	12.9	3.20	65.6	...	72.1	...	25.2	6.41
150	16.1	3.86	13.3	3.26	64.3	...	70.4	...	26.1	6.57
175	16.5	3.92	13.8	3.33	62.9	...	68.5	...	26.9	6.73
200	16.8	3.98	14.2	3.39	61.7	...	66.5	...	27.7	6.89
225	17.2	4.05	14.6	3.46	60.6	...	64.6	...	28.5	7.04
250	17.6	4.11	15.0	3.53	59.4	...	62.8	...	29.2	7.18
275	17.9	4.16	15.5	3.59	58.2	...	61.3	...	29.9	7.30
300	18.3	4.22	15.9	3.66	57.0	...	59.9	...	30.6	7.40
325	18.7	4.28	16.3	3.73	55.8	...	58.9	...	31.3	7.48
350	19.0	4.33	16.7	3.79	54.9	...	58.1	...	32.0	7.52
375	19.4	4.39	17.1	3.86	54.9	...	57.5	...	32.8	7.55
400	19.7	4.44	17.5	3.93	55.7	...	57.2	...	33.5	7.56
425	20.1	4.50	18.0	4.00	56.3	...	57.1	...	34.3	...
450	20.5	4.55	18.4	4.06	56.7	...	57.3	...	35.1	...
475	20.8	4.61	18.8	4.13	57.1	...	57.6	...	36.0	...
500	21.2	4.66	19.2	4.20	57.6	...	58.0	...	36.8	...
525	21.5	4.72	19.6	4.27	58.2	...	58.6	...	37.7	...
550	21.9	4.78	20.0	4.34	...	...	59.2	...	...	...
575	22.2	4.84	20.4	4.41	...	...	59.9	...	...	...
600	22.6	4.90	20.8	4.47	...	...	60.5	...	...	...
625	22.9	4.95	21.2	4.54	...	...	61.2	...	...	...
650	23.2	5.01	21.6	4.61	...	...	61.8	...	...	...
675	23.6	5.07	22.0	4.67	...	...	62.4	...	...	...
700	23.9	5.12	22.4	4.73	...	...	62.9	...	...	...
725	24.2	5.16	22.8	4.79	...	...	63.4	...	...	...
750	24.6	5.19	23.1	4.84	...	...	63.9	...	...	...
775	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	Ni–Cu N04405		Ni–Cr–Mo–Fe N06002		Ni–Cr–Fe–Mo–Cu N06007		N06022		N06030	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	21.8	...	9.0	2.25	10.1	3.00	9.7	...	10.2	...
50	22.7	...	9.8	2.44	10.5	2.98	10.2	...	10.9	...
75	23.5	...	10.4	2.59	10.9	2.99	10.6	...	11.5	...
100	24.3	...	11.0	2.74	11.3	3.01	11.1	...	12.1	...
125	25.2	...	11.6	2.88	11.7	3.05	11.7	...	12.7	...
150	26.1	...	12.1	3.01	12.0	3.10	12.2	...	13.2	...
175	26.9	...	12.6	3.14	12.4	3.15	12.8	...	13.8	...
200	27.7	...	13.1	3.26	12.8	3.21	13.3	...	14.4	...
225	28.5	...	13.6	3.37	13.2	3.28	13.9	...	15.0	...
250	29.2	...	14.0	3.48	13.6	3.34	14.4	...	15.5	...
275	29.9	...	14.5	3.58	13.9	3.41	14.9	...	16.1	...
300	30.6	...	15.0	3.68	14.3	3.48	15.5	...	16.7	...
325	31.3	...	15.4	3.77	14.7	3.55	16.0	...	17.2	...
350	32.0	...	15.9	3.86	15.1	3.61	16.5	...	17.7	...
375	32.8	...	16.4	3.95	15.5	3.68	16.9	...	18.3	...
400	33.5	...	16.9	4.03	15.9	3.75	17.4	...	18.8	...
425	34.3	...	17.4	4.11	16.3	3.81	17.9	...	19.2	...
450	35.1	...	17.9	4.19	16.7	3.88	18.4	...	19.7	...
475	36.0	...	18.4	4.26	17.1	3.95	18.9	...	20.0	...
500	36.8	...	18.9	4.33	17.5	4.02	19.5	...	20.4	...
525	37.7	...	19.4	4.39	17.9	4.09	20.0	...	20.7	...
550	...	...	19.9	4.46	...	4.16	20.5	...	21.0	...
575	...	...	20.4	4.51	...	4.22	...	...	...	...
600	...	...	20.9	4.56	...	4.29	...	...	...	...
625	...	...	21.4	4.61	...	...	...	...	...	...
650	...	...	21.9	4.65	...	...	...	...	...	...
675	...	...	22.4	4.68	...	...	...	...	...	...
700	...	...	22.8	4.71	...	...	...	...	...	...
725	...	...	23.3	4.73	...	...	...	...	...	...
750	...	...	23.8	4.74	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	N06045		N06059		N06230		Ni–Mo–Cr–Low C N06455 and N06686		Ni–Cr–Fe N06600	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	12.97	3.22	10.4	2.92	9.0	2.44	10.0	2.85	14.9	3.97
50	...	...	11.1	...	9.5	2.54	10.5	2.92	15.2	3.98
75	...	...	11.6	...	9.9	2.62	10.9	2.98	15.5	4.01
100	...	...	12.1	...	10.4	2.70	11.4	3.05	15.9	4.05
125	...	...	12.5	...	10.9	2.78	11.8	3.13	16.2	4.09
150	...	...	12.9	...	11.4	2.86	12.3	3.20	16.6	4.14
175	...	...	13.3	...	11.9	2.94	12.7	3.28	17.0	4.19
200	...	...	13.7	...	12.4	3.02	13.2	3.35	17.3	4.25
225	...	...	14.1	...	12.9	3.09	13.6	3.43	17.7	4.31
250	...	...	14.5	...	13.4	3.16	14.1	3.51	18.1	4.36
275	...	...	14.9	...	13.9	3.24	14.5	3.58	18.5	4.42
300	...	...	15.3	...	14.5	3.31	14.9	3.66	18.9	4.47
325	...	...	15.7	...	15.0	3.38	15.4	3.74	19.3	4.53
350	...	...	16.1	...	15.5	3.44	15.8	3.82	19.7	4.58
375	...	...	16.6	...	16.0	3.51	16.2	3.90	20.1	4.62
400	...	...	17.0	...	16.5	3.58	16.7	3.98	20.5	4.67
425	...	...	17.4	...	17.0	3.64	17.1	4.06	20.9	4.71
450	...	...	17.8	...	17.5	3.71	17.5	4.15	21.3	4.75
475	...	...	18.2	...	18.0	3.77	18.0	4.23	21.7	4.79
500	...	...	18.6	...	18.5	3.84	18.5	4.32	22.1	4.83
525	...	...	19.0	...	19.0	3.90	19.0	4.41	22.6	4.86
550	...	...	19.4	...	19.4	3.97	19.5	4.50	23.0	4.90
575	...	...	...	...	19.9	4.03	20.0	4.59	23.4	4.94
600	...	...	...	...	20.4	4.09	20.6	4.69	23.9	4.97
625	...	...	...	...	20.9	4.14	...	...	24.3	5.01
650	...	...	...	...	21.4	4.20	...	...	24.8	5.05
675	...	...	...	...	21.9	4.25	...	...	25.3	5.09
700	...	...	...	...	22.4	4.29	...	...	25.7	5.14
725	...	...	...	...	22.9	4.32	...	...	26.2	5.18
750	...	...	...	...	23.3	4.34	...	...	26.6	5.23
775	...	...	...	...	23.8	4.35	...	...	...	...
800	...	...	...	...	24.3	4.34	...	...	...	...
825	...	...	...	...	24.8	4.30	...	...	...	...
850	...	...	...	...	25.2	4.25	...	...	...	...
875	...	...	...	...	25.6	4.17	...	...	...	...
900	...	...	...	...	25.9	4.06	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	Ni–Cr–Mo–Cb N06625		Ni–Cr–Fe N06690		Ni–Cr–Fe–Mo–Cb N07718		70Ni–16Cr–7Fe–Ti–Al N07750		Cr–Ni–Fe–Mo–Cu–Cb N08020	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	9.8	2.85	11.8	3.23	11.1	3.05	11.9	3.41	...	...
50	10.2	2.95	12.3	3.33	11.6	3.21	12.3	3.41	12.2	5.21
75	10.6	3.02	12.8	3.40	12.0	3.30	12.6	3.42	12.7	5.40
100	10.9	3.08	13.3	3.48	12.4	3.37	12.9	3.43	13.1	5.58
125	11.3	3.14	13.8	3.55	12.9	3.43	13.2	3.45	13.5	5.76
150	11.7	3.19	14.2	3.63	13.3	3.49	13.5	3.48	13.9	5.94
175	12.0	3.24	14.7	3.70	13.7	3.55	13.8	3.52	14.3	6.13
200	12.4	3.29	15.1	3.78	14.1	3.61	14.1	3.56	14.7	6.32
225	12.8	3.33	15.6	3.86	14.6	3.68	14.4	3.61	15.2	6.51
250	13.2	3.38	16.1	3.93	15.0	3.76	14.8	3.67	15.6	6.71
275	13.5	3.43	16.5	4.01	15.4	3.84	15.1	3.73	16.0	6.89
300	13.9	3.47	17.0	4.09	15.8	3.94	15.5	3.79	16.5	7.08
325	14.3	3.52	17.5	4.17	16.3	4.05	15.8	3.85	16.9	7.25
350	14.7	3.57	17.9	4.25	16.7	4.15	16.2	3.91	17.4	7.41
375	15.0	3.62	18.4	4.33	17.1	4.27	16.5	3.96	17.8	7.58
400	15.4	3.66	18.9	4.41	17.5	4.38	16.9	4.02	18.2	7.75
425	15.8	3.71	19.4	4.49	18.0	4.48	17.3	4.07	18.6	...
450	16.1	3.76	19.9	4.57	18.4	4.57	17.7	4.12	19.0	...
475	16.5	3.81	20.4	4.64	18.8	4.65	18.0	4.17	19.4	...
500	16.9	3.86	20.8	4.71	19.3	4.70	18.4	4.23	19.9	...
525	17.2	3.91	21.3	4.78	19.7	4.74	...	...	...	...
550	17.6	3.95	21.8	4.85	20.1	4.74	...	...	...	...
575	18.0	3.99	22.3	4.91	20.5	4.72	...	...	...	...
600	18.4	4.04	22.8	4.97	20.9	4.67	...	...	...	...
625	18.7	4.08	23.3	5.03	21.4	4.60	...	...	...	...
650	19.1	4.12	23.7	5.08	21.8	4.52	...	...	...	...
675	19.5	4.15	24.2	5.13	22.2	4.42	...	...	...	...
700	19.9	4.19	24.7	5.17	22.6	4.32	...	...	...	...
725	20.3	4.23	25.1	5.22	23.0	4.23	...	...	...	...
750	20.7	4.28	25.6	5.26	23.4	4.15	...	...	...	...
775	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	N08031		Ni–Fe–Cr–Si N08330		Ni–Fe–Cr N08800, N08801, N08810, N08811		Ni–Fe–Cr–Mo–Cu N08825		Ni–Mo N10001	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	11.6	3.15	12.4	3.39	11.5	3.14	...	...	...	...
50	12.2	...	12.7	3.43	12.1	3.27	...	...	10.6	2.96
75	12.6	...	13.0	3.53	12.5	3.37	11.9	3.26	10.9	2.97
100	13.1	...	13.4	3.63	13.0	3.46	12.4	3.25	11.1	2.98
125	13.6	...	13.8	...	13.4	3.54	12.8	3.27	11.3	3.00
150	14.1	...	14.2	...	13.9	3.63	13.2	3.30	11.6	3.02
175	14.5	...	14.7	...	14.3	3.71	13.6	3.33	11.8	3.05
200	15.0	...	15.1	...	14.7	3.78	14.0	3.36	12.1	3.07
225	15.4	...	15.6	...	15.1	3.85	14.4	3.39	12.3	3.09
250	15.9	...	16.1	...	15.5	3.92	14.8	3.41	12.6	3.12
275	16.3	...	16.6	...	16.0	3.99	15.2	3.42	12.9	3.15
300	16.8	...	17.0	...	16.4	4.05	15.5	3.44	13.2	3.18
325	17.2	...	17.5	...	16.7	4.12	15.9	3.44	13.5	3.21
350	17.6	...	18.0	...	17.1	4.18	16.3	3.44	13.9	3.25
375	18.0	...	18.4	...	17.5	4.24	16.6	3.44	14.2	3.29
400	18.4	...	18.9	...	17.9	4.30	17.0	3.44	14.6	3.34
425	18.9	...	19.4	...	18.3	4.36	17.3	3.43	15.0	3.40
450	19.3	...	19.8	...	18.7	4.42	17.6	3.42	15.5	3.47
475	19.7	...	20.3	...	19.1	4.47	18.0	3.41	16.0	3.54
500	20.2	...	20.7	...	19.4	4.53	18.3	3.38	16.5	3.62
525	20.6	...	21.2	...	19.8	4.58	18.7	...	17.0	3.71
550	21.0	...	21.7	...	20.3	4.63	19.0	...	17.6	3.80
575	...	...	22.1	...	20.7	4.68	19.4	...	18.2	3.89
600	...	...	22.6	...	21.1	4.73	19.7	...	...	...
625	...	...	23.0	...	21.5	4.78	20.1	...	...	...
650	...	...	...	...	22.0	4.82	20.5	...	...	...
675	...	...	...	...	22.4	4.87	20.9	...	...	...
700	...	...	...	...	22.9	4.91	21.4	...	...	...
725	...	...	...	...	23.3	4.96	21.8	...	...	...
750	...	...	...	...	23.8	5.00	22.3	...	...	...
775	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	Ni–Mo–Cr–Fe N10003		65Ni–25Mo–8Cr–2Fe N10242		Ni–Mo–Cr N10276		N10629		Ni–Mo N10665	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	...	...	10.9	3.00	...	...	11.0	3.2	...	...
50	...	...	11.3	3.14	10.4	...	11.5	...	...	...
75	10.9	3.00	11.7	3.24	10.8	...	11.9	...	...	...
100	11.3	3.13	12.1	3.33	11.2	...	12.2	...	12.2	3.37
125	11.8	3.21	12.5	3.40	11.7	...	12.5	...	12.4	3.41
150	12.1	3.26	13.0	3.47	12.1	...	12.8	...	12.7	3.45
175	12.5	3.29	13.4	3.53	12.5	...	13.1	...	12.9	3.49
200	12.8	3.32	13.8	3.60	12.9	...	13.4	...	13.2	3.53
225	13.1	3.36	14.2	3.66	13.4	...	13.7	...	13.4	3.58
250	13.5	3.40	14.6	3.72	13.8	...	14.0	...	13.7	3.63
275	13.8	3.46	15.0	3.79	14.3	...	14.4	...	14.0	3.68
300	14.1	3.53	15.4	3.86	14.7	...	14.7	...	14.3	3.74
325	14.5	3.62	15.8	3.94	15.1	...	15.1	...	14.7	3.79
350	14.8	3.71	16.2	4.02	15.6	...	15.5	...	15.0	3.85
375	15.2	3.81	16.6	4.11	16.0	...	15.8	...	15.4	3.92
400	15.6	3.91	17.0	4.20	16.5	...	16.2	...	15.8	3.98
425	16.0	3.99	17.4	4.29	16.9	...	16.5	...	16.2	4.05
450	16.4	4.06	17.8	4.39	17.4	...	16.8	...	16.6	4.13
475	16.9	4.11	18.2	4.48	17.9	...	17.0	...	17.1	4.20
500	17.3	4.14	18.6	4.57	18.3	...	17.3	...	17.6	4.28
525	17.8	4.14	19.0	4.66	18.8	...	17.6	...	18.2	4.37
550	18.3	4.13	19.4	4.74	19.2	...	17.9	...	18.7	4.46
575	18.8	4.09	19.8	4.81	19.7	...	18.3	...	19.3	4.55
600	19.3	4.06	20.2	4.87	20.1	...	18.9	...	19.9	4.65
625	19.8	4.04	20.6	4.91	...	...	...	...	...	...
650	20.4	...	21.0	4.92	...	...	...	...	...	...
675	20.9	...	21.4	4.92	...	...	...	...	...	...
700	21.5	...	21.8	4.89	...	...	...	...	...	...
725	22.1	...	22.2	4.84	...	...	...	...	...	...
750	22.7	...	22.6	4.76	...	...	...	...	...	...
775	...	...	23.0	4.66	...	...	...	...	...	...
800	...	...	23.4	4.53	...	...	...	...	...	...
825	...	...	23.8	4.38	...	...	...	...	...	...
850	...	...	24.2	4.21	...	...	...	...	...	...
875	...	...	24.6	4.02	...	...	...	...	...	...
900	...	...	25.0	3.82	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		Titanium Alloys		Titanium Alloys	
	N10675		N12160		R20033		Titanium Gr. 1, 2, 2H, 3, 7, 7H, 11, 12, 16, 16H, 17, 26, 26H, and 27		Titanium Grades 9 and 28	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	11.2	2.98	10.9	2.97	13.3	3.350	22.0	9.27	8.8	3.74
50	11.5	3.05	11.2	3.01	13.8	...	21.4	8.95	9.2	3.83
75	11.8	3.12	11.6	3.04	14.2	...	21.1	8.70	9.6	3.89
100	12.1	3.19	11.9	3.09	14.6	...	20.7	8.47	9.9	3.95
125	12.4	3.26	12.3	3.15	14.9	...	20.5	8.26	10.2	4.01
150	12.7	3.33	12.7	3.21	15.3	...	20.2	8.07	10.5	4.07
175	13.0	3.40	13.1	3.28	15.7	...	20.0	7.90	10.8	4.13
200	13.3	3.46	13.5	3.35	16.0	...	19.9	7.76	11.0	4.20
225	13.7	3.53	14.0	3.43	16.4	...	19.7	7.63	11.3	4.26
250	14.0	3.59	14.5	3.52	16.8	...	19.6	7.52	11.5	4.32
275	14.4	3.66	14.9	3.61	17.1	...	19.5	7.42	11.7	4.37
300	14.8	3.72	15.4	3.70	17.5	...	19.4	7.34	11.9	4.41
325	15.1	3.79	16.0	3.79	17.9	...	19.4	7.27	...	...
350	15.5	3.85	16.5	3.89	18.3	...	19.3	7.22	...	...
375	15.9	3.92	17.0	3.98	18.7	...	19.3	7.17	...	...
400	16.3	3.99	17.6	4.08	19.0	...	19.3	7.13	...	...
425	16.7	4.06	18.1	4.16	19.4	...	19.4	7.10	...	...
450	17.1	4.13	18.7	4.25	...	...	19.4	7.07	...	...
475	17.5	4.21	19.3	4.33	...	...	19.5	7.05	...	...
500	18.0	4.28	19.9	4.40	...	...	19.6	7.02	...	...
525	18.4	4.36	20.4	4.46	...	...	19.7	7.01	...	...
550	18.8	4.44	21.0	4.52	...	...	19.8	6.99	...	...
575	19.2	4.52	21.6	4.57	...	...	...	...	...	...
600	19.6	4.59	22.2	4.61	...	...	...	...	...	...
625	20.1	4.66	22.8	4.64	...	...	...	...	...	...
650	20.5	4.73	23.4	4.67	...	...	...	...	...	...
675	20.9	4.78	23.9	4.69	...	...	...	...	...	...
700	21.4	4.82	24.5	4.71	...	...	...	...	...	...
725	21.8	4.85	24.9	4.73	...	...	...	...	...	...
750	22.3	4.85	25.4	4.75	...	...	...	...	...	...
775	22.8	4.83	25.8	4.78	...	...	...	...	...	...
800	23.3	4.78	26.1	4.83	...	...	...	...	...	...
825	23.9	4.69	26.3	4.89	...	...	...	...	...	...
850	24.5	4.56	26.4	4.98	...	...	...	...	...	...
875	25.1	4.39	26.3	5.10	...	...	...	...	...	...
900	25.8	4.17	26.2	5.27	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	Titanium Alloys (Cont'd)		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys	
	Titanium Grade 38		A24430		A03560		A91060		A91100		A92014	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	7.4	3.16	162.6	68.14	159.1	67.38	234.2	95.16	230.5	94.86	155.5	63.71
50	7.8	3.23	164.6	68.01	161.8	67.26	229.8	92.89	226.7	91.87	158.4	64.03
75	8.1	3.31	167.0	67.88	163.8	67.12	227.0	90.66	224.1	89.64	160.6	64.00
100	8.4	3.38	168.8	67.85	165.5	66.97	224.5	88.71	221.9	87.74	162.5	64.01
125	8.7	3.46	170.1	67.82	167.1	66.87	222.4	86.97	220.0	86.13	164.2	64.04
150	9.0	3.54	171.2	67.66	168.6	66.84	220.6	85.39	218.4	84.71	165.7	63.97
175	9.3	3.62	172.6	67.35	169.9	66.83	219.0	83.94	216.9	83.38	167.1	63.77
200	9.6	3.70	173.7	67.10	171.0	66.66	217.6	82.57	215.7	82.05	168.4	63.69
225	9.9	3.79	...	...	...	...	...	...	...	...	...	...
250	10.2	3.88	...	...	...	...	...	...	...	...	...	...
275	10.5	3.98	...	...	...	...	...	...	...	...	...	...
300	10.9	4.08	...	...	...	...	...	...	...	...	...	...
325	11.2	4.19	...	...	...	...	...	...	...	...	...	...
350	11.6	4.31	...	...	...	...	...	...	...	...	...	...
375	12.0	4.44	...	...	...	...	...	...	...	...	...	...
400	12.5	4.58	...	...	...	...	...	...	...	...	...	...
425	12.9	4.72	...	...	...	...	...	...	...	...	...	...
450	...	...	...	...	...	...	...	...	...	...	...	...
475	...	...	...	...	...	...	...	...	...	...	...	...
500	...	...	...	...	...	...	...	...	...	...	...	...
525	...	...	...	...	...	...	...	...	...	...	...	...
550	...	...	...	...	...	...	...	...	...	...	...	...
575	...	...	...	...	...	...	...	...	...	...	...	...
600	...	...	...	...	...	...	...	...	...	...	...	...
625	...	...	...	...	...	...	...	...	...	...	...	...
650	...	...	...	...	...	...	...	...	...	...	...	...
675	...	...	...	...	...	...	...	...	...	...	...	...
700	...	...	...	...	...	...	...	...	...	...	...	...
725	...	...	...	...	...	...	...	...	...	...	...	...
750	...	...	...	...	...	...	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	Aluminum Alloys (Cont'd)		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys	
	A92024		A93003		A93004		A95052 and A95652		A95083	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	148.4	60.88	177.0	72.52	162.1	67.10	137.6	57.29	116.1	48.47
50	151.7	61.30	178.5	72.02	165.2	66.98	141.3	57.78	120.6	49.67
75	154.1	61.52	179.6	71.55	167.0	66.85	144.2	58.27	123.8	50.36
100	156.3	61.65	180.5	71.18	168.6	66.82	146.7	58.63	126.7	50.93
125	158.3	61.77	181.3	70.86	170.1	66.79	149.0	58.88	129.5	51.44
150	160.0	61.89	182.1	70.47	171.4	66.63	151.0	59.11	132.1	51.91
175	161.5	61.96	182.9	69.96	172.5	66.32	152.9	59.34	134.5	52.34
200	163.1	61.76	183.5	69.48	173.6	66.07	154.7	59.40	136.7	52.81
225	...	...	...	...	...	...	...	...	...	...
250	...	...	...	...	...	...	...	...	...	...
275	...	...	...	...	...	...	...	...	...	...
300	...	...	...	...	...	...	...	...	...	...
325	...	...	...	...	...	...	...	...	...	...
350	...	...	...	...	...	...	...	...	...	...
375	...	...	...	...	...	...	...	...	...	...
400	...	...	...	...	...	...	...	...	...	...
425	...	...	...	...	...	...	...	...	...	...
450	...	...	...	...	...	...	...	...	...	...
475	...	...	...	...	...	...	...	...	...	...
500	...	...	...	...	...	...	...	...	...	...
525	...	...	...	...	...	...	...	...	...	...
550	...	...	...	...	...	...	...	...	...	...
575	...	...	...	...	...	...	...	...	...	...
600	...	...	...	...	...	...	...	...	...	...
625	...	...	...	...	...	...	...	...	...	...
650	...	...	...	...	...	...	...	...	...	...
675	...	...	...	...	...	...	...	...	...	...
700	...	...	...	...	...	...	...	...	...	...
725	...	...	...	...	...	...	...	...	...	...
750	...	...	...	...	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD) (Cont'd)

	Aluminum Alloys (Cont'd)		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys	
	A95086		A95154 and A95254		A95454		A95456		A96061		A96063	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	TBD	TBD	126.9	52.83	134.0	55.45	116.1	48.75	166.2	68.66	209.1	68.53
50	TBD	TBD	131.0	53.96	137.6	56.25	120.6	49.63	168.6	68.54	207.8	68.42
75	TBD	TBD	134.1	54.37	140.8	56.71	123.7	50.34	170.2	68.41	206.7	68.40
100	TBD	TBD	136.9	54.81	143.6	57.15	126.7	51.03	171.7	68.29	205.7	68.34
125	TBD	TBD	139.4	55.32	145.9	57.56	129.6	51.66	173.0	68.12	204.9	68.11
150	TBD	TBD	141.8	55.76	148.0	57.87	132.2	52.20	174.1	67.87	204.5	67.84
175	TBD	TBD	143.9	55.99	150.0	58.03	134.5	52.60	175.3	67.61	204.2	67.63
200	TBD	TBD	145.9	56.18	151.9	58.07	136.7	52.87	176.2	67.57	203.7	67.60
225	...	...	...	...	...	...	...	...	...	...	...	...
250	...	...	...	...	...	...	...	...	...	...	...	...
275	...	...	...	...	...	...	...	...	...	...	...	...
300	...	...	...	...	...	...	...	...	...	...	...	...
325	...	...	...	...	...	...	...	...	...	...	...	...
350	...	...	...	...	...	...	...	...	...	...	...	...
375	...	...	...	...	...	...	...	...	...	...	...	...
400	...	...	...	...	...	...	...	...	...	...	...	...
425	...	...	...	...	...	...	...	...	...	...	...	...
450	...	...	...	...	...	...	...	...	...	...	...	...
475	...	...	...	...	...	...	...	...	...	...	...	...
500	...	...	...	...	...	...	...	...	...	...	...	...
525	...	...	...	...	...	...	...	...	...	...	...	...
550	...	...	...	...	...	...	...	...	...	...	...	...
575	...	...	...	...	...	...	...	...	...	...	...	...
600	...	...	...	...	...	...	...	...	...	...	...	...
625	...	...	...	...	...	...	...	...	...	...	...	...
650	...	...	...	...	...	...	...	...	...	...	...	...
675	...	...	...	...	...	...	...	...	...	...	...	...
700	...	...	...	...	...	...	...	...	...	...	...	...
725	...	...	...	...	...	...	...	...	...	...	...	...
750	...	...	...	...	...	...	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...	...	...	...

GENERAL NOTES:

(a) TC is the thermal conductivity, W/(m·°C), and TD is the thermal diffusivity, 10^{-6} m^2/sec:

$$TD = \frac{TC\left[W/\left(m\cdot°C\right)\right]}{\text{density}\left(kg/m^3\right) \times \text{specific heat}\left[J/\left(kg\cdot°C\right)\right]}$$

(b) Values of thermal expansion and thermal diffusivity should be used with the understanding that there is an associated ±10% uncertainty. This uncertainty results from compositional variations and variables associated with original data acquisition and analysis.

NOTES:

(1) Material Group A includes those materials listed as "Carbon steel" in the Nominal Composition column in Tables 1A, 2A, 3, 5A, U, or Y-1.

(2) Material Group B includes those materials listed as "C–Mn–Si–Cb," "C–Mn–Si–V," "C–Mn–Si–V–Cb," "C–Mn–Ti," or "C–Si–Ti" in the Nominal Composition column in Tables 1A, 2A, 3, 5A, U, or Y–1. Also includes:

¾Cr–½Ni–Cu	¾Ni–½Cu–Mo
1Cr–½Mo–Si	2½Ni

(3) Material Group C includes the following carbon–moly steels:

C–¼Mo	C–½Mo

The following low chrome steels:

½Cr–⅕Mo–V	1Cr–½Mo
½Cr–¼Mo–Si	1¼Cr–½Mo
½Cr–½Mo	1¼Cr–½Mo–Si
½Cr–½Ni–⅕Mo	1¾Cr–½Mo–Cu
¾Cr–¾Ni–Cu–Al	1¾Cr–½Mo–Ti
1Cr–1Mn–¼Mo	2Cr–½Mo
1Cr–⅕Mo	

The following manganese steels:

Mn–½Mo	Mn–½Mo–¾Ni
Mn–½Mo–¼Ni	Mn–½Ni–V
Mn–½Mo–½Ni	Mn–V

The following nickel steels:

½Ni–½Cr–¼Mo–V	¾Ni–1Mo–¾Cr
½Ni–½Mo–V	1Ni–½Cr–½Mo
¾Ni–½Cr–½Mo–V	1¼Ni–1Cr–½Mo
¾Ni–½Mo–⅓Cr–V	3½Ni–1¾Cr–½Mo–V
¾Ni–½Mo–Cr–V	4Ni–1½Cr–½Mo–V

(4) Material Group D includes the following low chrome steels:

2¼Cr–1Mo	3Cr–1Mo–¼V–Cb–Ca
3Cr–1Mo	3Cr–1Mo–¼V–Ti–B

The following manganese steel:

Mn–¼Mo

The following nickel steels:

1¾Ni–¾Cr–¼Mo	2¾Ni–1½Cr–½Mo–V
2Ni–¾Cr–¼Mo	5Ni–¼Mo
2Ni–¾Cr–⅓Mo	8Ni
2Ni–1½Cr–¼Mo–V	9Ni
2Ni–1Cu	

(5) Material Group E includes:

5Cr–½Mo	5Cr–½Mo–Ti
5Cr–½Mo–Si	

(6) Material Group F includes:

9Cr–1Mo

(7) Material Group G includes:

12Cr	13Cr–4Ni
12Cr–1Al	15Cr
13Cr	17Cr

(8) Material Group H includes:

27Cr

(9) Material Group I includes:

17Cr–4Ni–4Cu	15Cr–5Ni–3Mo (only to 425°C)

NOTES (CONT'D):

(10) Material Group J includes:

15Cr–6Ni–Cu–Mo (only to 425°C)
17Cr–7Ni–1Al (only to 425°C)
18Cr–8Ni
18Cr–8Ni–S (or Se)
18Cr–11Ni
22Cr–2Ni–Mo–N
23Cr–4Ni–Mo–Cu

These thermal conductivity and diffusivity values are also appropriate for H, L, N, and LN grades of austenitic stainless steels.

(11) Material Group K includes:

13Cr–8Ni–2Mo (only to 425°C)
29Cr–7Ni–2Mo–N
25Ni–15Cr–2Ti
29Ni–20Cr–3Cu–2Mo
16Cr–12Ni–2Mo
18Cr–5Ni–3Mo
18Cr–10Ni–Cb
18Cr–10Ni–Ti
18Cr–13Ni–3Mo
19Cr–9Ni–Mo–W
21Cr–11Ni–N
22Cr–5Ni–3Mo–N
23Cr–12Ni
25Cr–7Ni–4Mo–N
25Cr–20Ni
25Cr–20Ni–2Mo
44Fe–25Ni–21Cr–Mo

These thermal conductivity and diffusivity values are also appropriate for H, L, N, and LN grades of austenitic stainless steels.

(12) Material Group L includes:

18Cr–18Ni–2Si
22Cr–13Ni–5Mn
24Cr–22Ni–7.5Mo
25Cr–12Ni
25Cr–35Ni–N–Ce
31Ni–31Fe–29Cr–Mo

These thermal conductivity and diffusivity values are also appropriate for H, L, N, and LN grades of austenitic stainless steels.

Table TM-1
Moduli of Elasticity *E* of Ferrous Materials for Given Temperatures

Materials	Modulus of Elasticity E = Value Given × 10^3 MPa, for Temperature, °C, of																
	−200	−125	−75	25	100	150	200	250	300	350	400	450	500	550	600	650	700
Carbon steels with C ≤ 0.30%	216	212	209	202	198	195	192	189	185	179	171	162	151	137	...	...	...
Carbon steels with C > 0.30%	215	211	207	201	197	194	191	188	183	178	170	161	149	136	121	...	...
Ductile cast iron	...	...	169	161	155	151	147	142	138	134	...	...	...	...	...	...	...
Material Group A [Note (1)]	214	210	207	200	196	193	190	187	183	177	170	160	149	135	121	...	...
Material Group B [Note (2)]	204	200	197	191	187	184	181	178	174	171	167	163	158	153	147	141	133
Material Group C [Note (3)]	218	213	210	204	200	197	193	190	186	183	179	174	169	164	157	150	142
Material Group D [Note (4)]	225	220	217	210	206	202	199	196	192	188	184	180	175	169	162	155	146
Material Group E [Note (5)]	228	223	220	213	208	205	201	198	195	191	187	183	179	174	168	161	153
Material Group F [Note (6)]	215	212	208	201	195	192	189	186	182	178	173	166	157	145	131	...	...
Material Group G [Note (7)]	209	204	201	195	189	186	183	179	176	172	169	165	160	156	151	146	140
Material Group H [Note (8)]	...	...	209	200	194	190	186	183	180	177	174	172	...	...	...	...	...
Material Group I [Note (9)]	192	187	184	178	173	170	167	163	160	157	154	151	148	145	142	139	135
Material Group J [Note (10)]	214	209	205	197	191	187	184	180	176	172	168	164	161	157	...	...	...
S13800 [Note (11)]	217	213	209	202	197	194	190	186	183	179	175	171	...	...	...	...	...
S15500 [Note (12)]	210	206	203	196	191	188	184	181	177	173	169	166	...	...	...	...	...
S45000 [Note (13)]	218	213	210	203	198	194	191	187	183	179	175	171	...	...	...	...	...
S17400 [Note (14)]	210	206	203	196	191	188	184	181	177	173	169	166	...	...	...	...	...
S17700 [Note (15)]	218	213	210	203	198	194	191	187	183	179	175	171	...	...	...	...	...
S66286 [Note (16)]	214	211	208	201	196	192	189	185	181	178	174	169	...	...	...	...	...

NOTES:

(1) Material Group A consists of the following carbon–molybdenum and manganese steels:

C–¼Mo
C–½Mo
Mn–¼Mo
Mn–½Mo
Mn–½Mo–¼Ni
Mn–½Mo–½Ni
Mn–½Ni–V
Mn–V

(2) Material Group B consists of the following Ni steels:

¾Cr–½Ni–Cu
¾Cr–¾Ni–Cu–Al
½Ni–½Cr–¼Mo–V
½Ni–½Mo–V
¾Ni–½Cr–½Mo–V
¾Ni–½Cu–Mo
¾Ni–½Mo–⅓Cr–V
¾Ni–½Mo–Cr–V
¾Ni–1Mo–¾Cr
1Ni–½Cr–½Mo
1¼Ni–1Cr–½Mo
1¾Ni–¾Cr–¼Mo
2Ni–1½Cr–¼Mo–V
2Ni–1Cu

Table TM-1
Moduli of Elasticity *E* of Ferrous Materials for Given Temperatures (Cont'd)

NOTES (CONT'D):

$2\frac{1}{2}$Ni
$2\frac{3}{4}$Ni–$1\frac{1}{2}$Cr–$\frac{1}{2}$Mo–V
$3\frac{1}{2}$Ni
$3\frac{1}{2}$Ni–$1\frac{3}{4}$Cr–$\frac{1}{2}$Mo–V
4Ni–$1\frac{1}{2}$Cr–$\frac{1}{2}$Mo–V

(3) Material Group C consists of the following $\frac{1}{2}$–2Cr steels:

$\frac{1}{2}$Cr–$\frac{1}{5}$Mo–V
$\frac{1}{2}$Cr–$\frac{1}{4}$Mo–Si
$\frac{1}{2}$Cr–$\frac{1}{2}$Mo
1Cr–$\frac{1}{5}$Mo
1Cr–$\frac{1}{2}$Mo
1Cr–$\frac{1}{2}$Mo–V
$1\frac{1}{4}$Cr–$\frac{1}{2}$Mo
$1\frac{1}{4}$Cr–$\frac{1}{2}$Mo–Si
$1\frac{3}{4}$Cr–$\frac{1}{2}$Mo–Ti
2Cr–$\frac{1}{2}$Mo

(4) Material Group D consists of the following $2\frac{1}{4}$–3Cr steels:

$2\frac{1}{4}$Cr–1Mo
3Cr–1Mo
3Cr–1Mo–$\frac{1}{4}$V–Cb–Ca
3Cr–1Mo–$\frac{1}{4}$V–Ti–B

(5) Material Group E consists of the following 5–9Cr steels:

5Cr–$\frac{1}{2}$Mo
5Cr–$\frac{1}{2}$Mo–Si
5Cr–$\frac{1}{2}$Mo–Ti
7Cr–$\frac{1}{2}$Mo
9Cr–Mo, including variations thereof

(6) Material Group F consists of the following chromium steels:

12Cr–Al
13Cr
15Cr
17Cr

(7) Material Group G consists of the following austenitic steels:

16Cr–12Ni–2Mo
16Cr–12Ni–2Mo–N
18Cr–3Ni–13Mn
18Cr–8Ni
18Cr–8Ni–N
18Cr–8Ni–S
18Cr–8Ni–Se
18Cr–10Ni–Cb
18Cr–10Ni–Ti
18Cr–13Ni–3Mo
18Cr–18Ni–2Si
21Cr–6Ni–9Mn
22Cr–13Ni–5Mn
23Cr–12Ni
25Cr–20Ni

(8) Material Group H consists of the following duplex (austenitic–ferritic) stainless steels:

18Cr–5Ni–3Mo
22Cr–2Ni–Mo–N
22Cr–5Ni–3Mo–N
23Cr–4Ni–Mo–Cu–N
24Cr–10Ni–4Mo–N
25Cr–5Ni–3Mo–2Cu
25Cr–6Ni–Mo–N
25Cr–6.5Ni–3Mo–N
25Cr–7Ni–3Mo–W–Cu–N
25Cr–7Ni–4Mo–N
25Cr–7.5Ni–3.5Mo–N–Cu–W
29Cr–6.5Ni–2Mo–N

Table TM-1
Moduli of Elasticity *E* of Ferrous Materials for Given Temperatures (Cont'd)

NOTES (CONT'D):

(9) Material Group I consists of the following high-silicon austenitic steels:

17.5Cr–17.5Ni–5.3Si	18Cr–20Ni–5.5Si
18Cr–8Ni–4Si–N	UNS S38815

(10) Material Group J consists of the following high-molybdenum austenitic stainless steels:

20Cr–18Ni–6Mo	25Ni–47Fe–21Cr–5Mo
44Fe–25Ni–21Cr–Mo	27Ni–22Cr–7Mo–Cu–N
46Fe–24Ni–21Cr–6Mo–Cu–N	31Ni–31Fe–29Cr–Mo
25Ni–20Cr–6Mo–Cu–N	

(11) Also known as 13Cr–8Ni–2Mo, XM-13, or PH13-8Mo.
(12) Also known as 15Cr–5Ni–3Mo, XM-12, or 15-5PH.
(13) Also known as 15Cr–6Ni–Cu–Mo, Custom 450, or XM-25. Modulus values are for material aged at 480°C.
(14) Also known as 17Cr–4Ni–4Cu, Grade 630, or 17-4PH.
(15) Also known as 17Cr–7Ni–1Al, Grade 631, or 17-7PH.
(16) Also known as 25Ni–15Cr–2Ti, Grade 660, or A-286 stainless steel.

Table TM-2
Moduli of Elasticity *E* of Aluminum and Aluminum Alloys for Given Temperatures

	Modulus of Elasticity *E* = Value Given × 10^3 MPa, for Temperature, °C, of						
Material	**−200**	**−125**	**−75**	**25**	**100**	**150**	**200**
A03560	79	76	75	71	68	65	62
A95083	79	76	75	71	68	65	62
A95086	79	76	75	71	68	65	62
A95456	79	76	75	71	68	65	62
A24430	77	74	72	69	66	63	60
A91060	77	74	72	69	66	63	60
A91100	77	74	72	69	66	63	60
A93003	77	74	72	69	66	63	60
A93004	77	74	72	69	66	63	60
A96061	77	74	72	69	66	63	60
A96063	77	74	72	69	66	63	60
A92014	81	78	77	73	70	67	64
A92024	81	78	77	73	70	67	64
A95052	78	76	74	70	67	65	62
A95154	78	76	74	70	67	65	62
A95254	78	76	74	70	67	65	62
A95454	78	76	74	70	67	65	62
A95652	78	76	74	70	67	65	62

Table TM-3
Moduli of Elasticity *E* of Copper and Copper Alloys for Given Temperatures

	Modulus of Elasticity E = Value Given × 10^3 MPa, for Temperature, °C, of						
Material	−200	−125	−75	25	100	150	200
C93700	80	79	78	76	74	73	71
C83600	102	101	99	96	94	93	91
C92200	102	101	99	96	94	93	91
C28000	110	108	106	103	101	99	97
C36500	110	108	106	103	101	99	97
C46400	110	108	106	103	101	99	97
C65500	110	108	106	103	101	99	97
C66100	110	108	106	103	101	99	97
C95200	110	108	106	103	101	99	97
C95400	110	108	106	103	101	99	97
C44300	116	115	113	110	108	106	104
C44400	116	115	113	110	108	106	104
C44500	116	115	113	110	108	106	104
C64200	116	115	113	110	108	106	104
C68700	116	115	113	110	108	106	104
C10200	124	122	121	117	114	112	110
C10400	124	122	121	117	114	112	110
C10500	124	122	121	117	114	112	110
C10700	124	122	121	117	114	112	110
C11000	124	122	121	117	114	112	110
C12000	124	122	121	117	114	112	110
C12200	124	122	121	117	114	112	110
C12300	124	122	121	117	114	112	110
C12500	124	122	121	117	114	112	110
C14200	124	122	121	117	114	112	110
C23000	124	122	121	117	114	112	110
C61000	124	122	121	117	114	112	110
C61400	124	122	121	117	114	112	110
C65100	124	122	121	117	114	112	110
C70400	124	122	121	117	114	112	110
C19400	128	126	124	121	118	116	114
C60800	128	126	124	121	118	116	114
C63000	128	126	124	121	118	116	114
C70600	131	129	127	124	121	119	117
C97600	139	137	135	131	128	126	123
C71000	146	144	142	138	134	132	130
C71500	161	158	156	152	148	145	143

Table TM-4
Moduli of Elasticity *E* of High Nickel Alloys for Given Temperatures

	Modulus of Elasticity E = Value Given × 10^3 MPa, for Temperature, °C, of																			
Material	−200	−125	−75	25	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
N02200	222	216	213	207	202	199	197	194	191	189	186	183	180	176	172	169	164	160	...	...
N02201	222	216	213	207	202	199	197	194	191	189	186	183	180	176	172	169	164	160	...	...
N04400	192	188	185	179	175	173	171	168	166	163	161	158	155	152	149	146	142	139	...	...
N04405	192	188	185	179	175	173	171	168	166	163	161	158	155	152	149	146	142	139	...	...
N06002	211	206	202	196	192	189	187	184	182	179	176	173	170	167	163	160	156	152	...	...
N06007	205	200	197	191	187	185	182	180	177	175	172	169	166	163	160	156	152	148	...	...
N06022	221	216	212	206	201	199	196	193	191	188	185	182	179	175	172	168	164	160	155	151
N06030	217	212	208	202	197	195	192	189	187	184	181	178	175	172	168	165	161	156	152	148
N06045	207	202	199	193	189	186	184	181	179	176	173	170	167	164	161	157	153	150	...	...
N06059	225	220	216	210	205	203	200	197	194	192	189	185	182	178	175	171	167	162	158	154
N06230	226	221	217	211	206	203	200	198	195	192	189	186	183	179	176	172	168	163	159	154
N06455	220	215	212	205	201	198	195	193	190	187	184	181	178	175	171	167	163	159	...	...
N06600	229	224	220	213	209	206	203	201	198	195	192	189	186	182	178	174	170	165	...	...
N06617	...	...	...	201	196	193	191	189	187	184	181	178	174	171	167	164	160	156	152	146
N06625	222	216	213	207	202	199	197	194	191	189	186	183	180	176	172	169	164	160	...	...
N06686	225	220	216	210	205	203	200	197	194	192	189	185	182	178	175	171	167	162	158	154
N06690	225	219	215	208	204	201	199	196	193	191	188	185	181	178	174	170	166	162	...	...
N07718	214	210	206	199	195	192	190	188	185	183	180	176	173	169	...	...	...	...	...	...
N07750	229	224	220	213	208	206	203	201	198	195	192	189	185	181	178	...	...	...	...	...
N08020	207	202	199	193	189	186	184	181	179	176	173	170	167	164	161	157	153	150	...	...
N08031	212	207	204	198	193	191	188	185	183	180	178	175	172	168	165	161	157	153	149	145
N08330	207	202	199	193	189	186	184	181	179	176	173	170	167	164	161	157	153	150	...	...
N08800	211	206	202	196	192	189	187	184	182	179	176	173	170	167	164	160	156	152	...	...
N08801	211	206	202	196	192	189	187	184	182	179	176	173	170	167	164	160	156	152	...	...
N08810	211	206	202	196	192	189	187	184	182	179	176	173	170	167	164	160	156	152	...	...
N08825	207	202	199	193	189	186	184	181	179	176	173	170	167	164	161	157	153	150	...	...
N10001	230	224	221	214	209	206	204	201	198	196	193	189	186	182	178	174	170	166	...	...
N10003	234	229	225	218	213	210	207	205	202	199	196	193	190	186	182	178	173	169	...	...
N10242	245	240	236	229	224	221	217	214	211	208	205	202	198	195	191	186	182	177	172	167
N10276	220	215	212	205	201	198	195	193	190	187	184	181	178	175	171	167	163	159	...	...
N10629	232	227	223	216	211	208	206	203	200	197	194	191	188	184	180	176	172	168	...	...
N10665	232	227	223	216	211	208	206	203	200	197	194	191	188	184	180	176	172	168	...	...
N10675	232	227	223	216	211	208	206	203	200	197	194	191	188	184	180	176	172	168	...	...
N12160	226	221	217	211	206	203	200	198	195	192	189	186	183	179	176	172	168	163	159	154
R20033	210	204	201	195	191	188	186	183	181	178	175	172	169	166	162	159	155	151	147	142

Table TM-5
Moduli of Elasticity *E* of Titanium and Zirconium for Given Temperatures

(13)

Material Grade/UNS No.	Modulus of Elasticity E = Value Given × 10^3 MPa, for Temperature, °C, of							
	25	100	150	200	250	300	350	400
Titanium Alloys								
1 (R50250)	107	103	101	97	93	88	84	80
2, 2H (R50400)	107	103	101	97	93	88	84	80
3 (R50550)	107	103	101	97	93	88	84	80
7, 7H (R52400)	107	103	101	97	93	88	84	80
9 (R56320)	110	105	101	96	92	87	...	...
11 (R52250)	107	103	101	97	93	88	84	80
12 (R53400)	107	103	101	97	93	88	84	80
16, 16H (R52402)	107	103	101	97	93	88	84	80
17 (R52252)	107	103	101	97	93	88	84	80
26, 26H (R52404)	107	103	101	97	93	88	84	80
27 (R52254)	107	103	101	97	93	88	84	80
28 (R56323)	110	105	101	96	92	87	...	...
38 (R54250)	105	101	95	89	85	82	79	76
Zirconium Alloys								
702 (R60702)	99	92	87	81	76	71	66	60
705 (R60705)	94	90	87	84	82	79	76	73

GENERAL NOTE: These elastic modulus values are for the longitudinal direction of wrought plate. This represents a practical minimum for design. The modulus in other orientations will be higher. See Nonmandatory Appendix A, A-804.

Table PRD
Poisson's Ratio and Density of Materials

(13)

Material	Poisson's Ratio	Density, kg/m^3	Material	Poisson's Ratio	Density, kg/m^3
Ferrous Materials			Cast high alloy steels	0.30	7830
Carbon steels	0.30	7750			
Cast irons	0.29	7200	**Nonferrous Materials**		
Low alloy steels			**Aluminum Base**		
C–Mo steels	0.30	7750	Alclad 3003	0.33	2730
$\frac{1}{2}$Cr to 1$\frac{1}{4}$Cr steels	0.30	7750	Alclad 3004	0.33	2720
1$\frac{3}{4}$Cr to 3Cr steels	0.30	7750	Alclad 6061	0.33	2700
5Cr to 9Cr steels	0.30	7750	A02040	0.33	2800
Mn, Mn–Mo, and Si steels	0.30	7750	A03560	0.33	2680
Ni steels	0.30	7750	A24430	0.33	2700
PH stainless: S15500, S17400, S17700	0.31	7750	A91060	0.33	2705
			A91100	0.33	2710
High alloy steels (200 series)	0.31	7810	A92014	0.33	2800
High alloy steels (300 series)	0.31	8030	A92024	0.33	2780
High-Si stainless: S30600, S30601, S32615, and S38815	0.31	7600	A93003	0.33	2730
			A93004	0.33	2720
5–7% Mo stainless: S32050, S31254, S31266, S31277, and S32654	0.31	8100	A95052	0.33	2680
			A95083	0.33	2660
			A95086	0.33	2660
S32202	0.31	7770	A95154	0.33	2660
High alloy steels (400 series)	0.31	7750	A95254	0.33	2660
High alloy steels (duplex/ austenitic–ferritic)	0.31	7800	A95454	0.33	2690
			A95456	0.33	2660
PH stainless: S66286	0.31	7920	A95652	0.33	2670

Table PRD
Poisson's Ratio and Density of Materials (Cont'd)

Material	Poisson's Ratio	Density, kg/m^3
Nonferrous Materials (Cont'd)		
Aluminum Base (Cont'd)		
A96061	0.33	2700
A96063	0.33	2700
Chromium Base		
R20033	0.31	7950
Cobalt Base		
R30556	0.31	8200
R31233	0.31	8400
Copper Base		
C10200, C10400, C10500, and C10700	0.33	8940
C11000	0.33	8890
C12000, C12200, C12300, and C14200	0.33	8940
C19200	0.33	8860
C19400	0.33	8910
C23000	0.33	8750
C28000	0.33	8390
C36500	0.33	8420
C37700	0.33	8440
C44300, C44400, and C44500	0.33	8520
C46400 and C46500	0.33	8420
C60800	0.33	8170
C61400	0.33	7890
C63000	0.33	7580
C64200	0.33	7700
C65100	0.33	8750
C65500 and C66100	0.33	8520
C68700	0.33	8330
C70400, C70600, C71000, C71500, and C72200	0.33	8940
C83600	0.33	8800
C99200	0.33	8640
C93700	0.33	8940
C95200	0.31	7640
C95400	0.32	7450
C97600	0.33	8880
Nickel Base		
N02200 and N02201	0.31	8890
N04400 and N04405	0.31	8860
N05500	0.31	8300
N06002	0.31	8310
N06022	0.31	8690
N06030	0.31	8220

Material	Poisson's Ratio	Density, kg/m^3
Nonferrous Materials (Cont'd)		
Nickel Base (Cont'd)		
N06045	0.31	8000
N06059	0.31	8600
N06200	0.31	8500
N06230	0.31	8970
N06455	0.31	8640
N06600	0.31	8410
N06601	0.31	8050
N06617	0.31	8360
N06625	0.31	8440
N06686	0.31	8730
N06690	0.31	8110
N06975	0.31	8170
N06985	0.31	8310
N07718	0.31	8220
N07750	0.31	8250
N08020	0.31	8050
N08024	0.31	8110
N08026	0.31	8140
N08028	0.31	8000
N08031	0.31	8110
N08330	0.31	8030
N08367 and J94651	0.31	8060
N08800, N08810, and N08811	0.31	8030
N08825	0.31	8140
N08904	0.31	8060
N08925	0.31	8150
N08926	0.31	8060
N10001	0.31	9150
N10003	0.31	8860
N10242	0.31	9050
N10276	0.31	8870
N10629	0.31	9190
N10665 and N10675	0.31	9220
N12160	0.31	8080
Titanium Base		
R50250, R50400, R50550, R52250, R52252, R52254, R52400, R52402, R52404, and R53400	0.32	4510
R56320 and R56323	0.32	4480
R54250	0.32	4450
Zirconium Base		
R60702, R60704, and R60705	0.35	6480

SUBPART 3
CHARTS AND TABLES FOR DETERMINING SHELL THICKNESS OF COMPONENTS UNDER EXTERNAL PRESSURE

Figure G

Geometric Chart for Components Under External or Compressive Loadings (for All Materials)

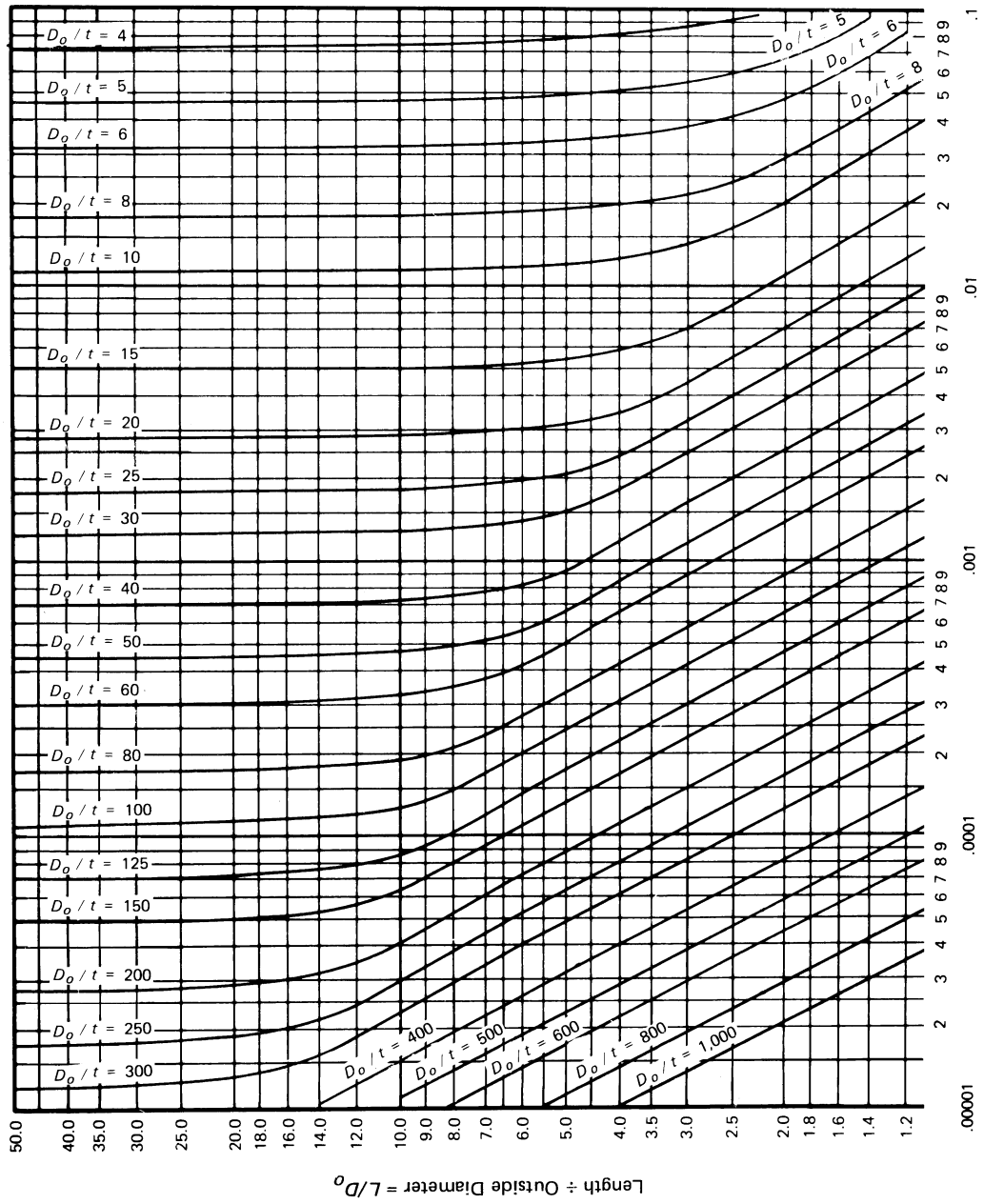
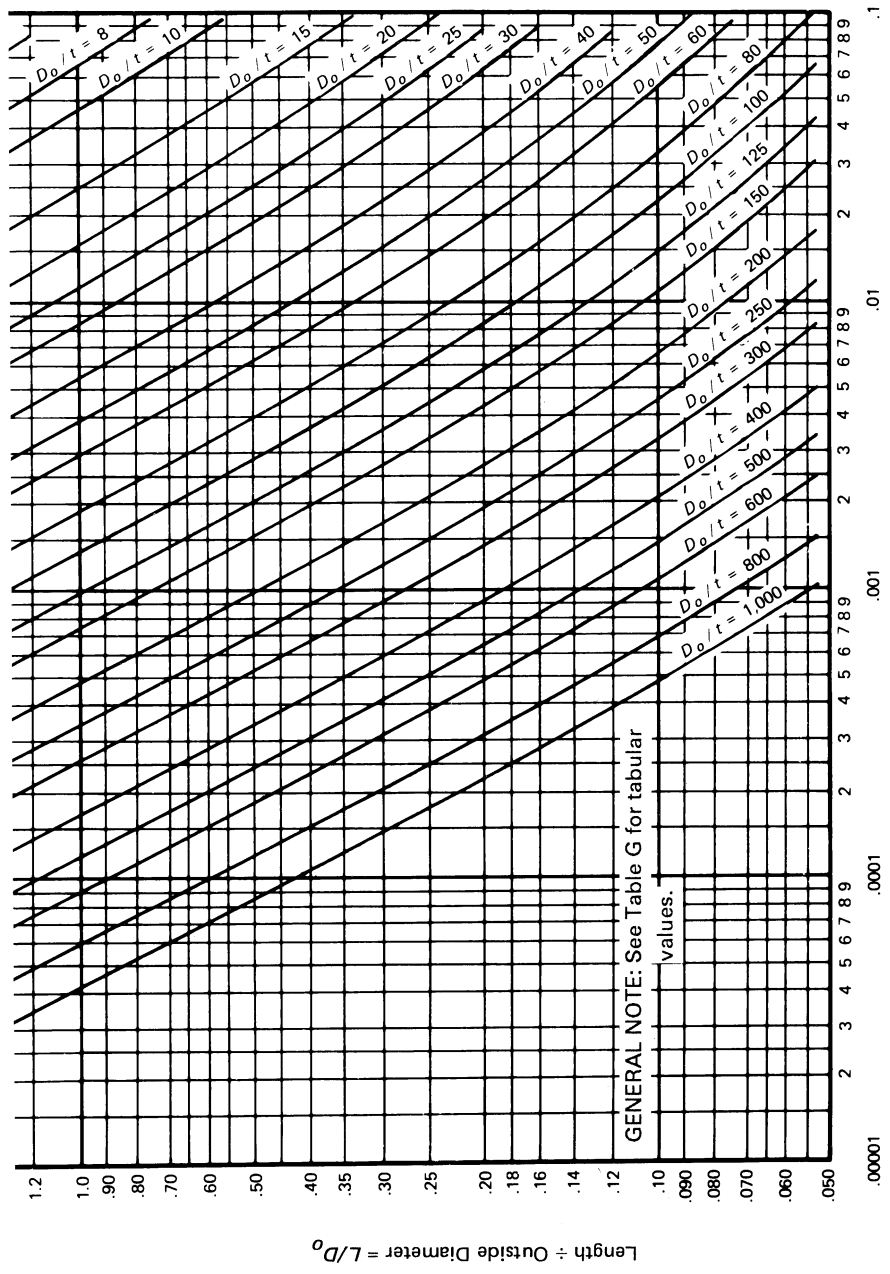
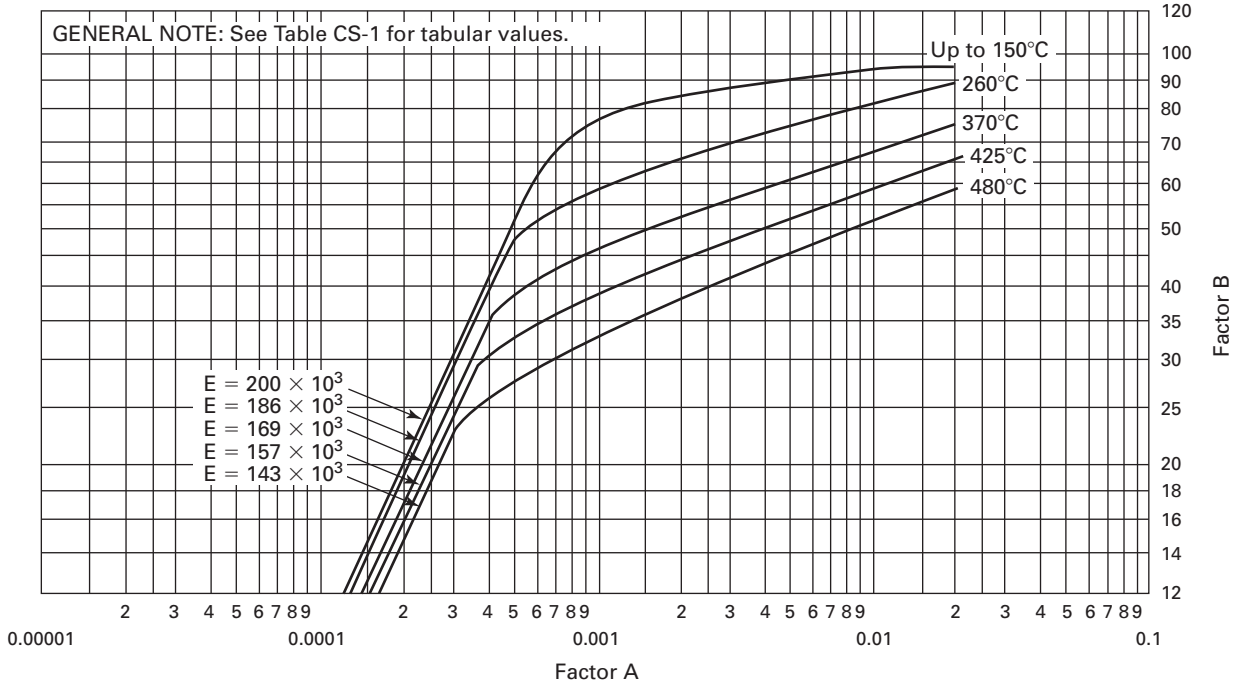


Figure G
Geometric Chart for Components Under External or Compressive Loadings (for All Materials) (Cont'd)



GENERAL NOTE: Extrapolation is not permitted except as explicitly allowed by the Construction Code.

Figure CS-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon or Low Alloy Steels With Specified Minimum Yield Strength Less Than 207 MPa

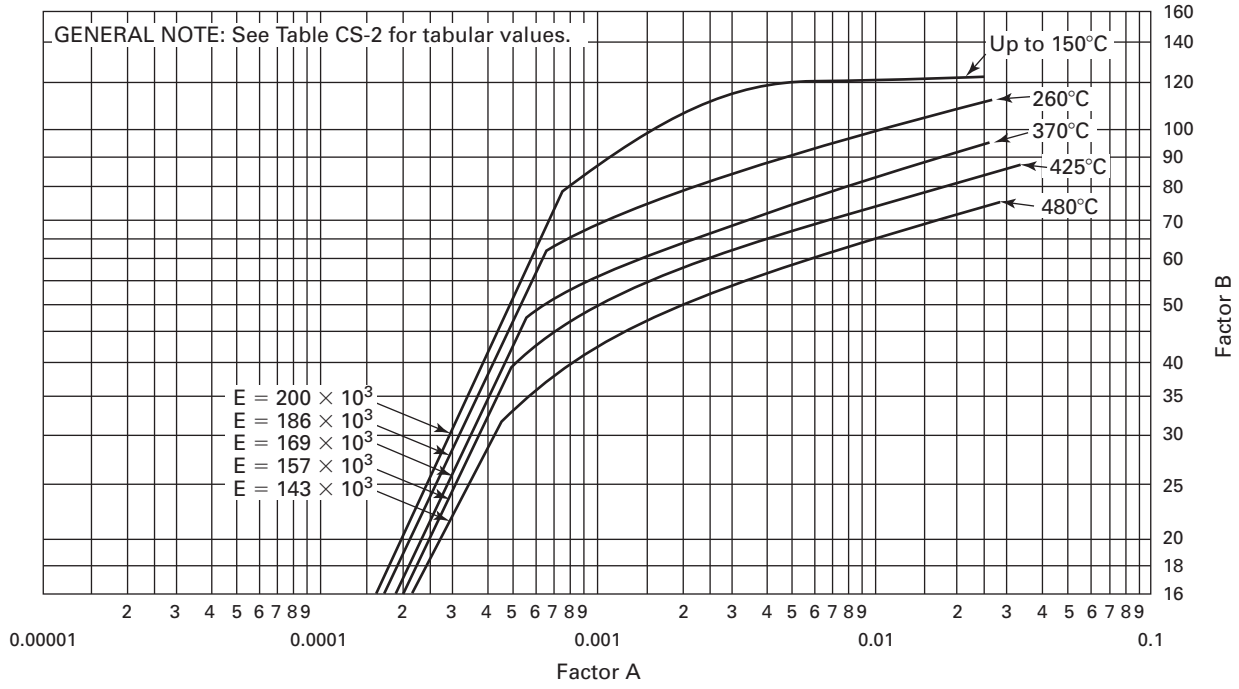


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CS-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon or Low Alloy Steels With Specified Minimum Yield Strength 207 MPa and Higher

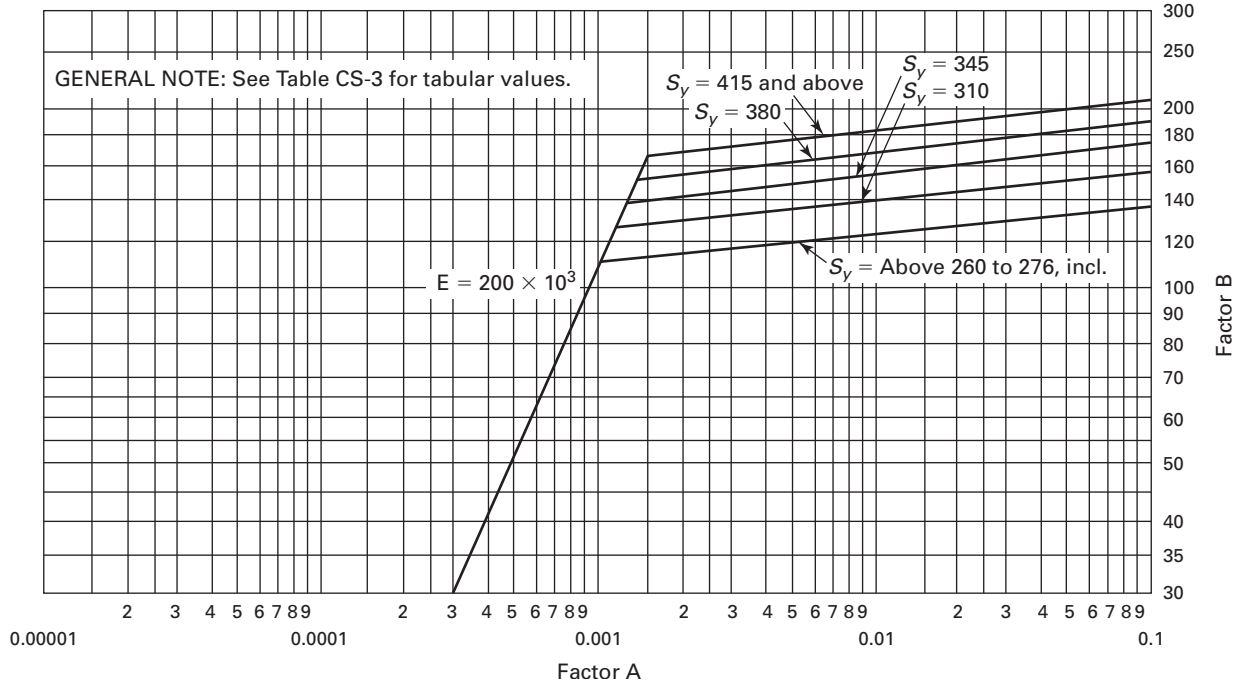


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CS-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon Steel and Low Alloy Steels With Specified Minimum Yield Strength 260 MPa and Higher for Temperatures 150°C and Less



GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

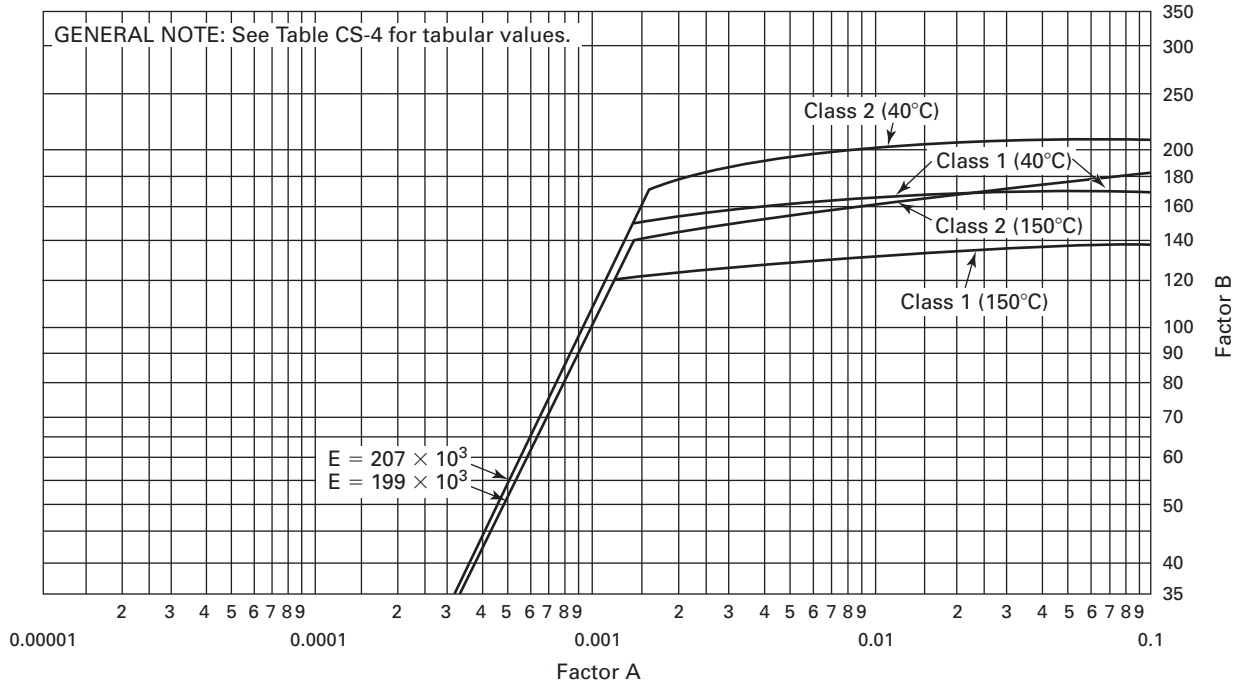
(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) See Table Y-1 for values of yield strength at design temperature.

(d) When Table Y-1 yield strength values at design temperature are less than 260 MPa for the material covered by this chart, Figure CS-2 shall be used.

(e) These curves shall not be used for design temperature above 150°C. Above 150°C, use the appropriate temperature curve shown in Figure CS-2.

Figure CS-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-537 Thickness 64 mm and Less

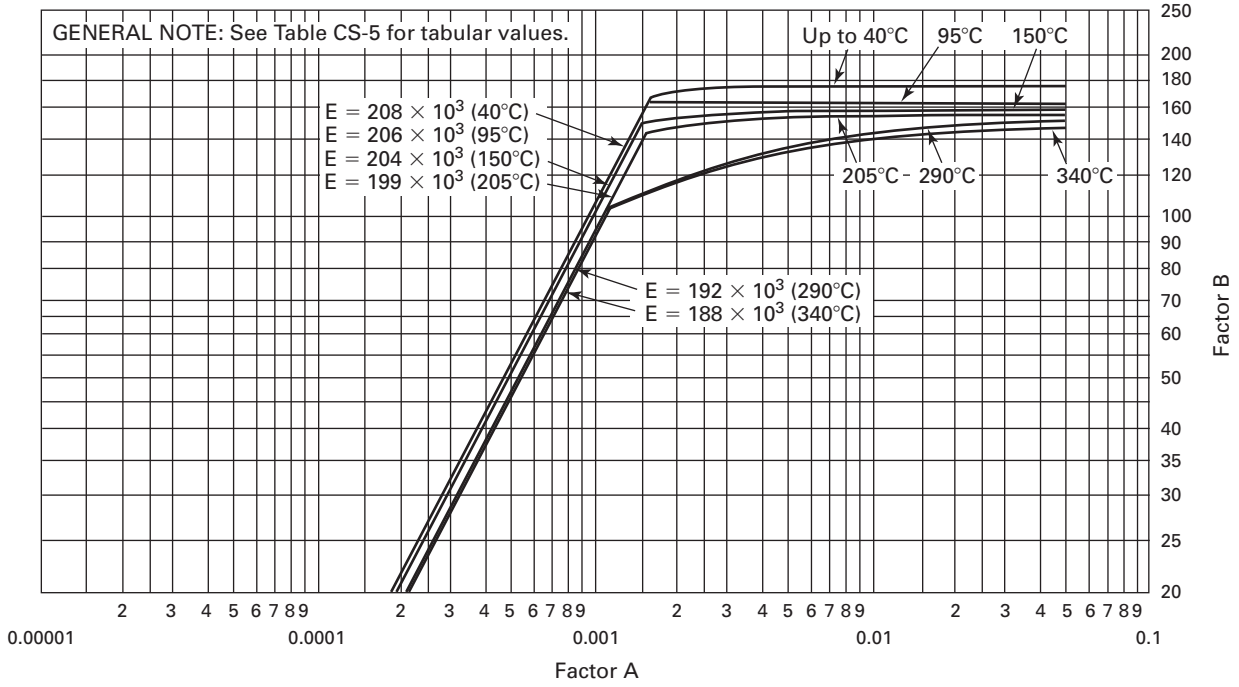


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CS-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-508 Class 1, Grades 2 and 3; SA-508 Class 2, Grade 2; SA-533 Class 1, Grades A, B, C, and D; SA-533 Class 2, Grades A, B, C, and D; or SA-541 Grades 2 and 3

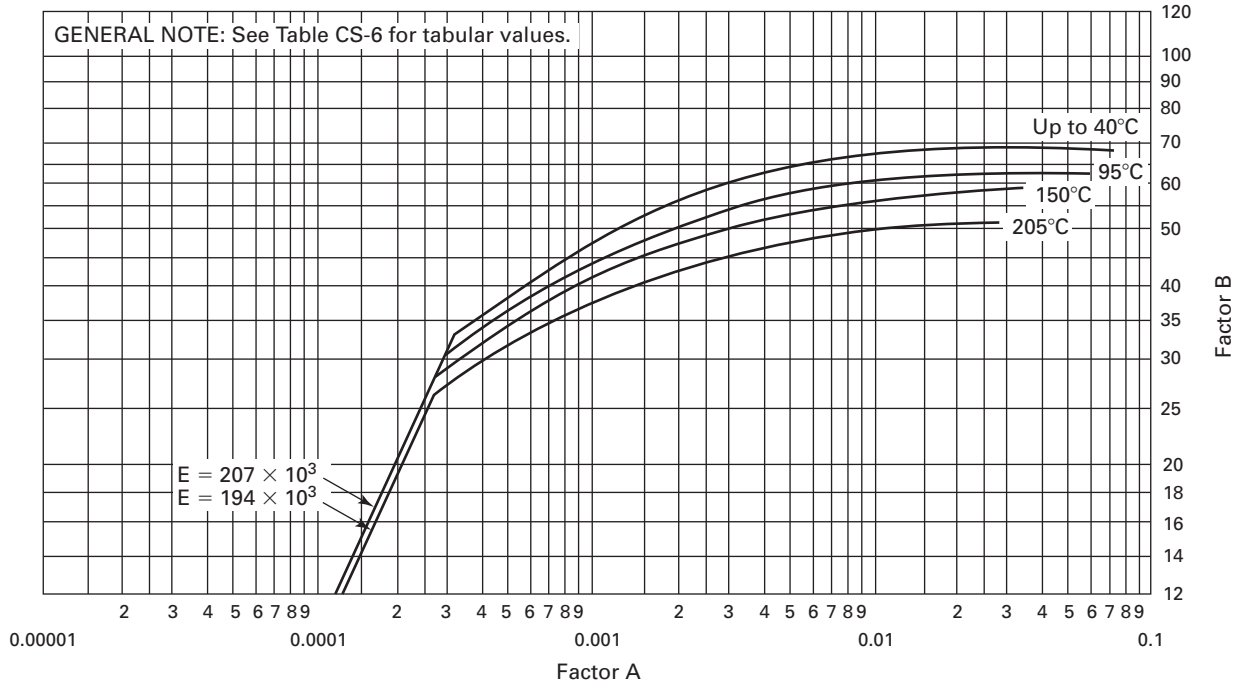


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CS-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon Steel With Specified Minimum Yield Strength of 138 MPa

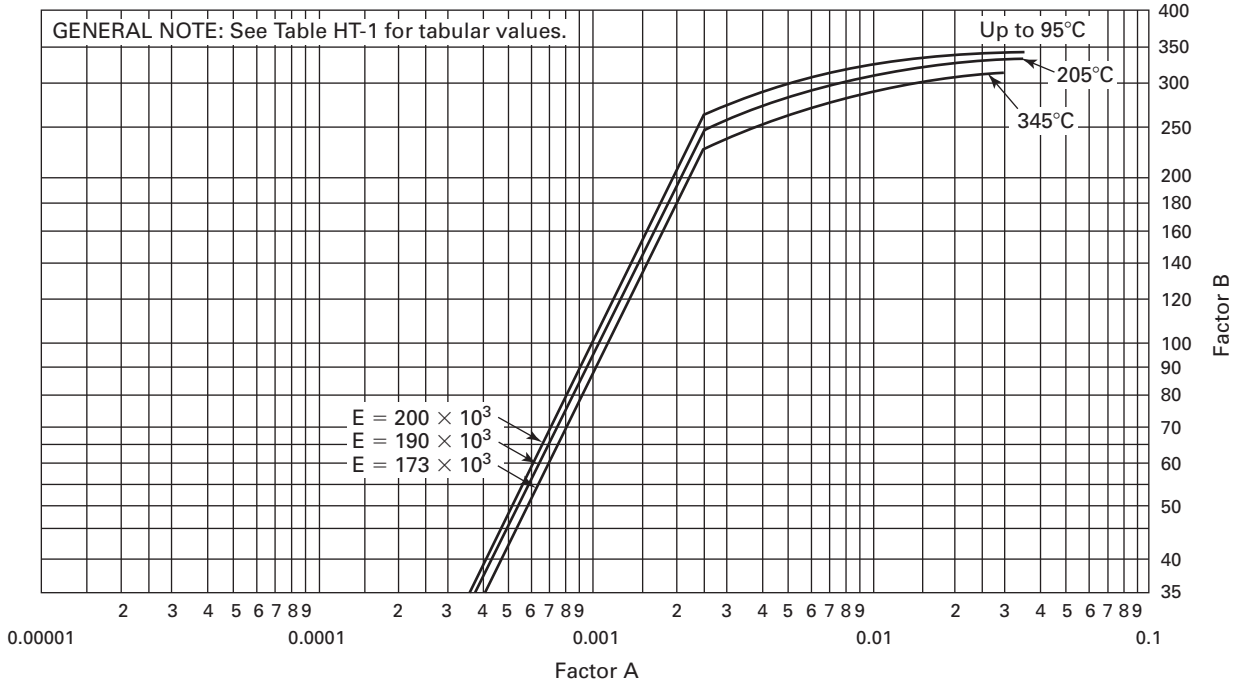


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HT-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Quenched and Tempered Low Alloy Steel With Specified Minimum Yield Strength of 689 MPa and Thickness 64 mm and Less

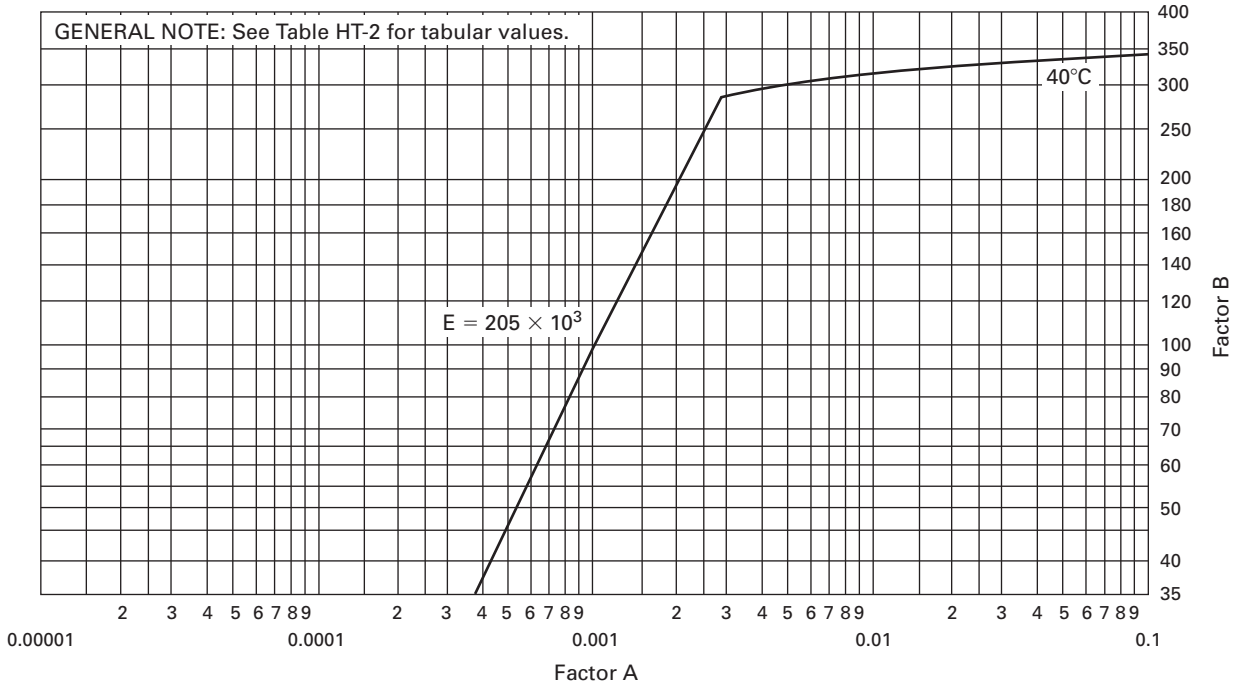


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HT-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-508 Grade 4N, Class 2 or SA-543 Types B and C, Class 2 With Specified Minimum Yield Strength of 689 MPa



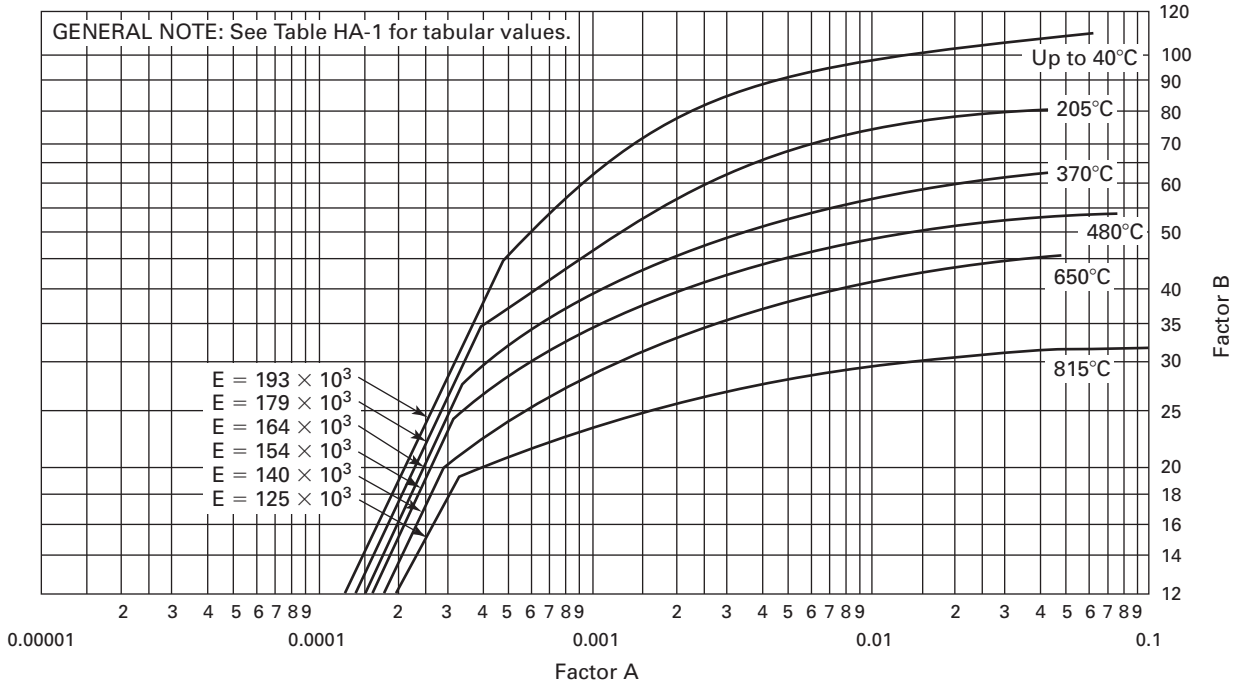
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) For temperatures over 40°C, use Figure CS-2.

Figure HA-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr–8Ni, Type 304

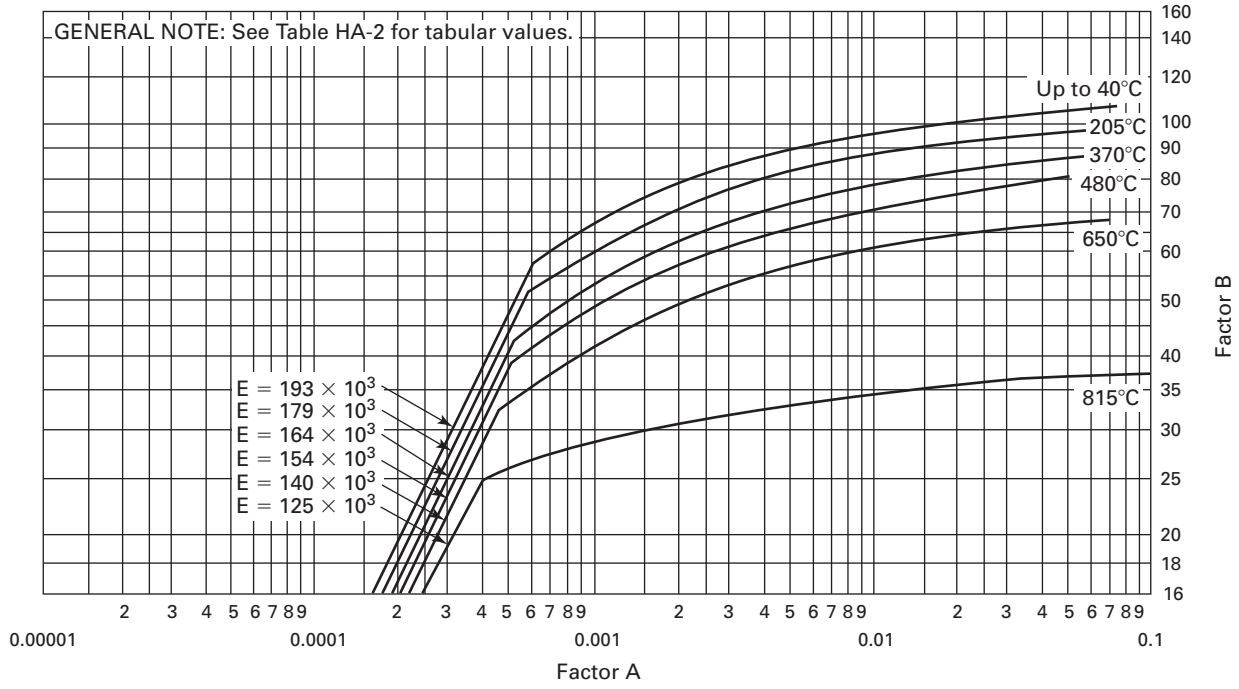


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 16Cr–12Ni–2Mo, Type 316

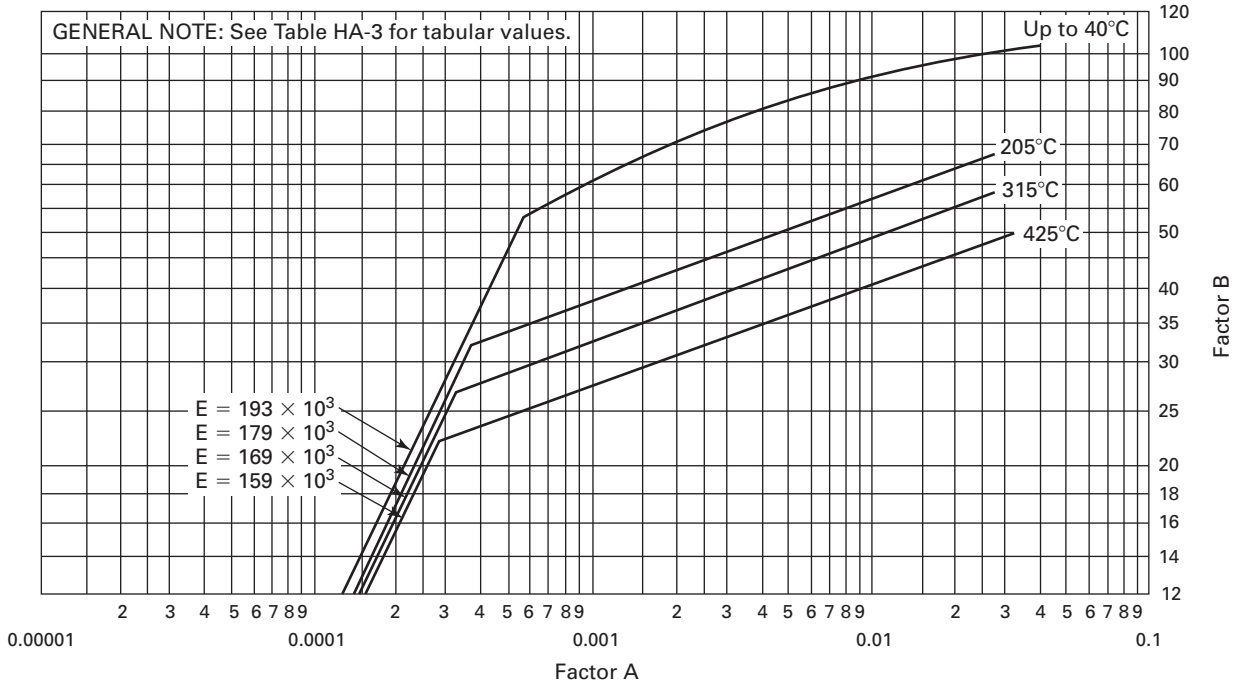


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr–8Ni–0.035 Maximum Carbon, Type 304L

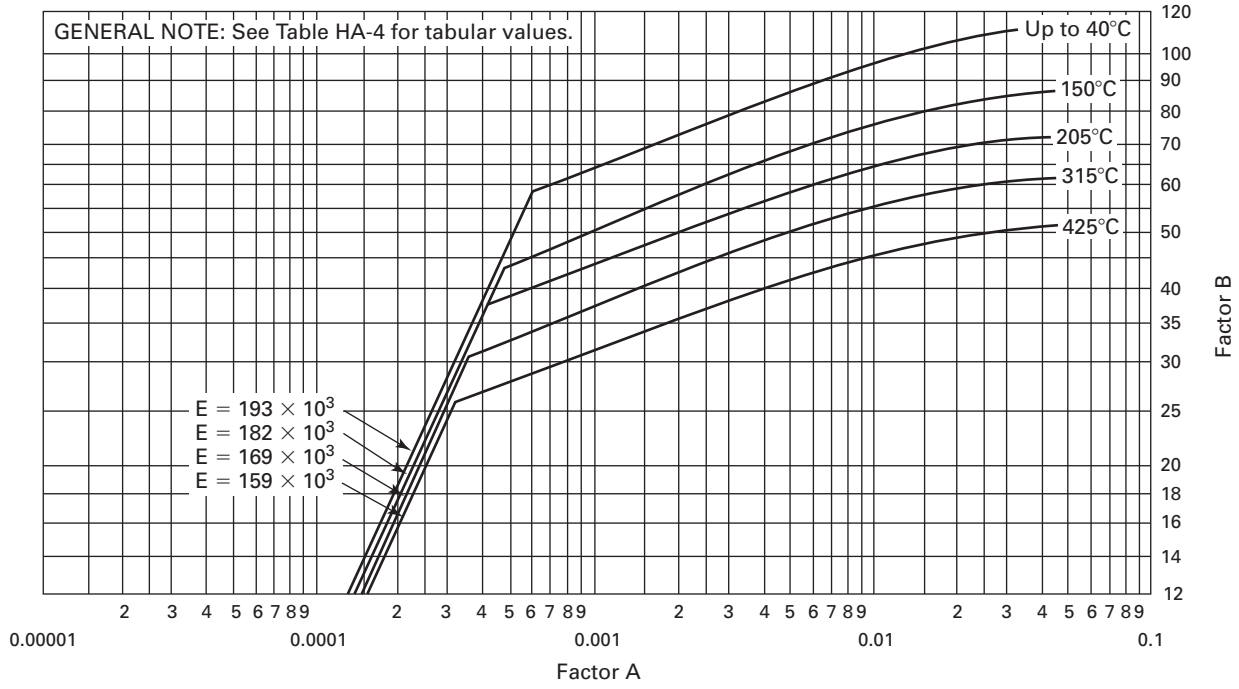


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr–8Ni–Mo–0.035 Maximum Carbon, Type 316L

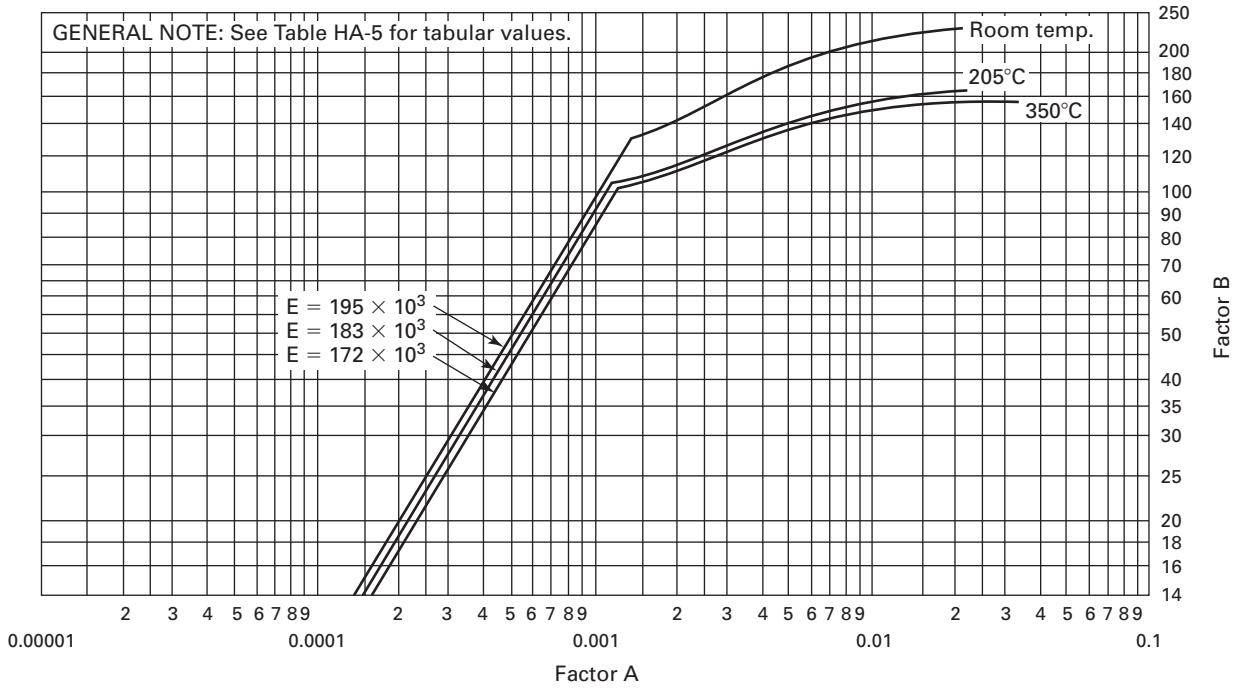


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic–Ferritic Steel 18Cr–5Ni–3Mo S31500

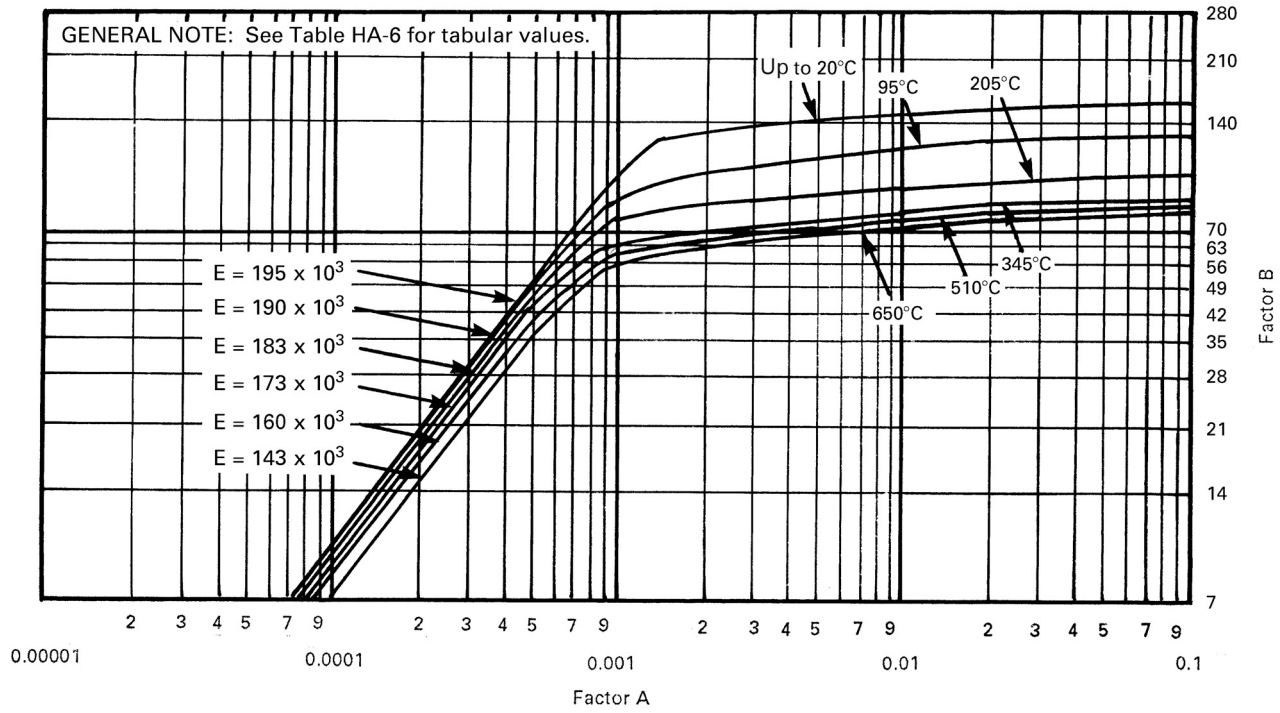


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 21Cr–11Ni–N S30815



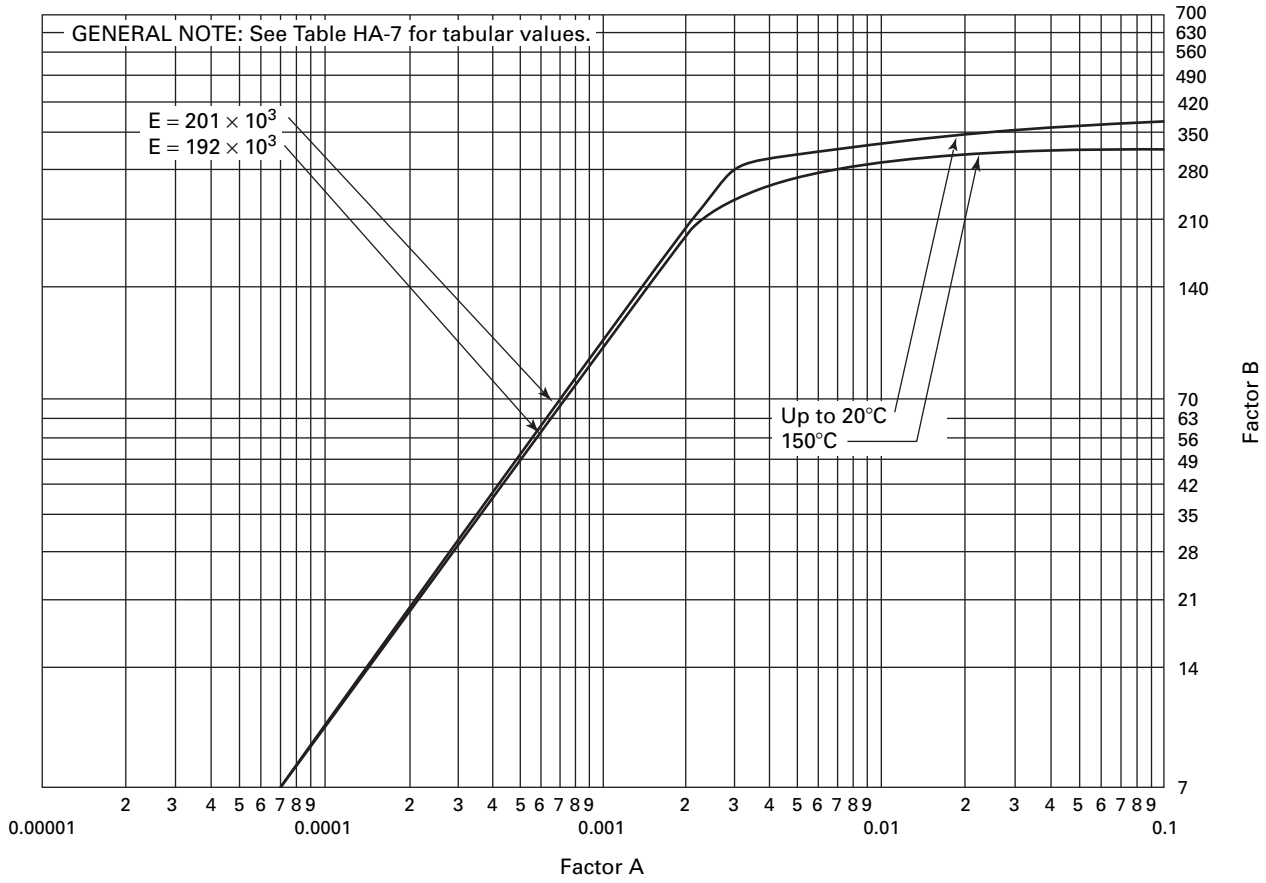
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) The external pressure chart does not account for reduction of buckling strength due to creep under long-term loads at temperatures above 540°C.

Figure HA-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-564 Type 630 H1150 (17Cr–4Ni–4Cu S17400)

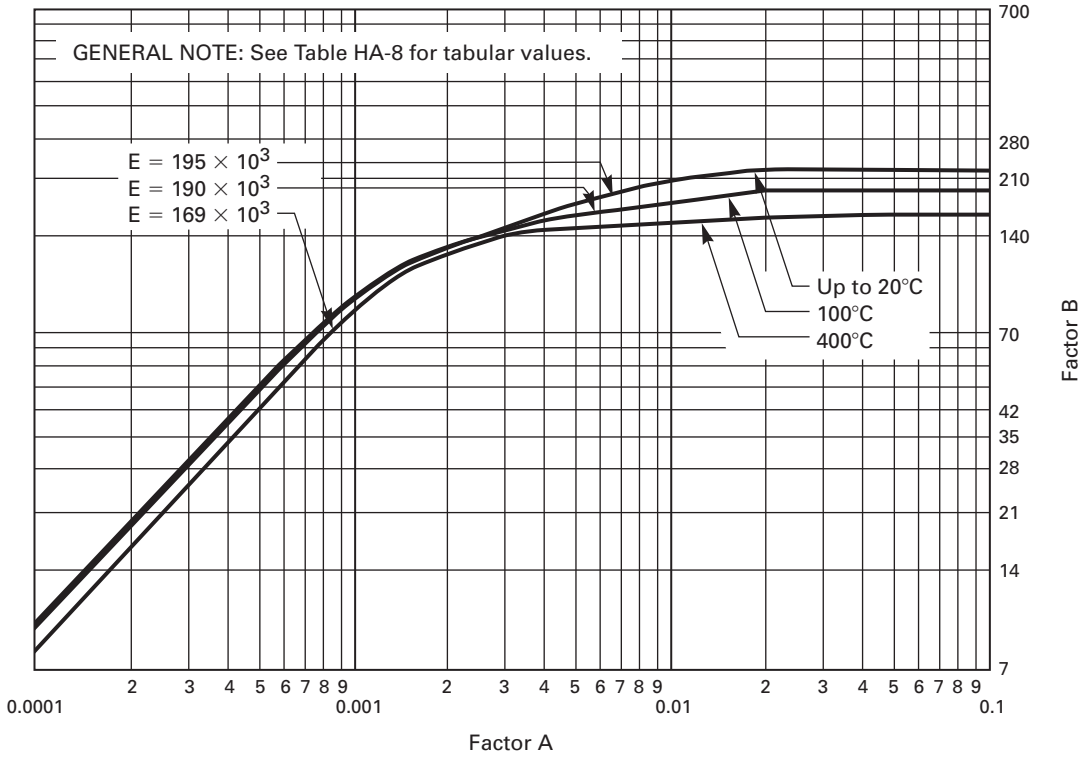


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure HA-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic–Ferritic Steel 25Cr–7Ni–3Mo–2W–0.28N S39274



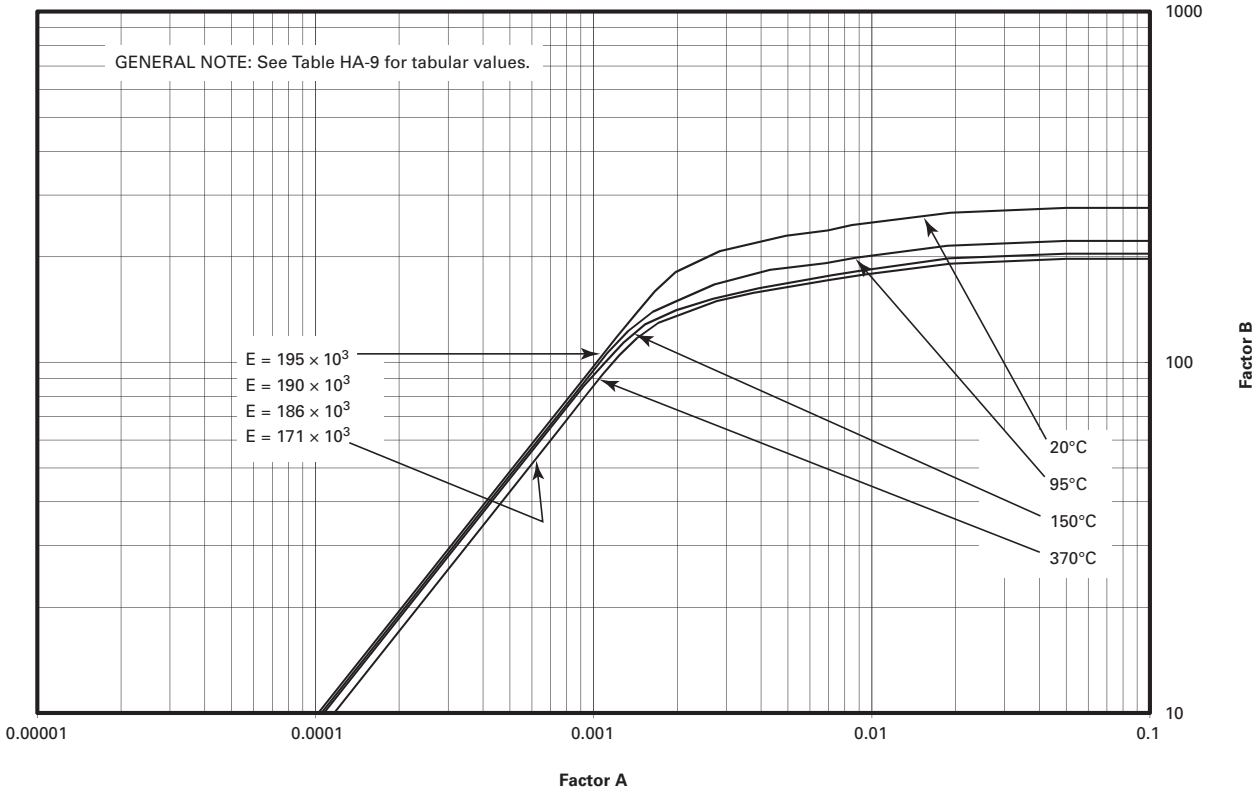
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(13)

Figure HA-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 25Cr–7.5Ni–3.5Mo–N–Cu–W S32760

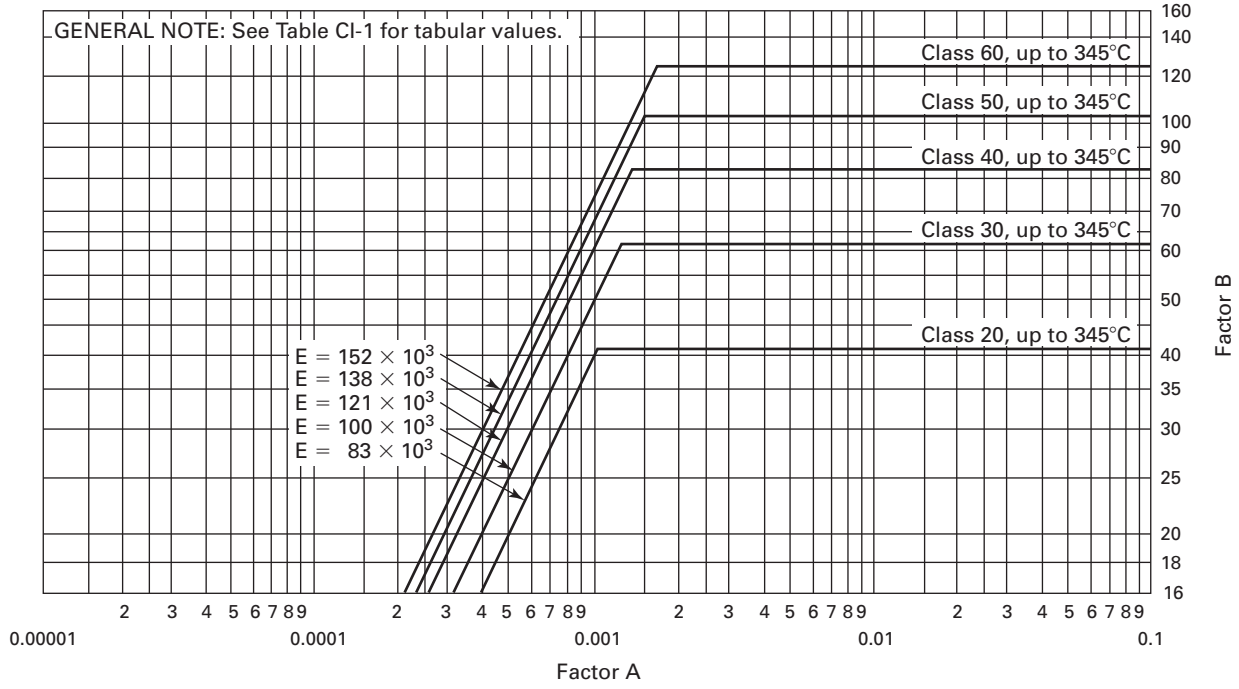


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CI-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Iron

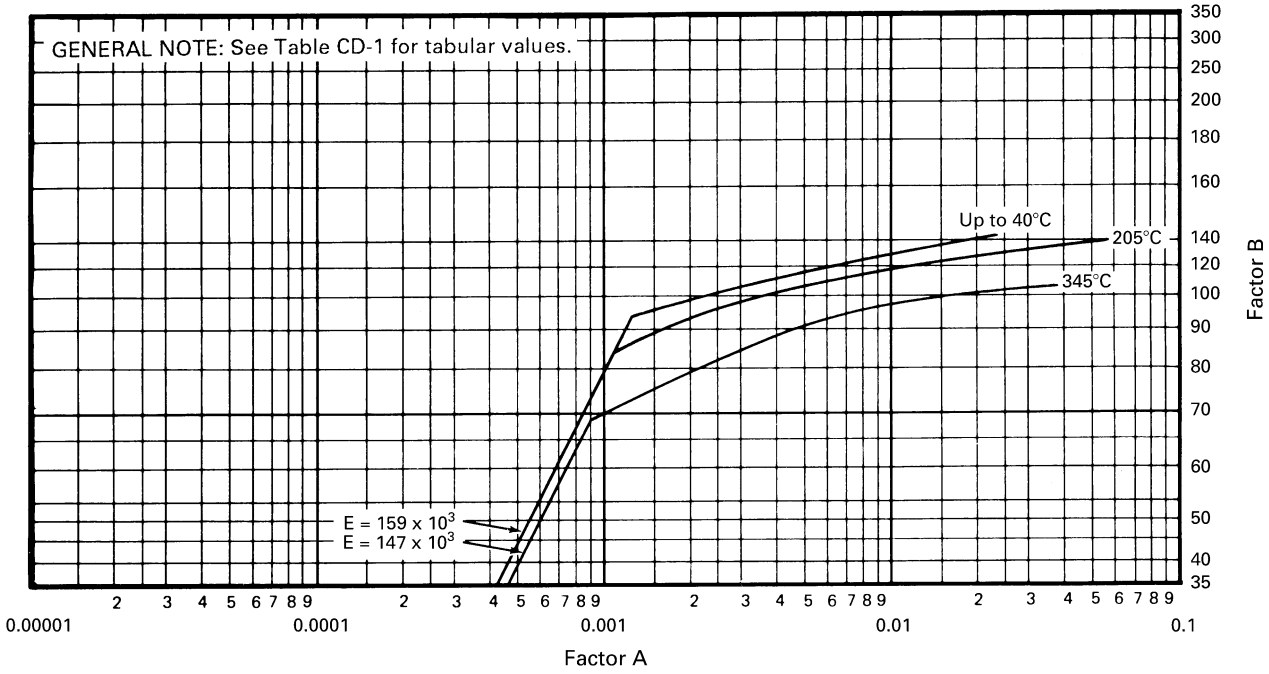


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure CD-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Ductile Iron With a Specified Minimum Yield Strength of 275 MPa



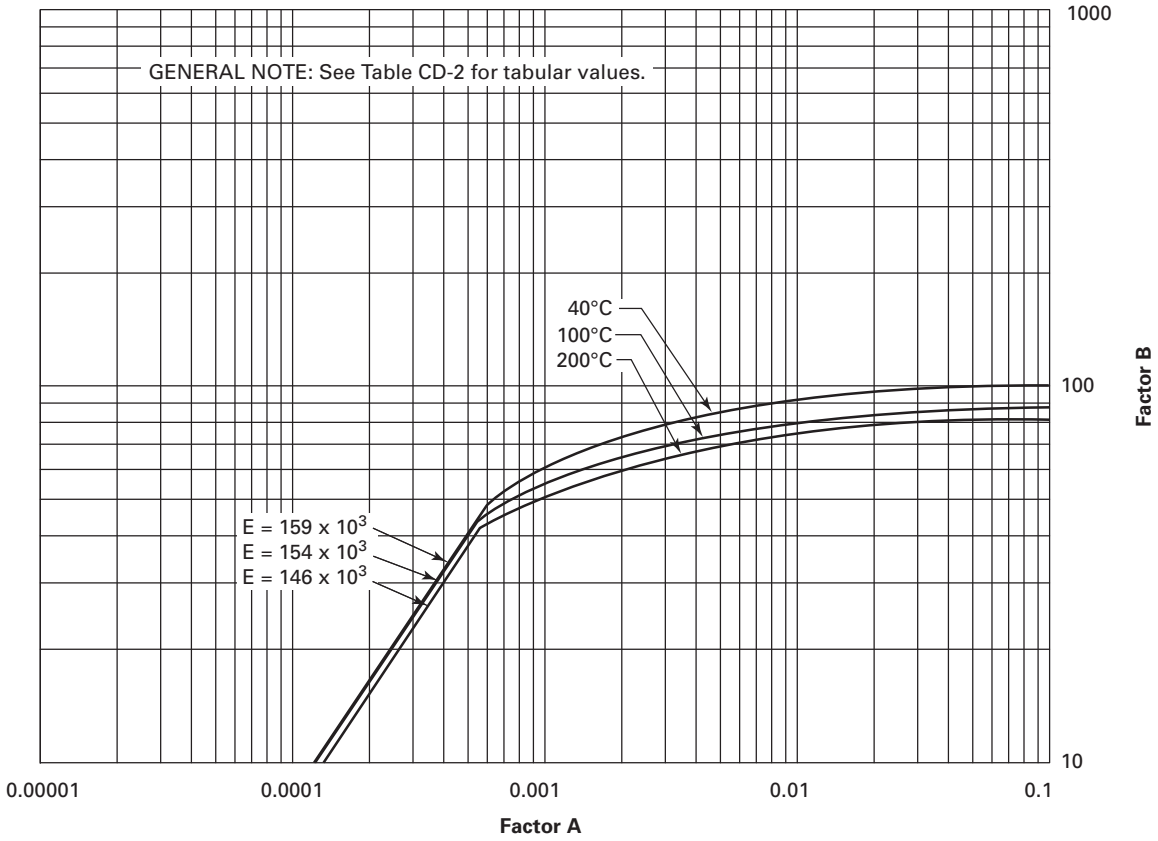
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(13)

Figure CD-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Ductile Iron With a Specified Minimum Yield Strength of 200 MPa

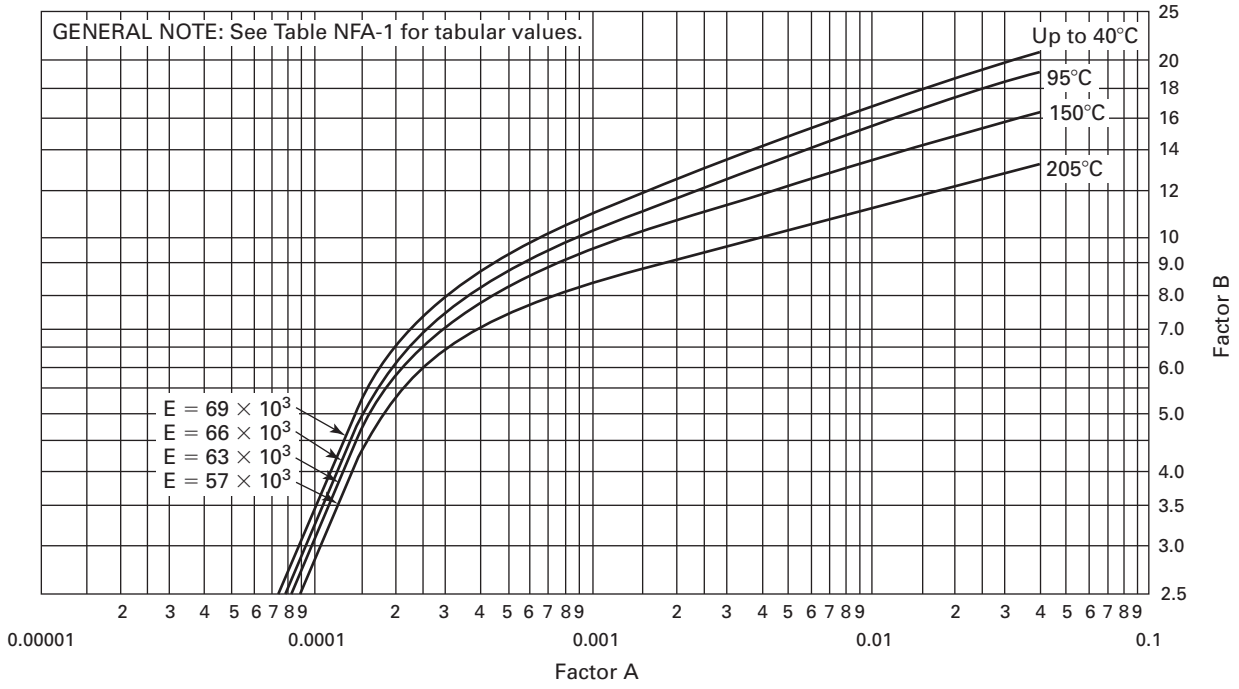


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3003 in O Temper



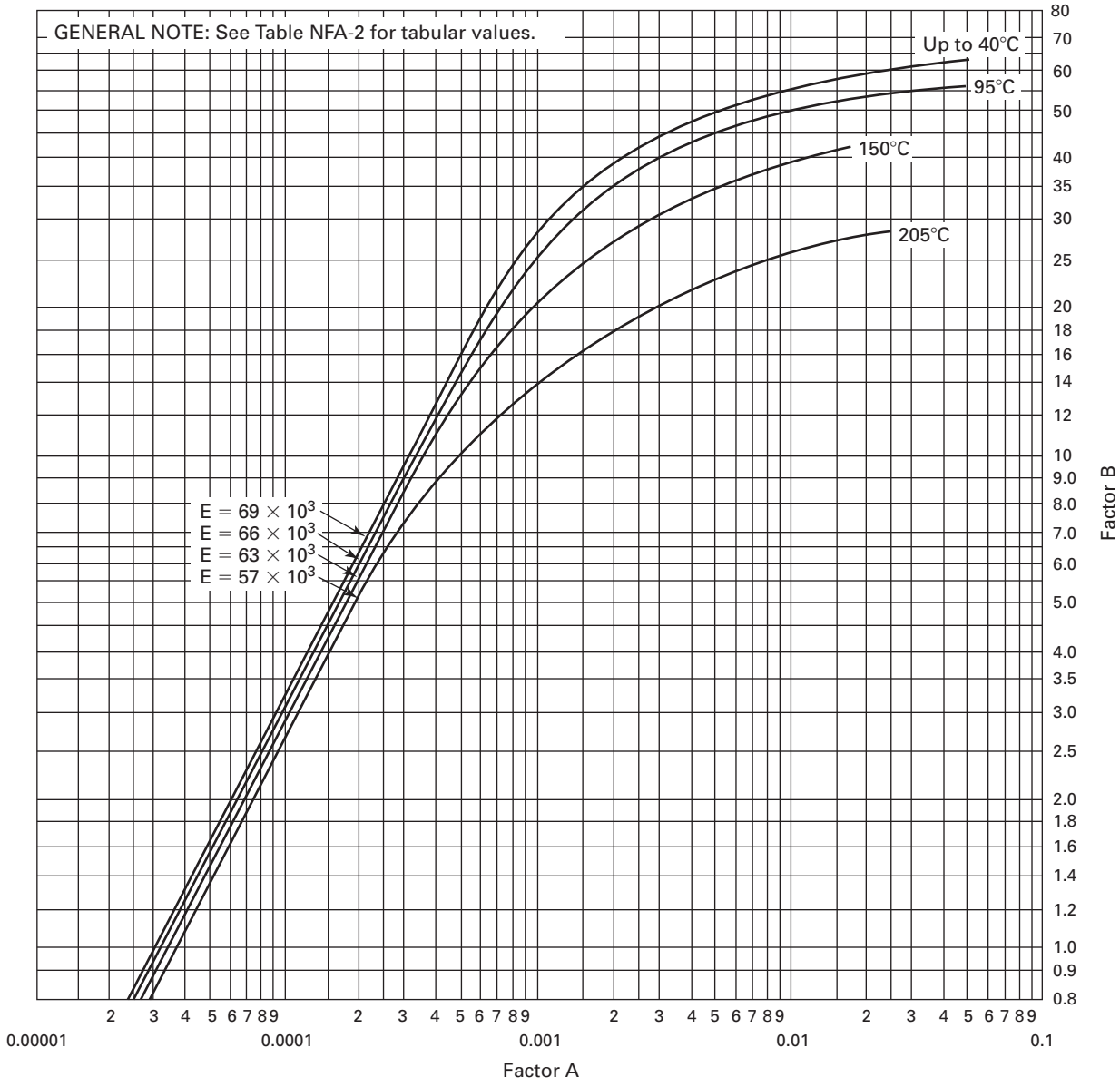
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) For Section III application, maximum use limit is 120°C, except for SB-209/3003/H112/6–12.7 and 13–75 mm use limits are 150°C and 95°C, respectively. Use 150°C curve for interpolation only.

Figure NFA-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3003 in H14 Temper



GENERAL NOTES:

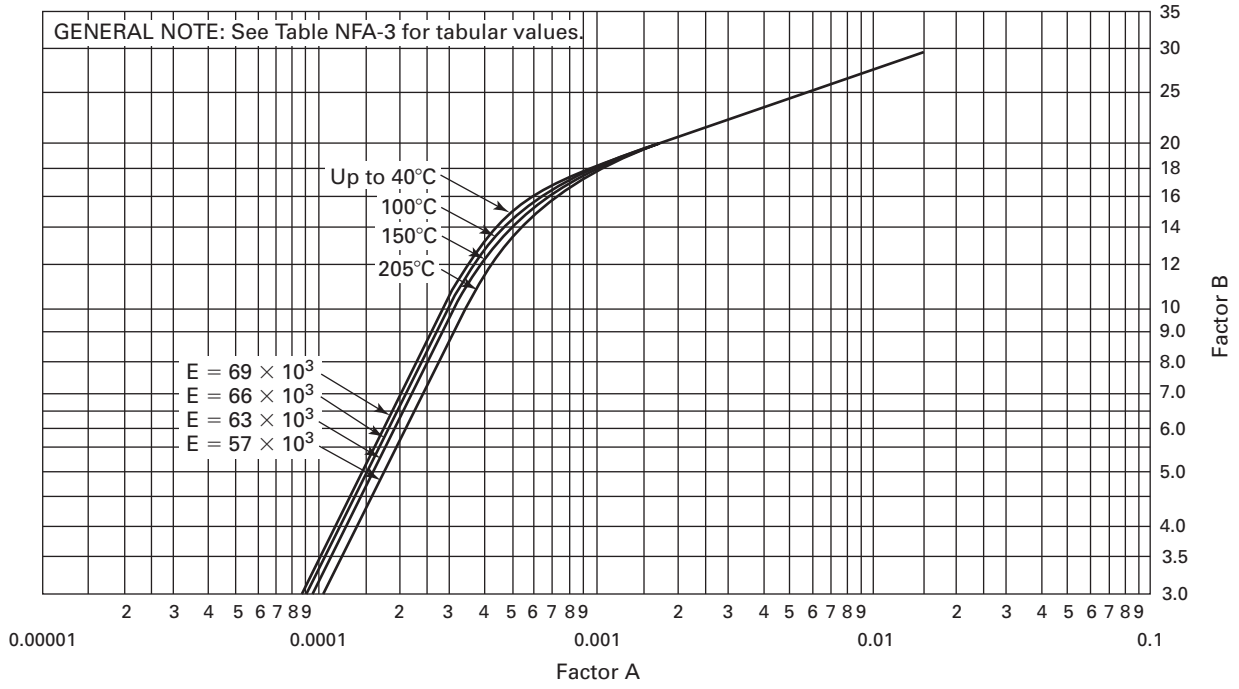
(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) For Section III application, maximum use limit is 120°C, except for SB-209/3003/H112/6–12.7 and 13–75 mm use limits are 150°C and 95°C, respectively. Use 150°C curve for interpolation only.

(d) This chart is not to be used for welded construction.

Figure NFA-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3004 in O Temper

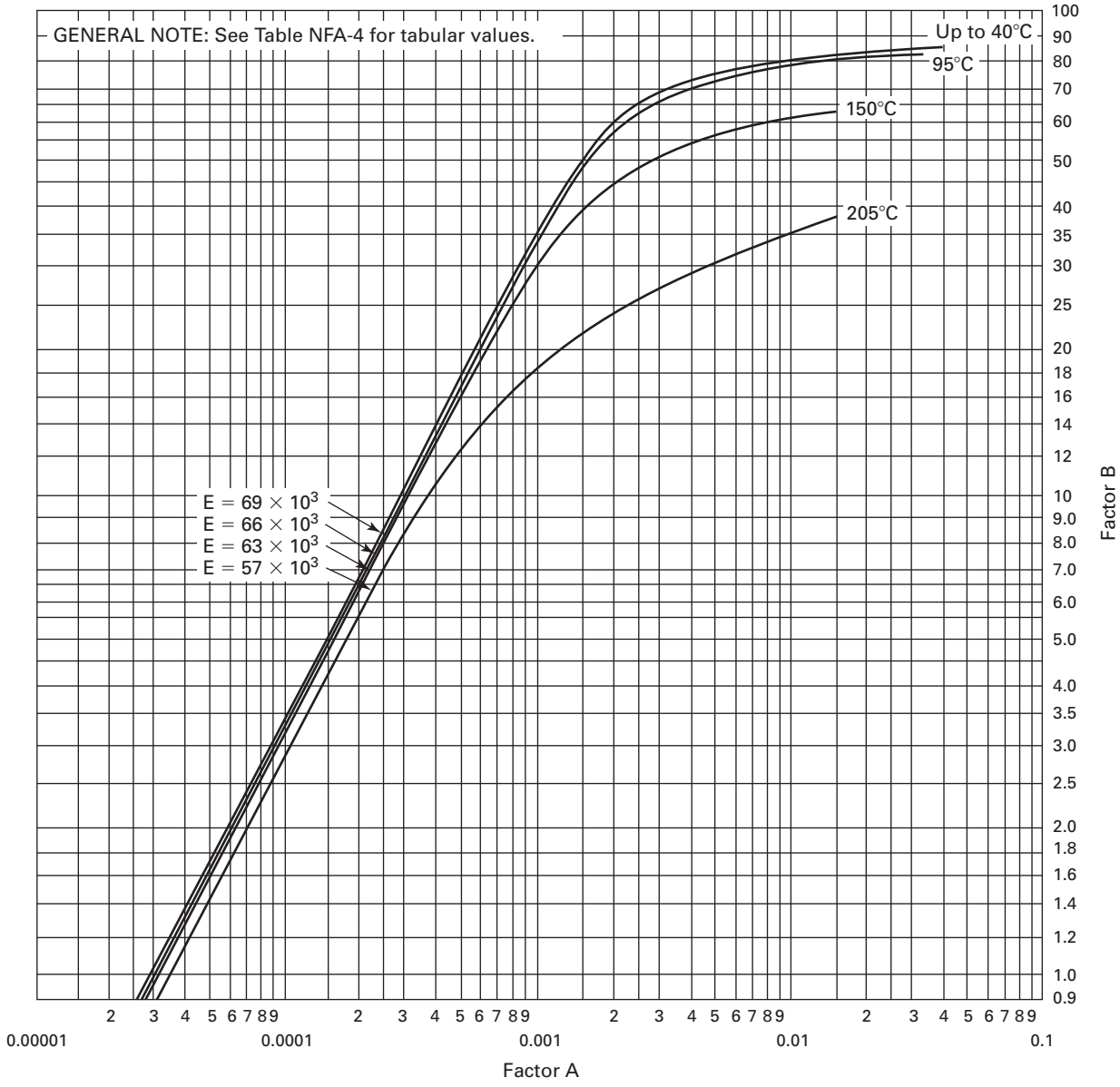


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3004 in H34 Temper



GENERAL NOTES:

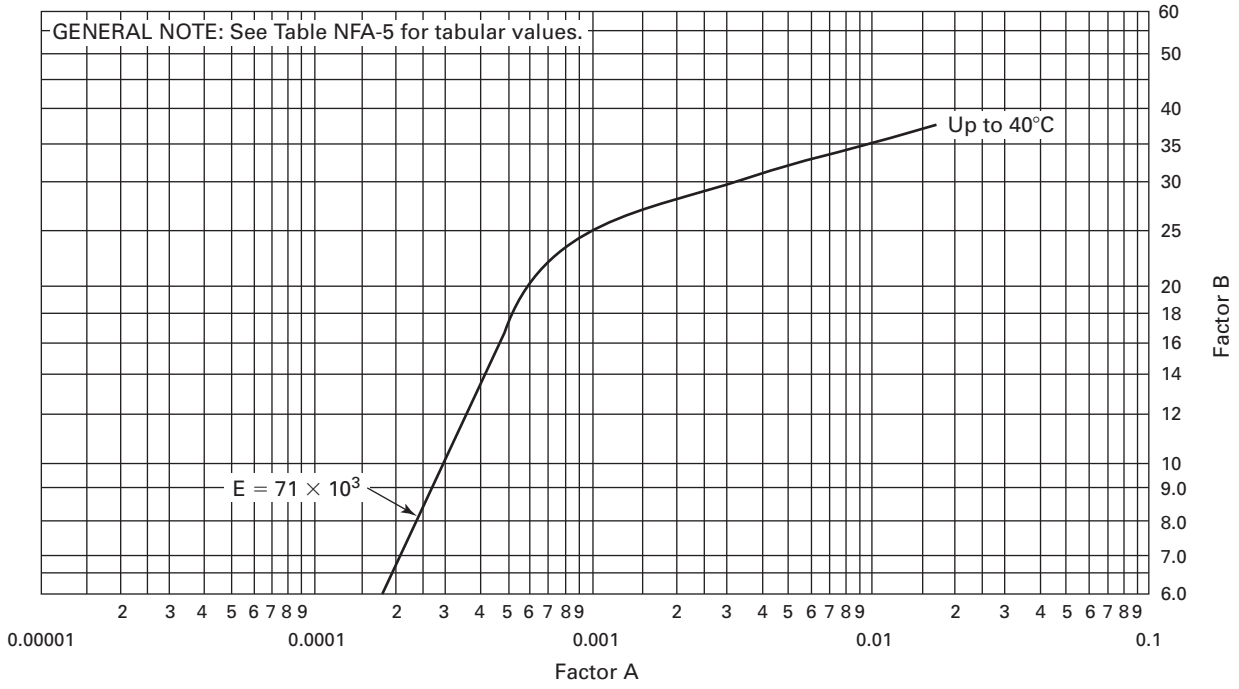
(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) For Section III application, maximum use limit is 120°C, except for SB-209/3003/H112/6–12.7 and 13–75 mm use limits are 150°C and 95°C, respectively. Use 150°C curve for interpolation only.

(d) This chart is not to be used for welded construction.

Figure NFA-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5154 in O Temper

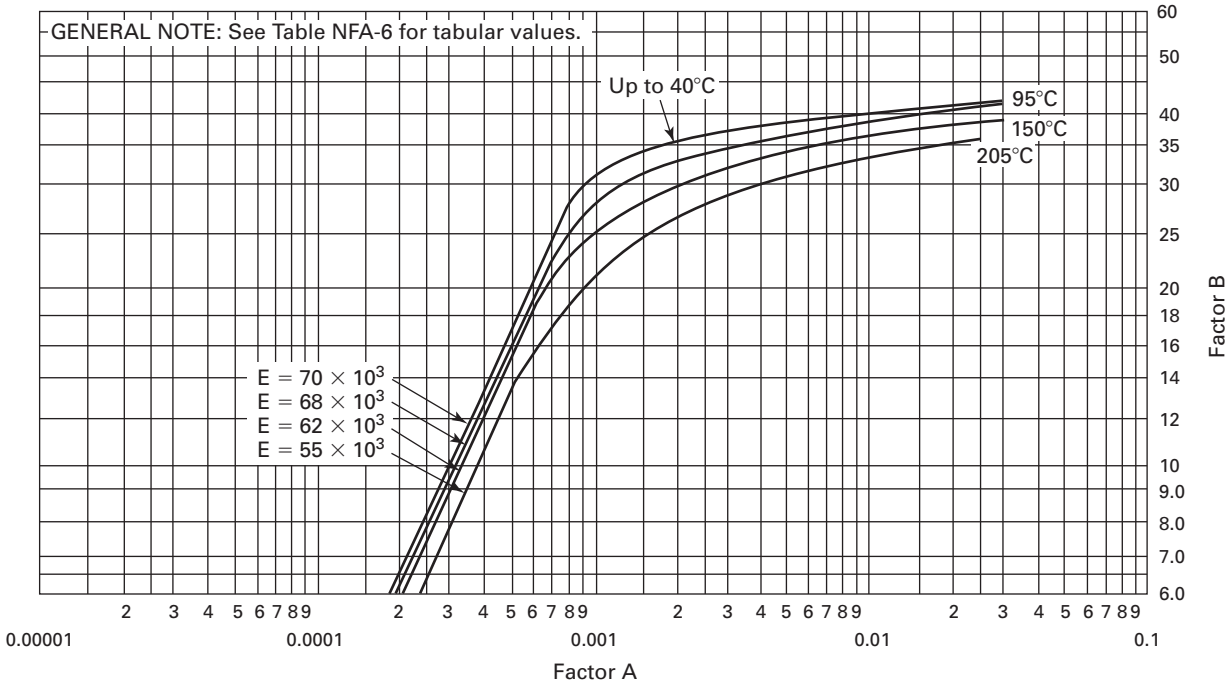


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5454 in O Temper

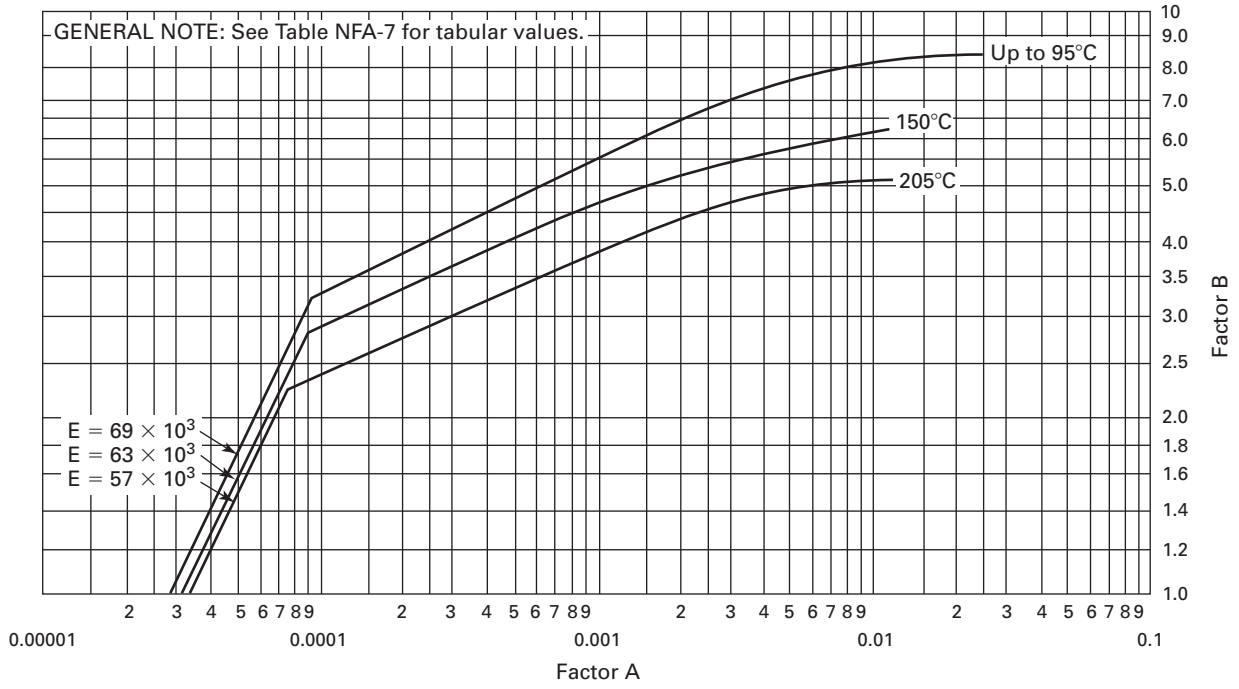


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 1060 in O Temper



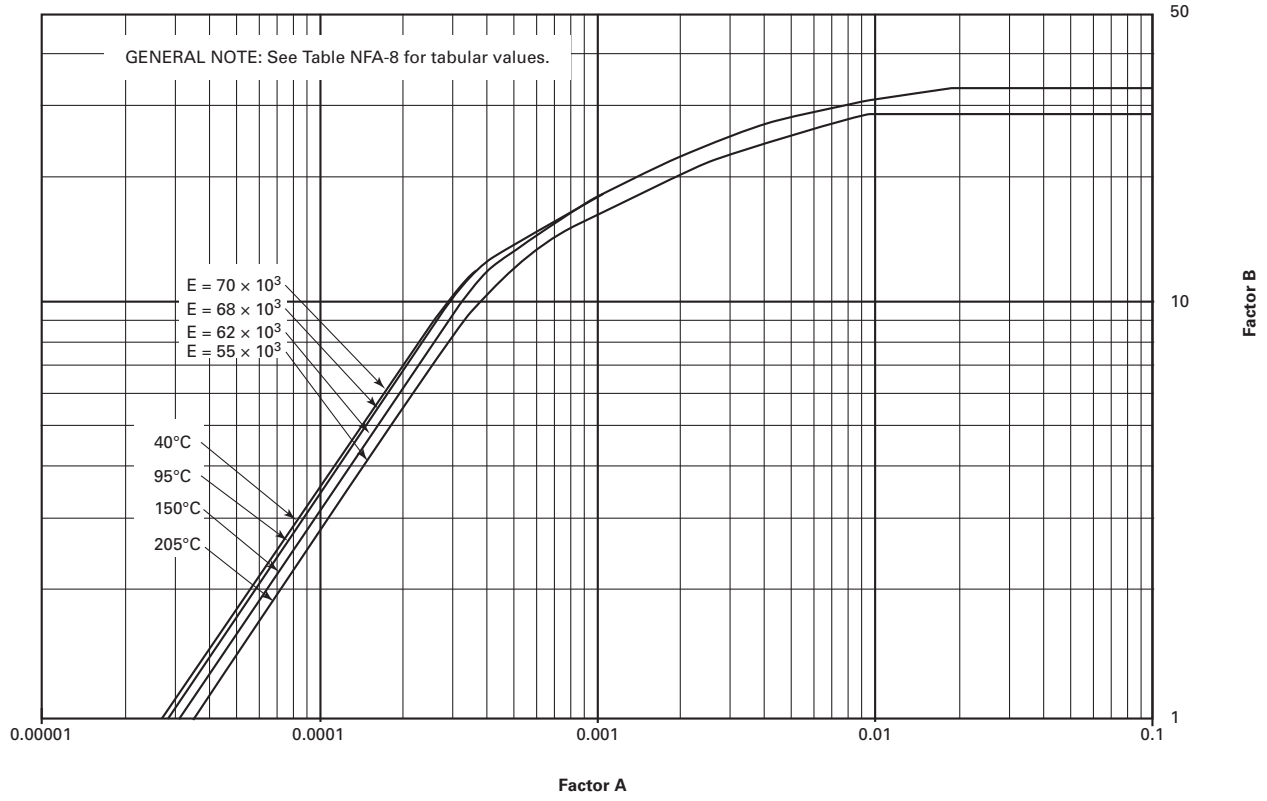
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(13)

Figure NFA-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5052 in O Temper



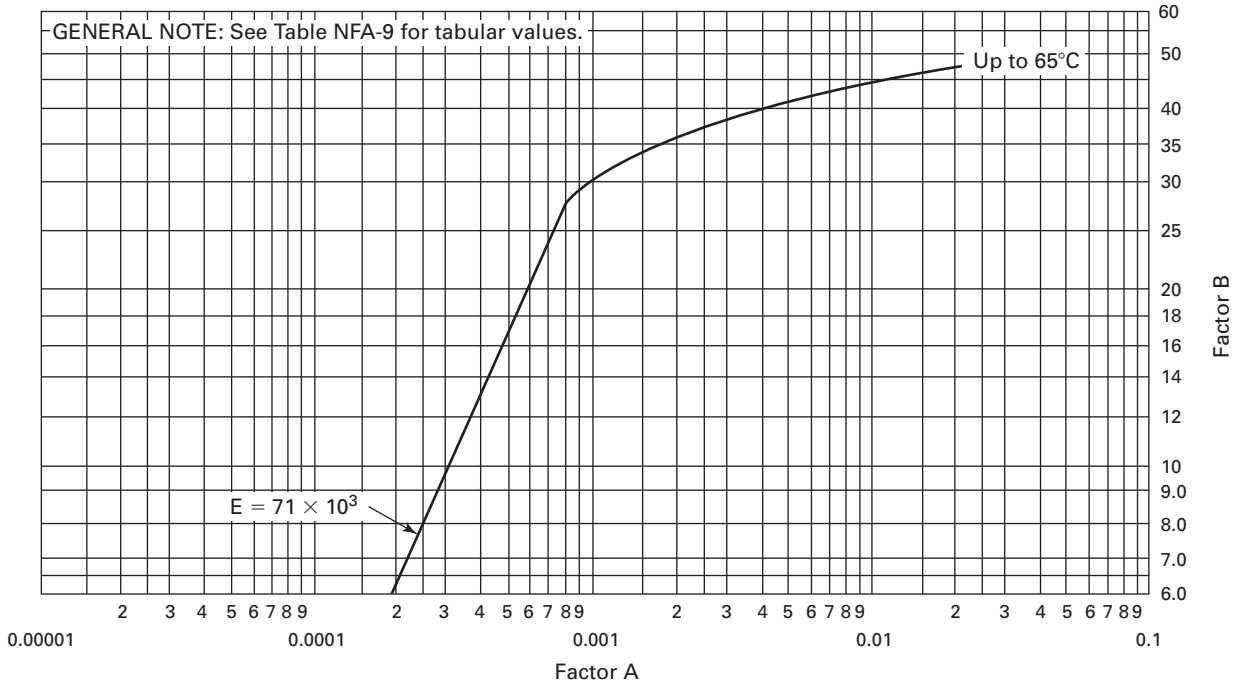
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) For Section III application, maximum use limit is 120°C, except for SB-210 use limit is 150°C. Use 150°C curve for interpolation only.

Figure NFA-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5086 in O Temper

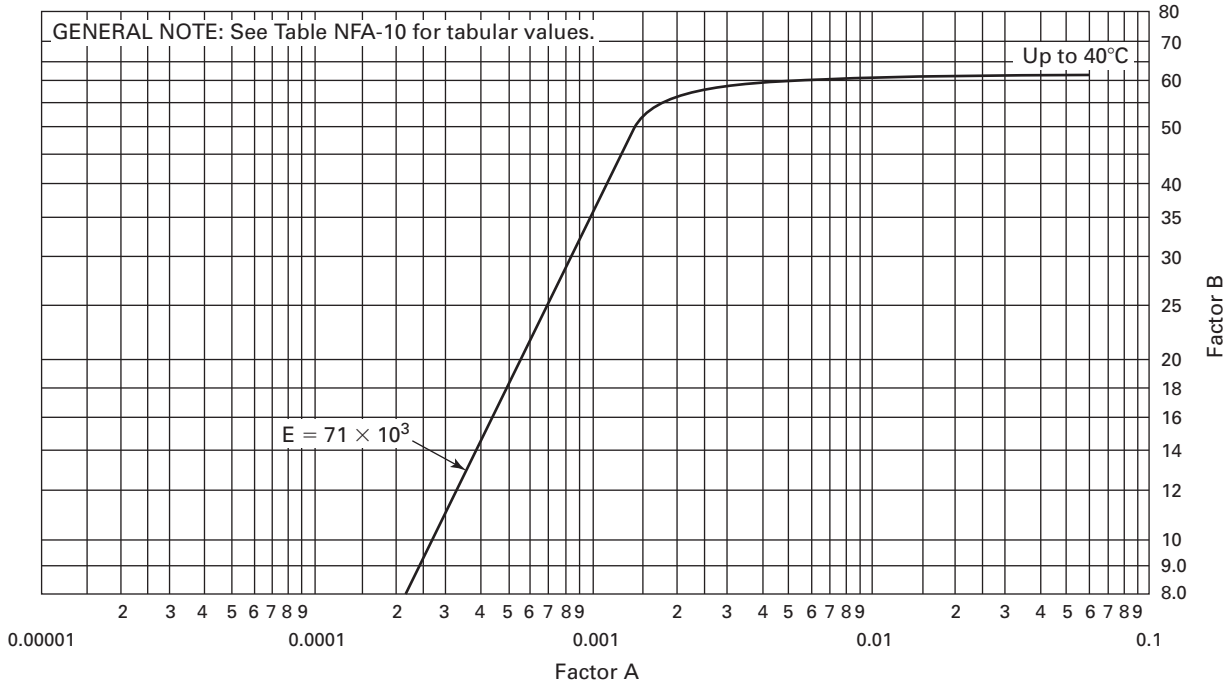


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-10
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5456 in O Temper

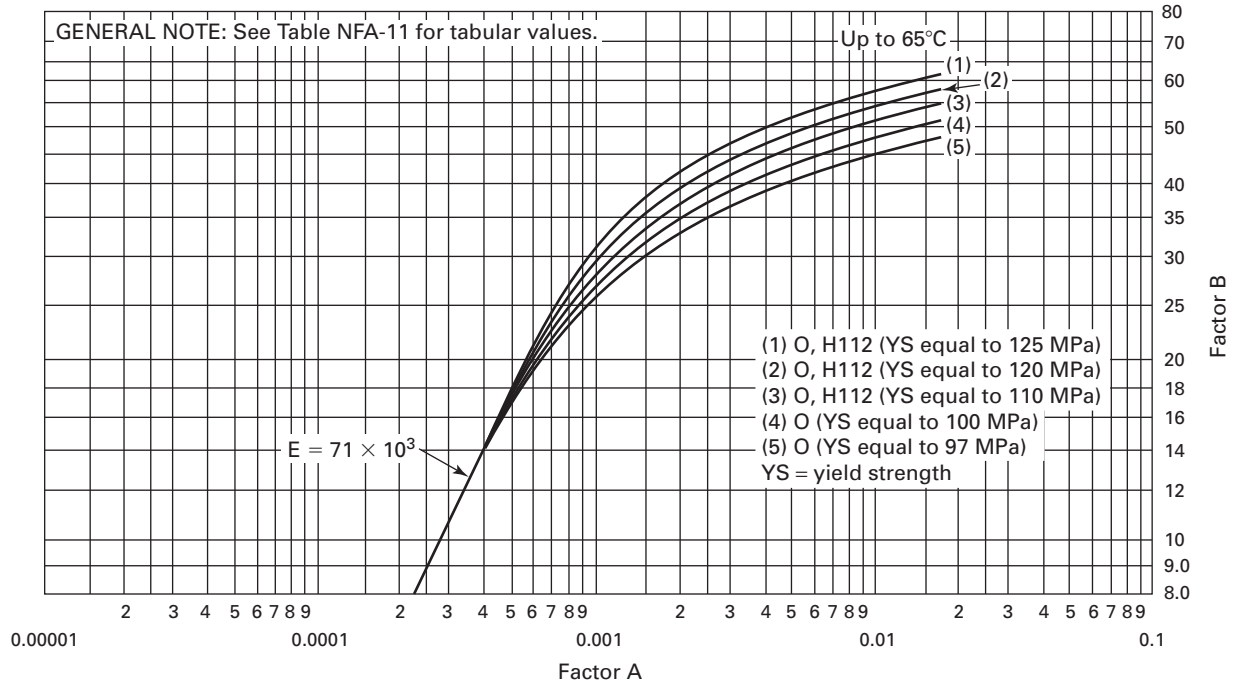


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-11
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5083 in O Temper

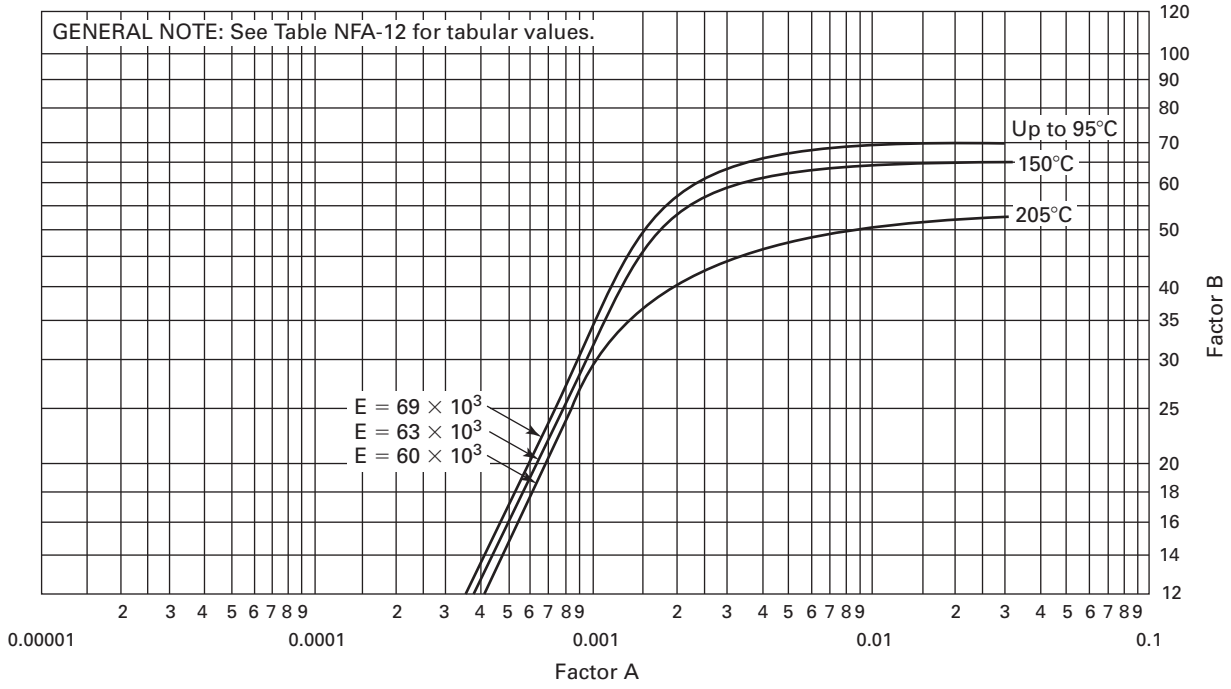


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-12
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Aluminum Alloy 6061-T6

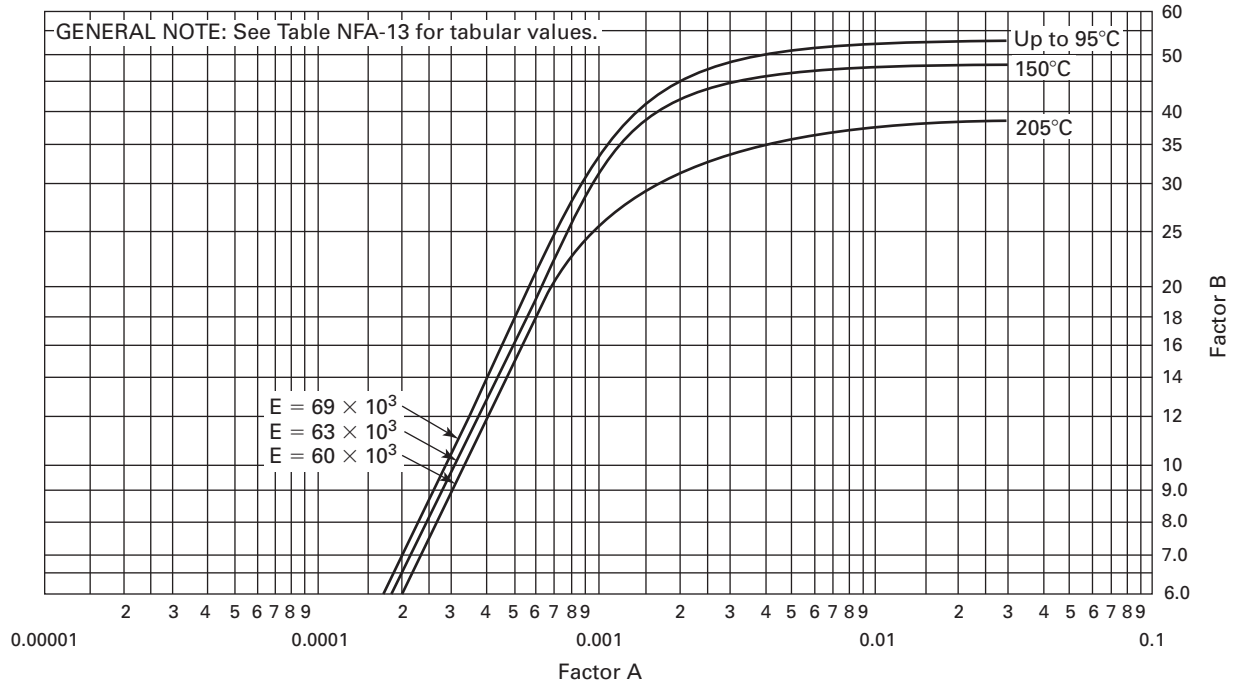


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFA-13
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Aluminum Alloy 6061-T4

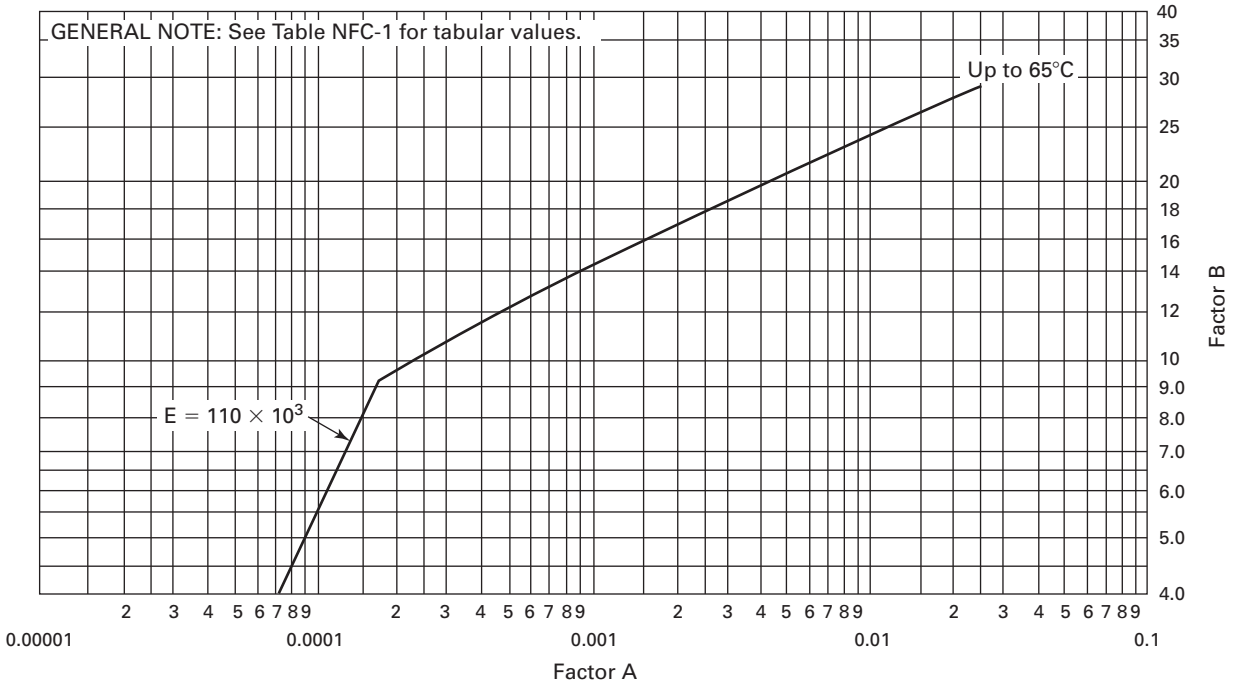


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Copper, Type DHP

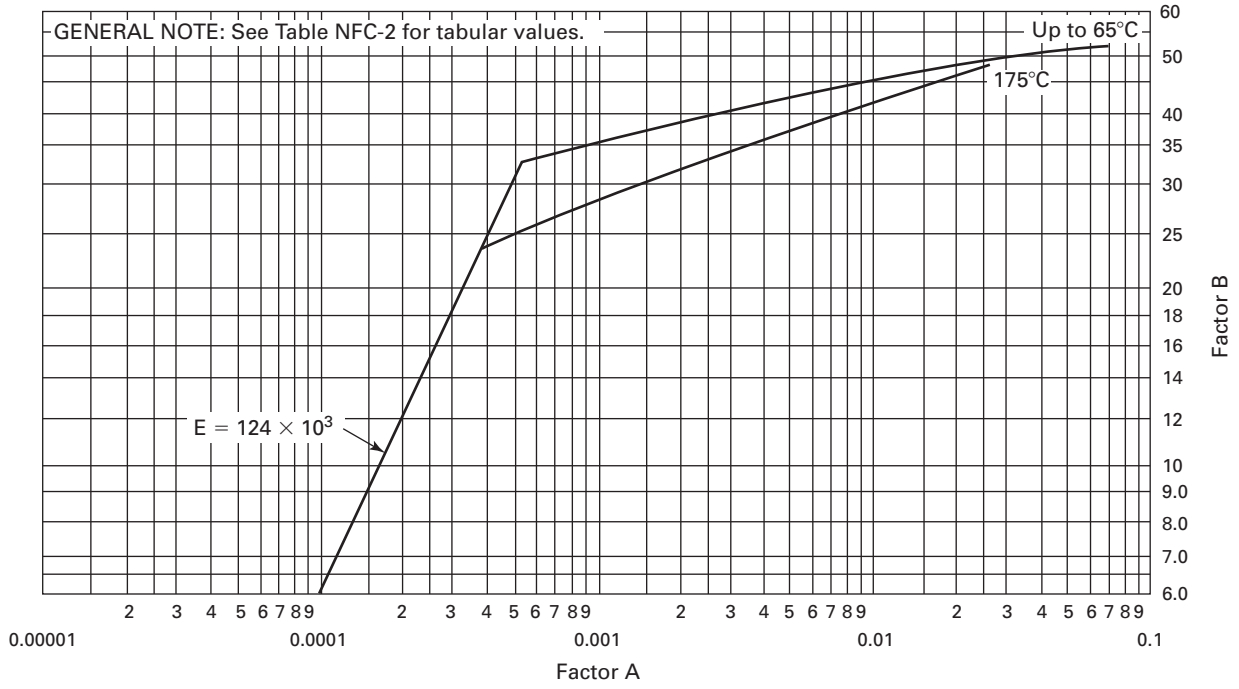


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Copper–Silicon Alloys A and C

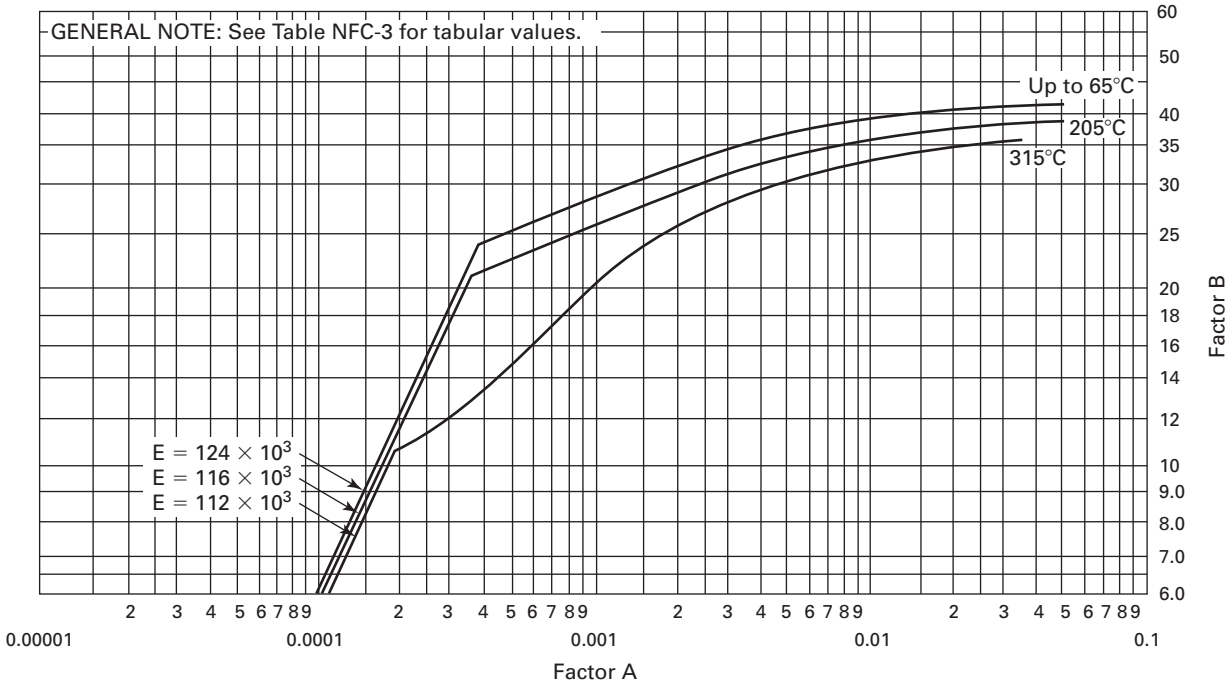


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed 90–10 Copper–Nickel Alloy

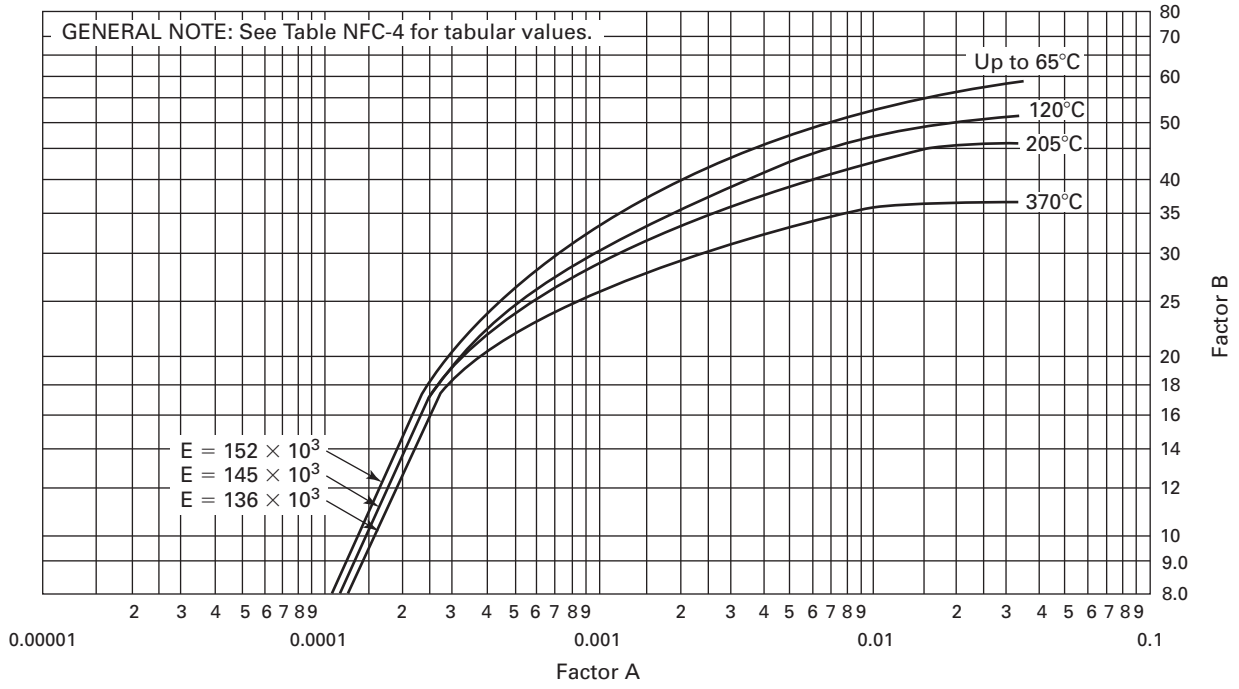


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed 70–30 Copper–Nickel Alloy

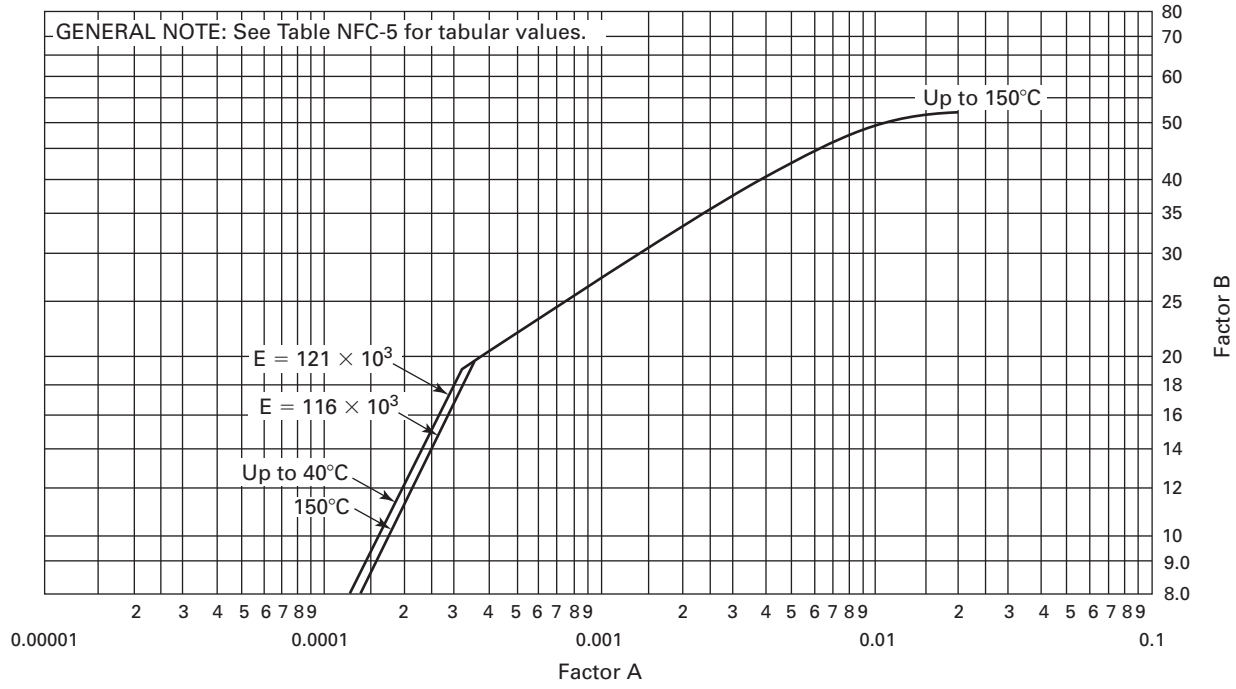


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Copper–Iron Alloy Tube C19400 (SB-543 Welded)

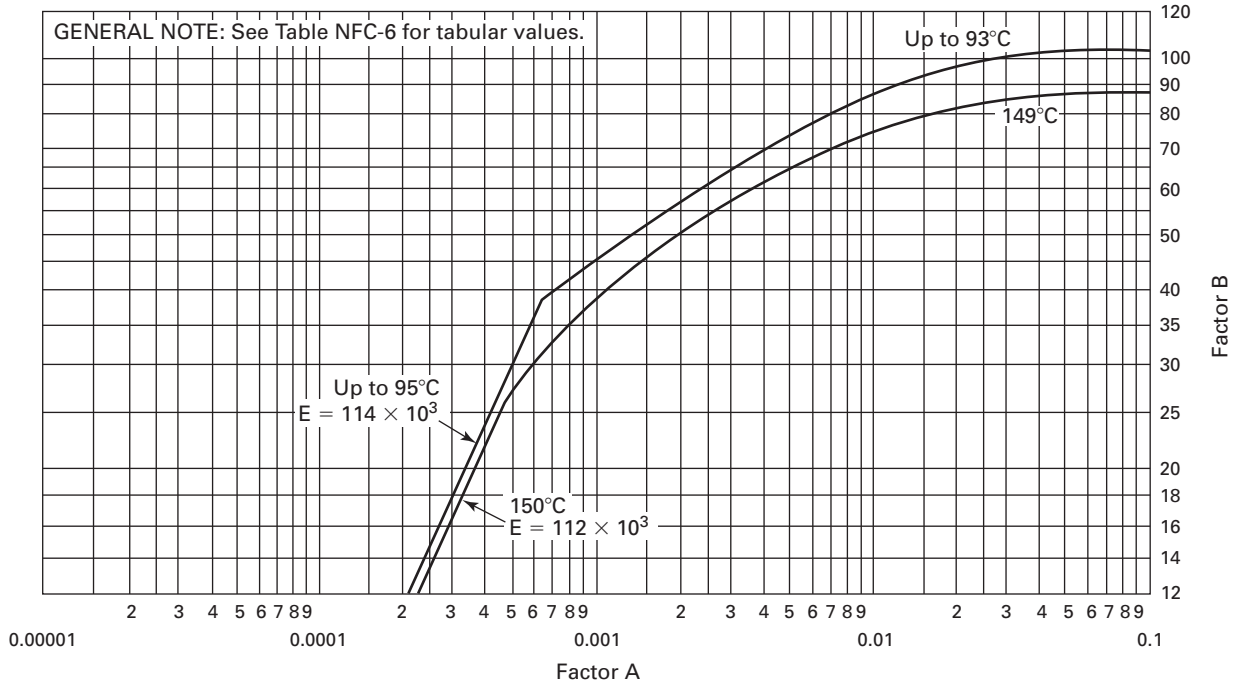


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SB-75 and SB-111 Light Drawn Seamless Copper Tubes, Alloys C10200, C12000, C12200, and C14200

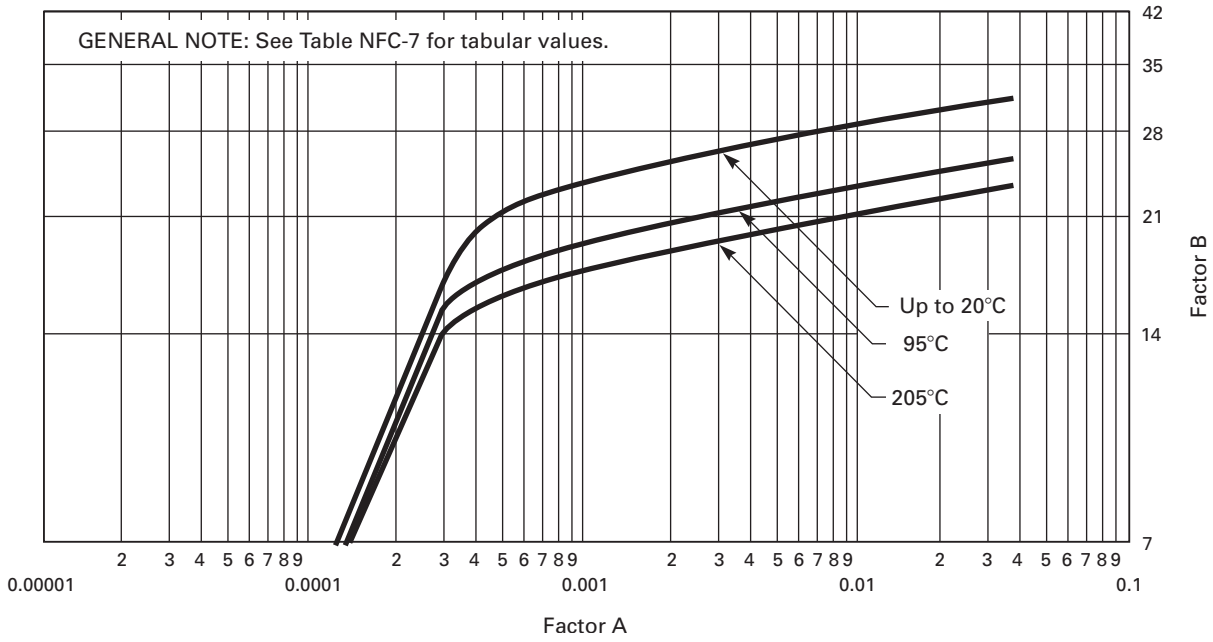


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFC-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Copper, SB-75, UNS C12200, Temper 050



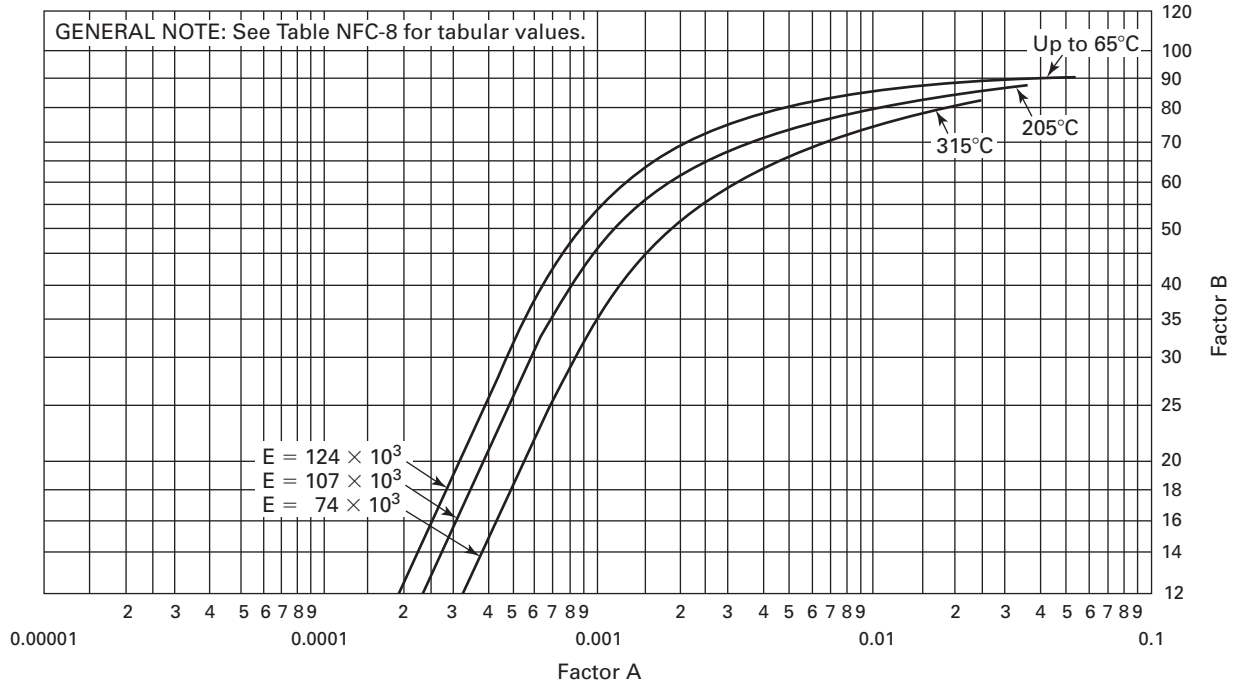
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) Use tabular data in Table NFC-7 for values of Factor A to the left of each curve.

Figure NFC-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Bronze Alloy C61400

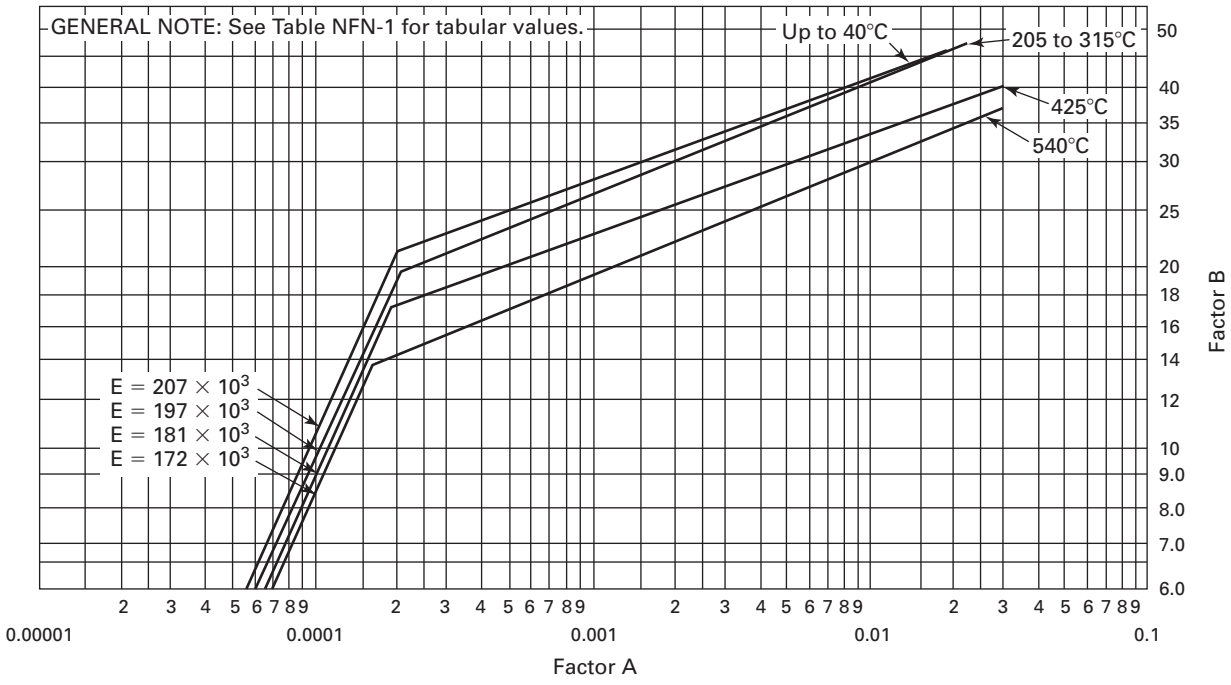


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Low Carbon Nickel N02201

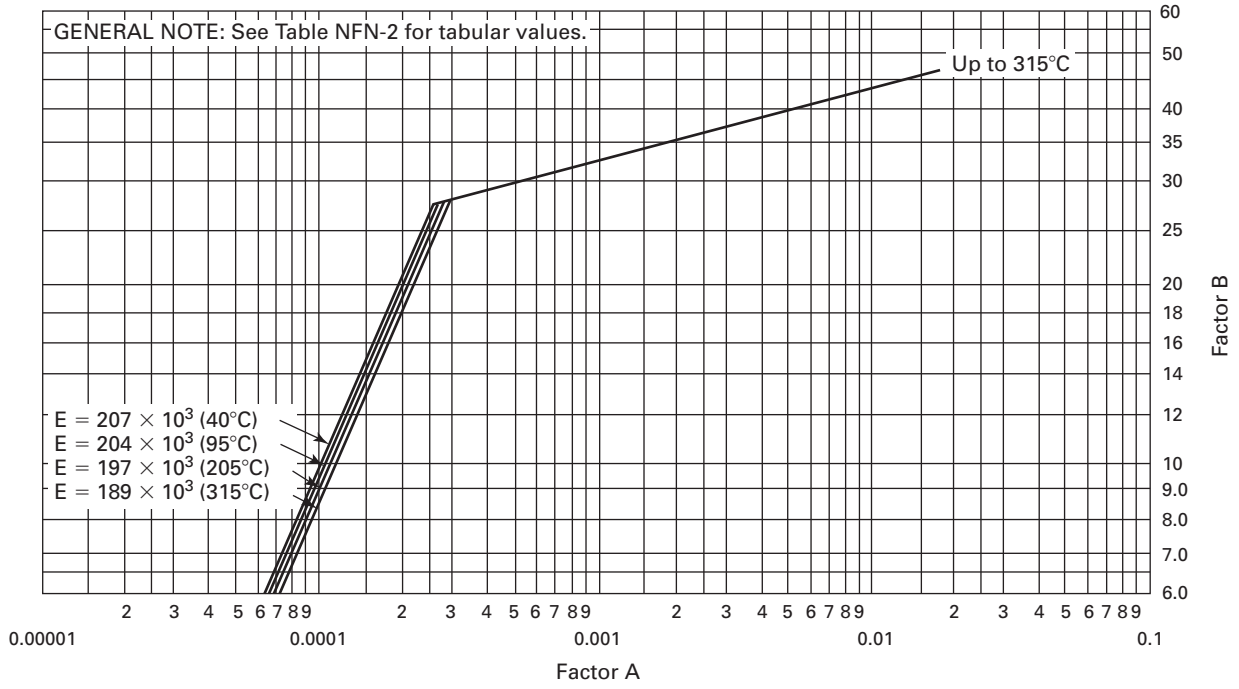


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel N02200

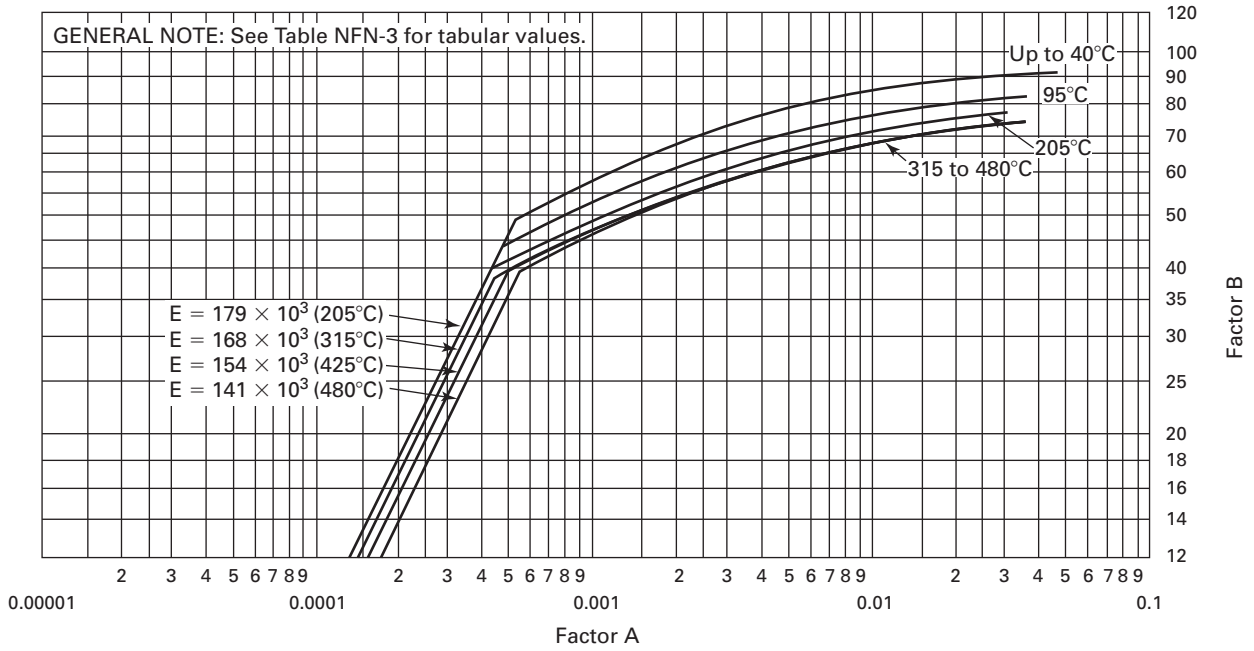


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel–Copper Alloy N04400

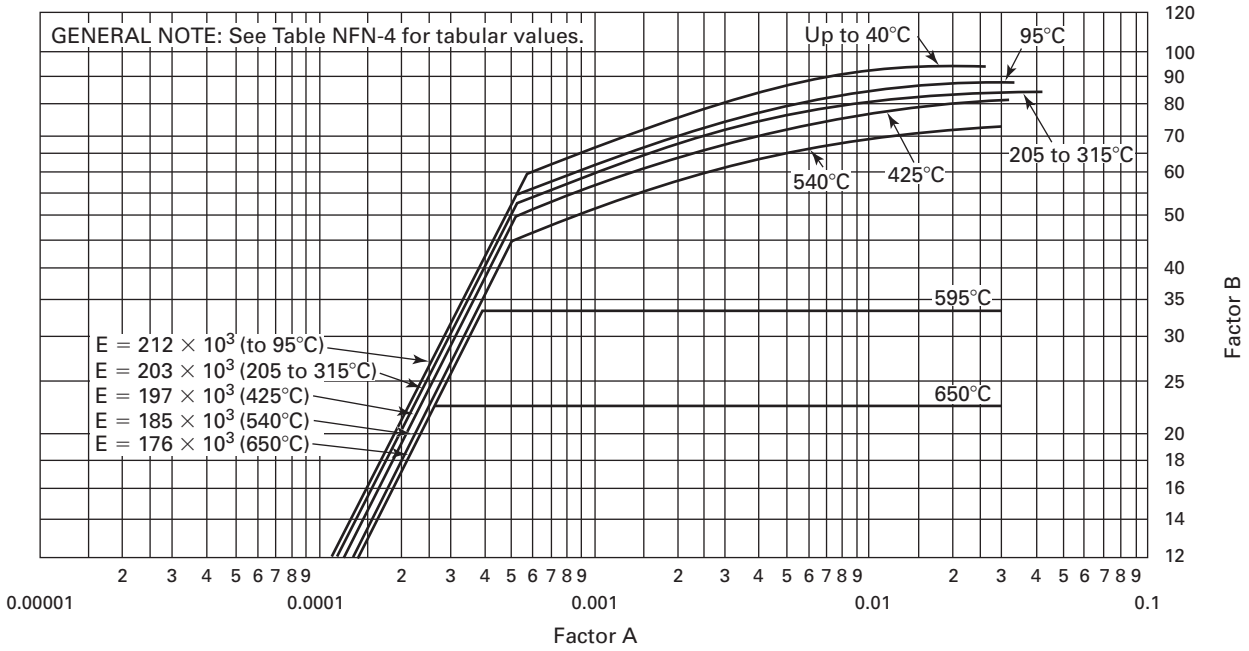


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel–Chromium–Iron Alloy N06600

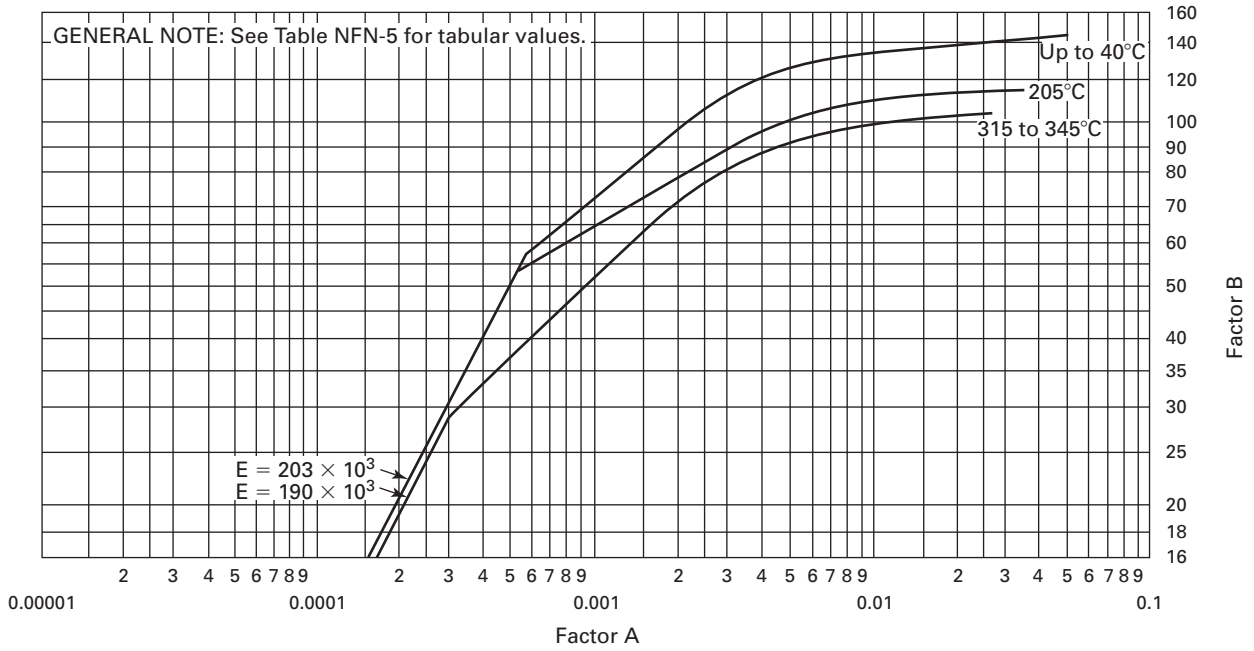


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum Alloy N10001

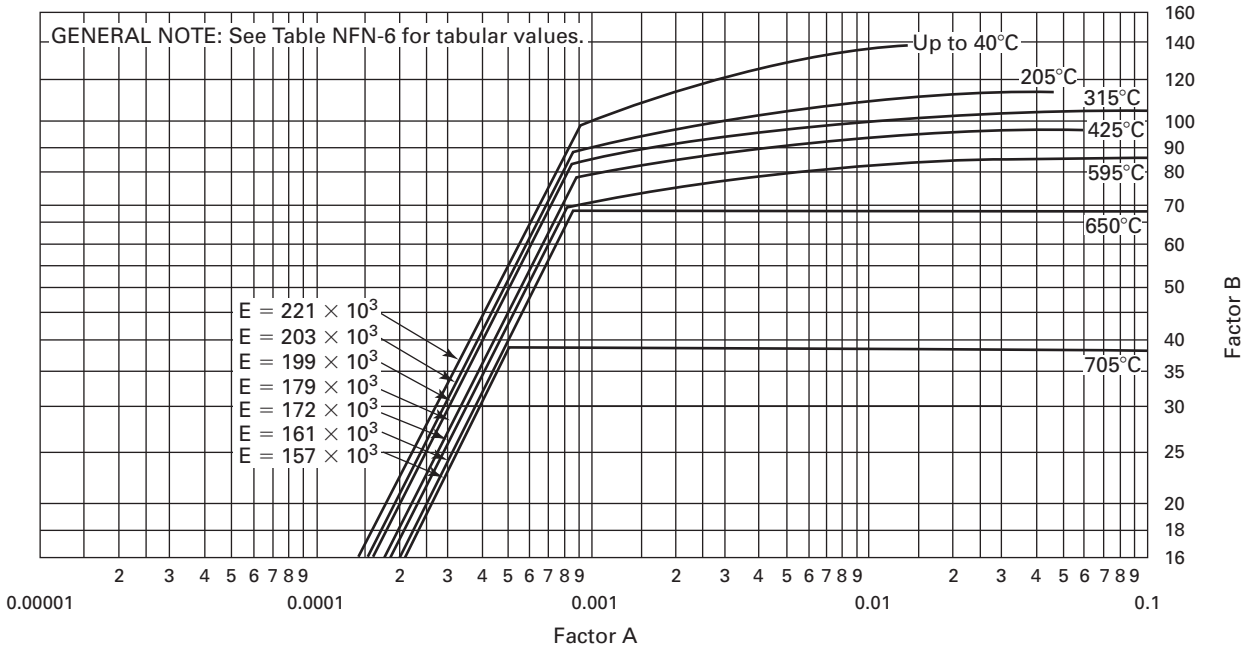


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron Alloy N10003

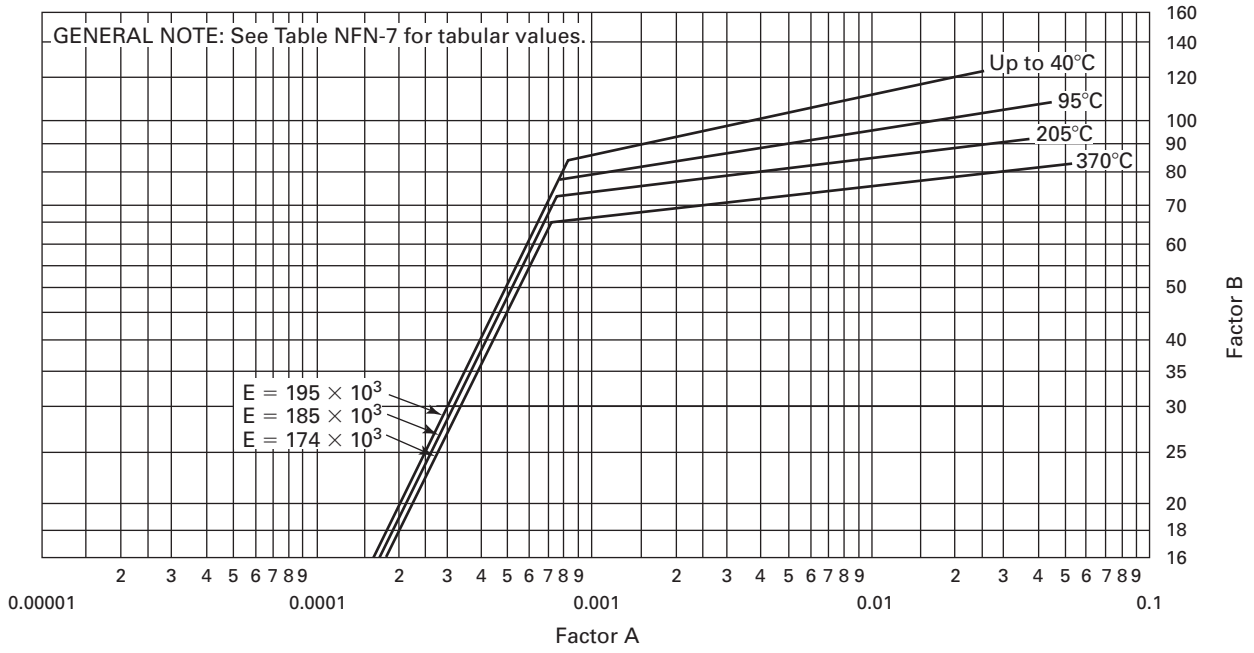


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Iron–Chromium–Molybdenum–Copper Alloy N08825

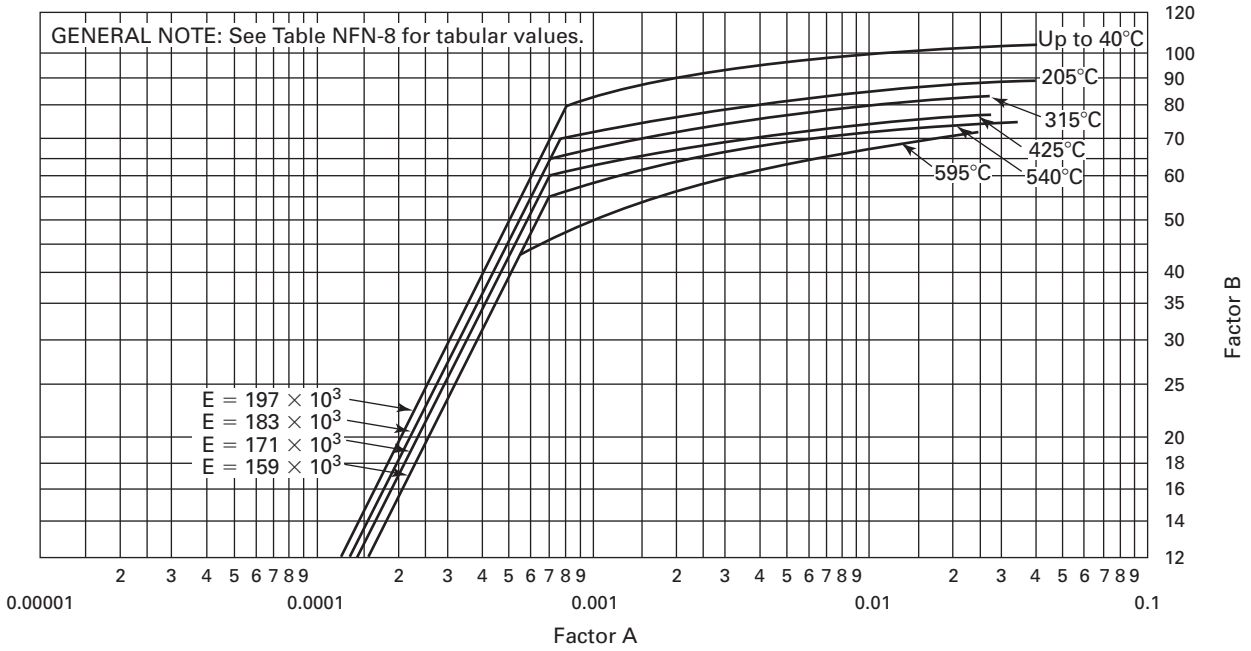


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel–Iron–Chromium Alloy N08800

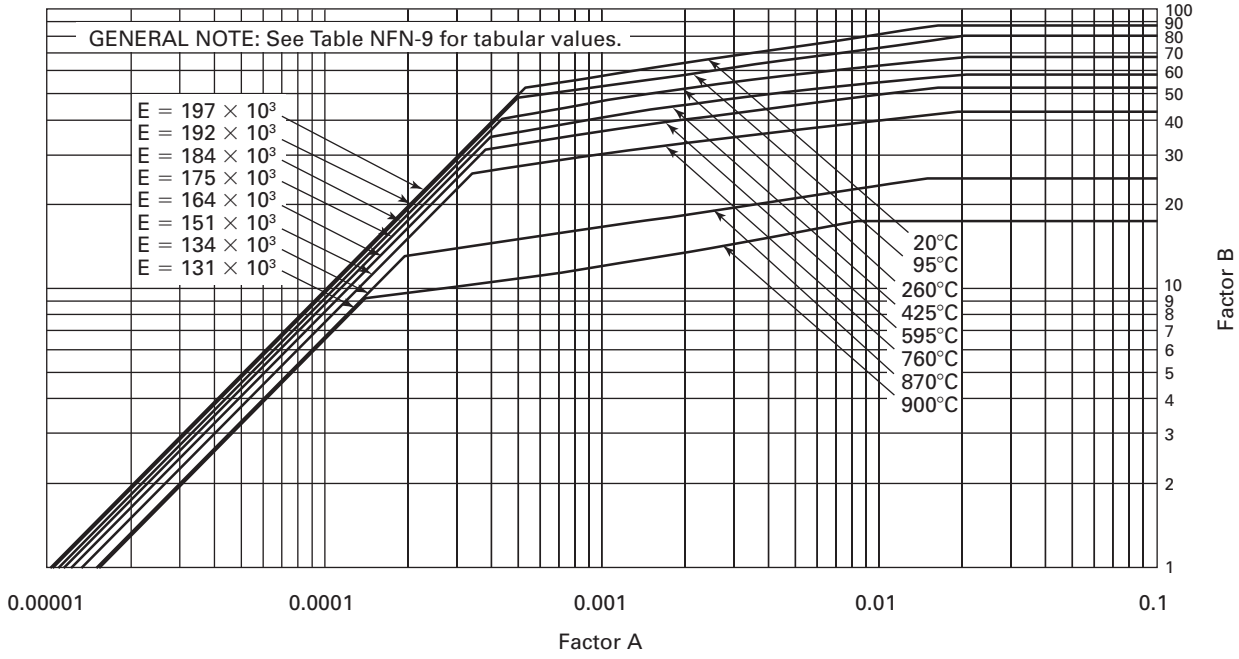


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel–Iron–Chromium Alloy N08810

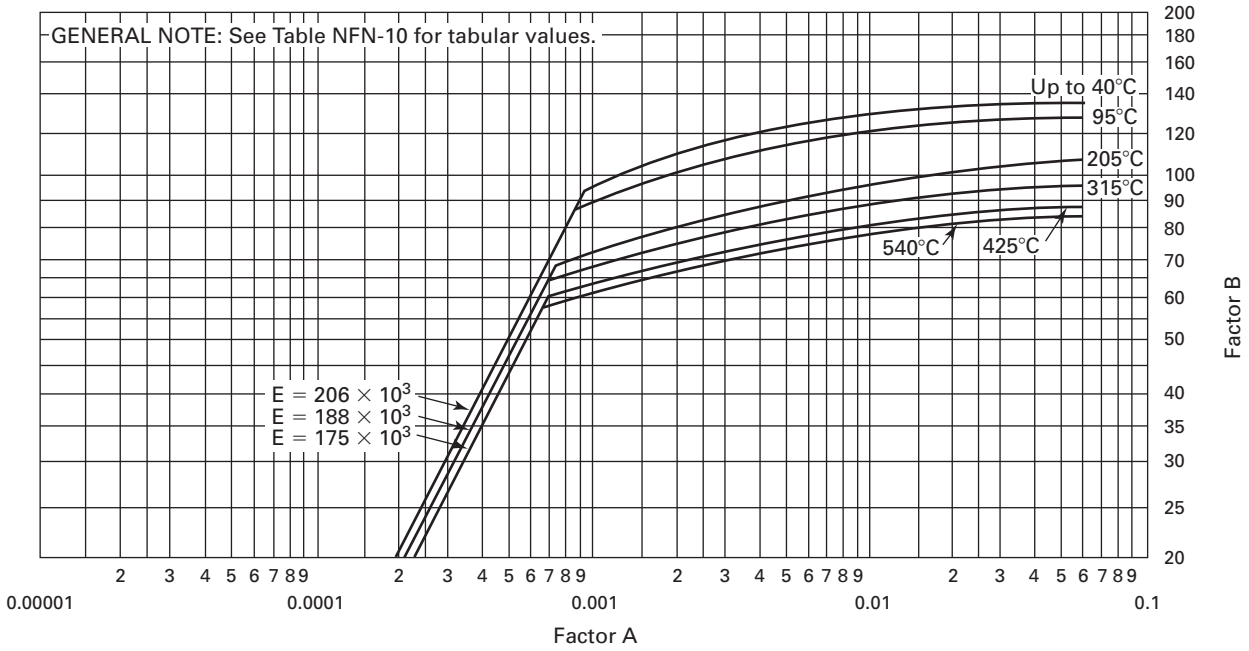


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-10
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Low Carbon Nickel–Molybdenum–Chromium Alloy N10276

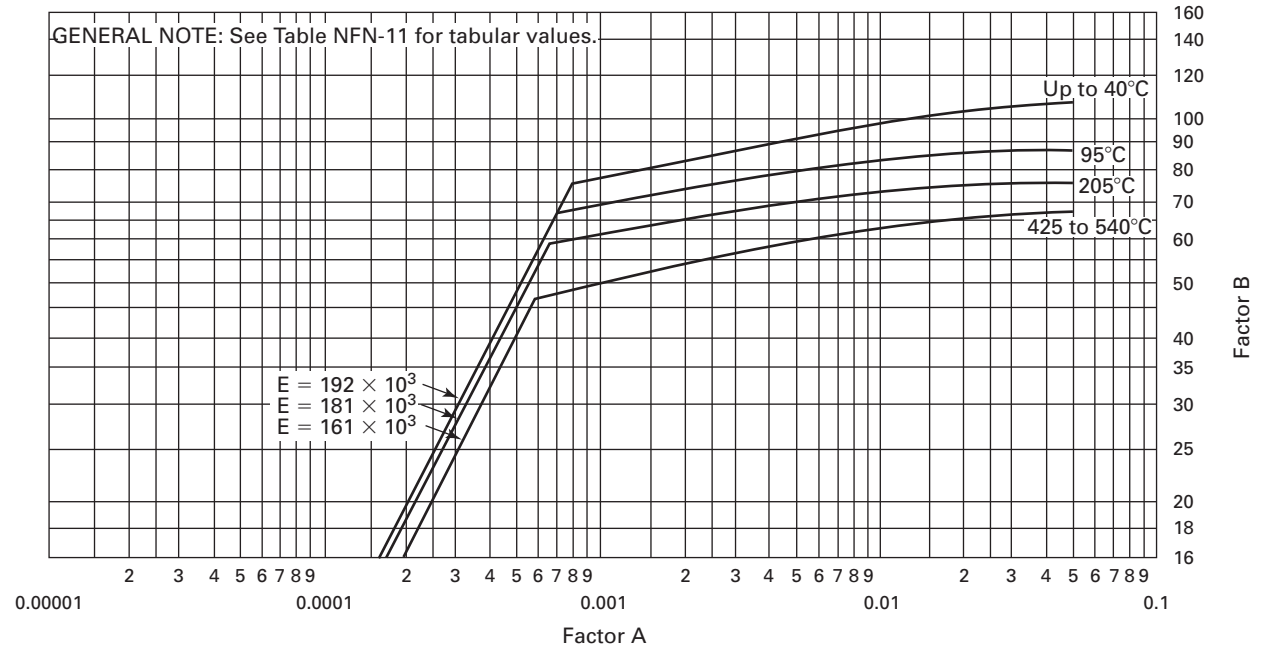


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-11
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution Treated Nickel–Chromium–Iron–Molybdenum–Copper Alloy N06007

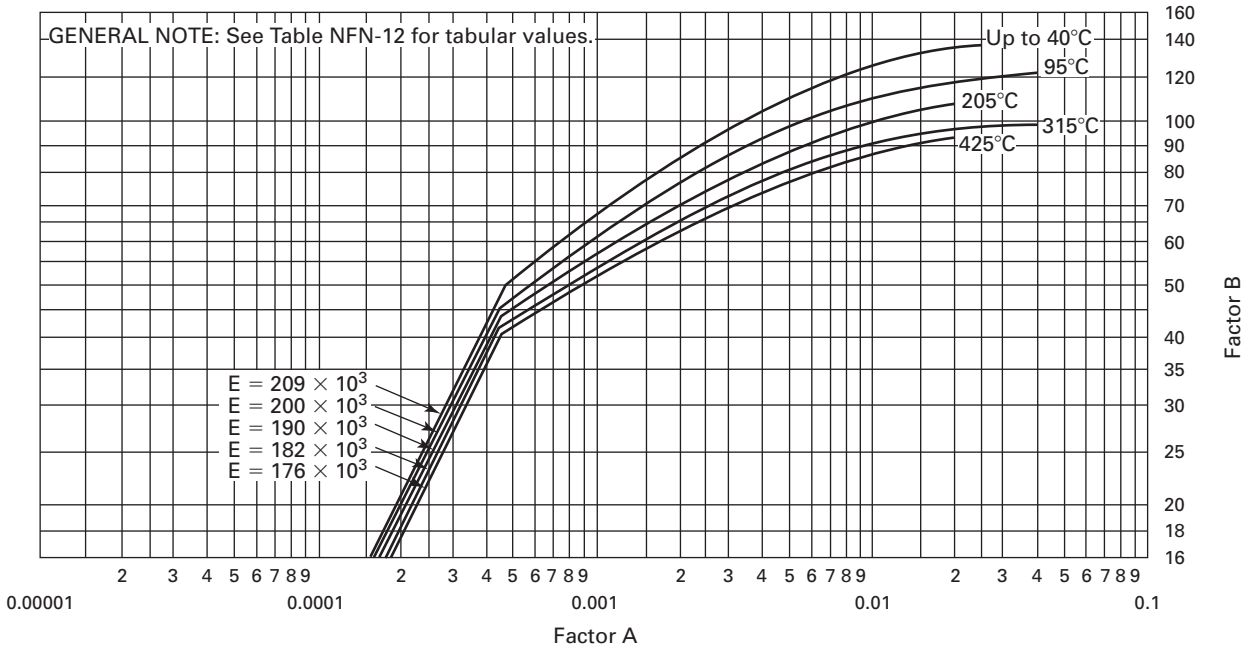


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-12
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Chromium–Nickel–Iron–Molybdenum–Copper–Columbium Alloy N08020

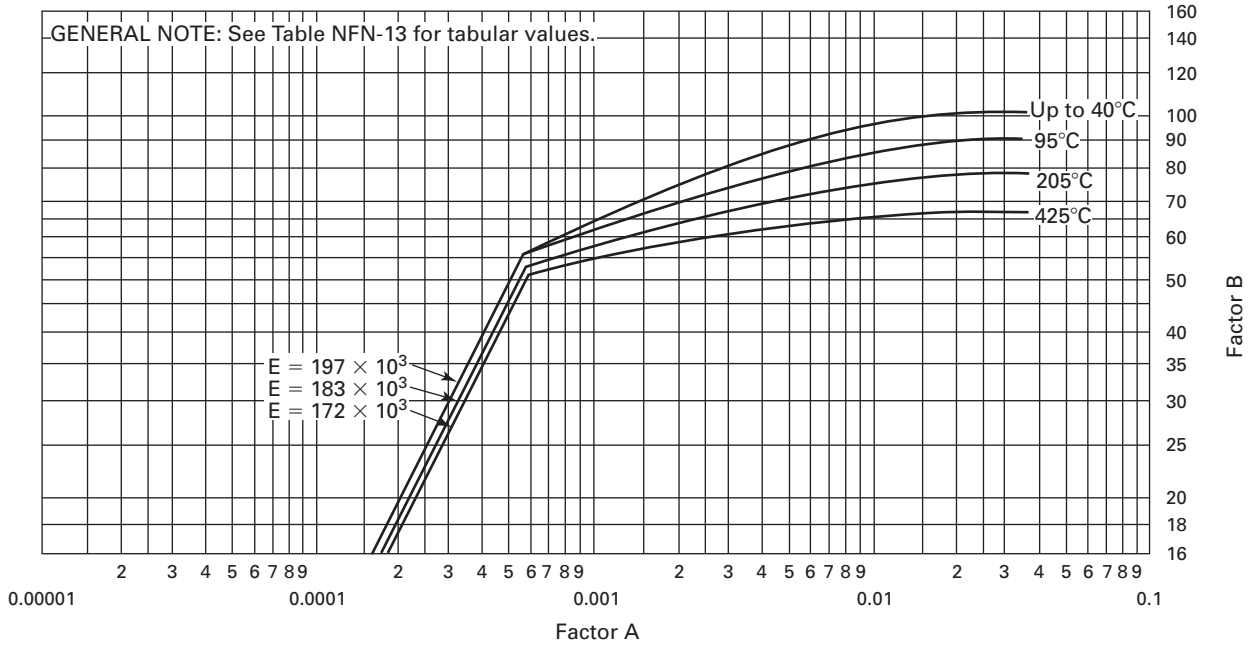


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-13
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Iron–Chromium–Silicon Alloy N08330

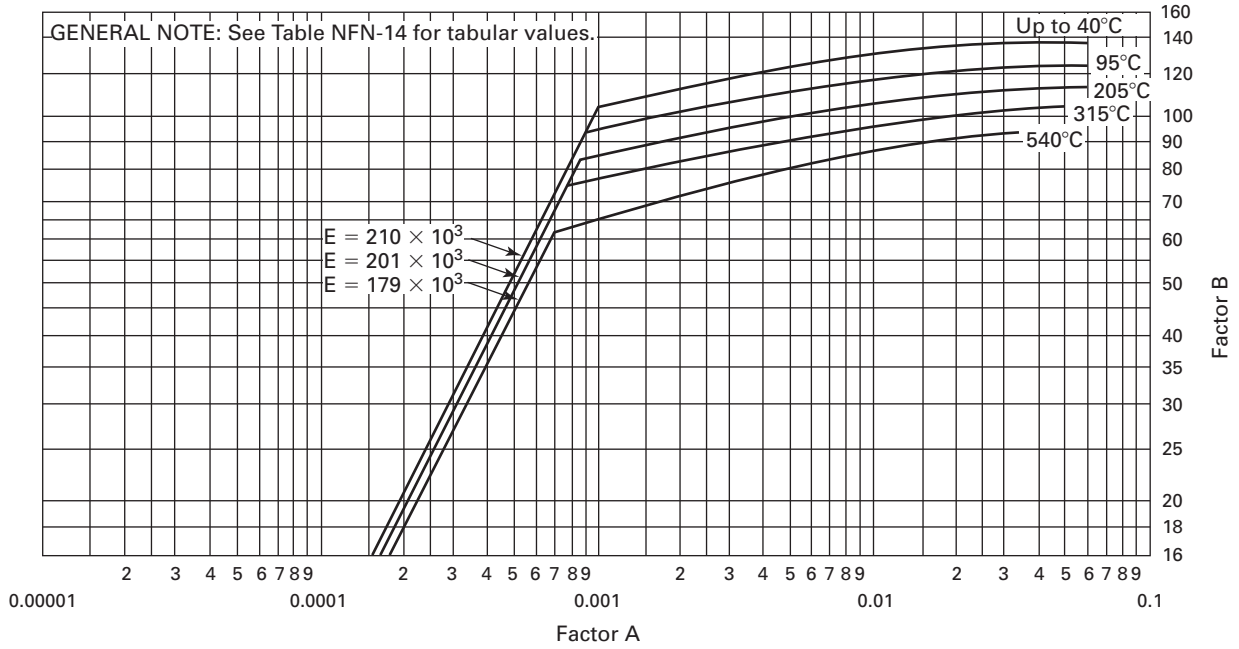


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-14
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Chromium–Molybdenum Alloy N06455

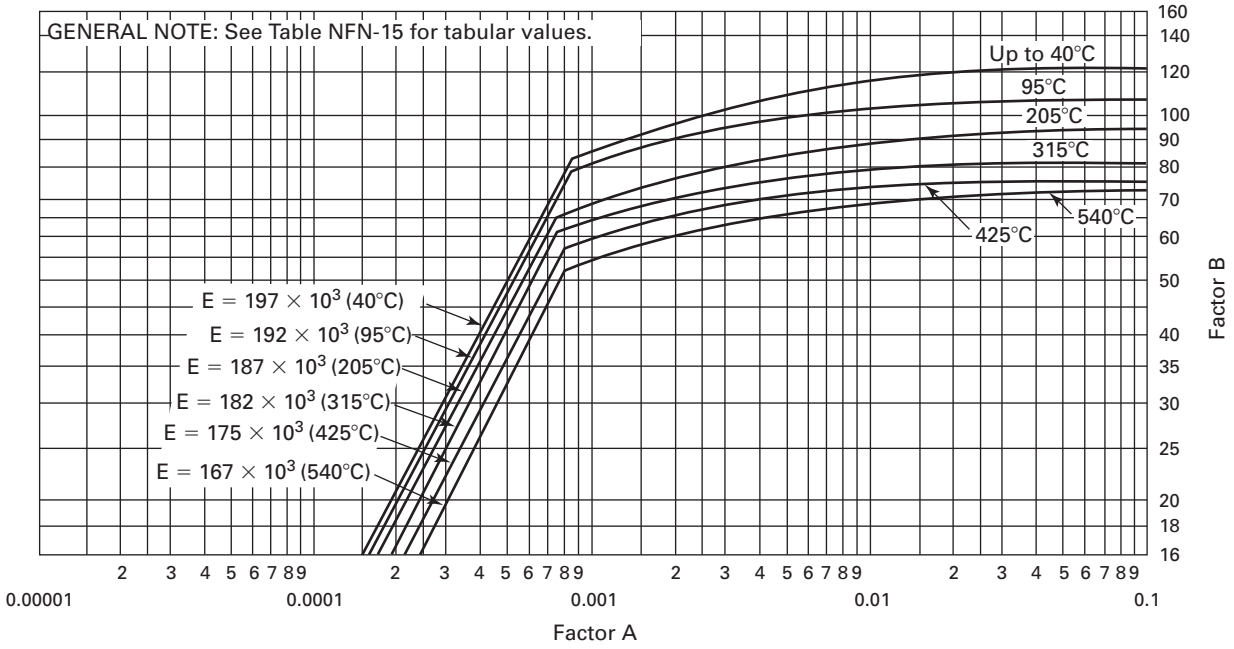


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-15
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum Alloy N06002

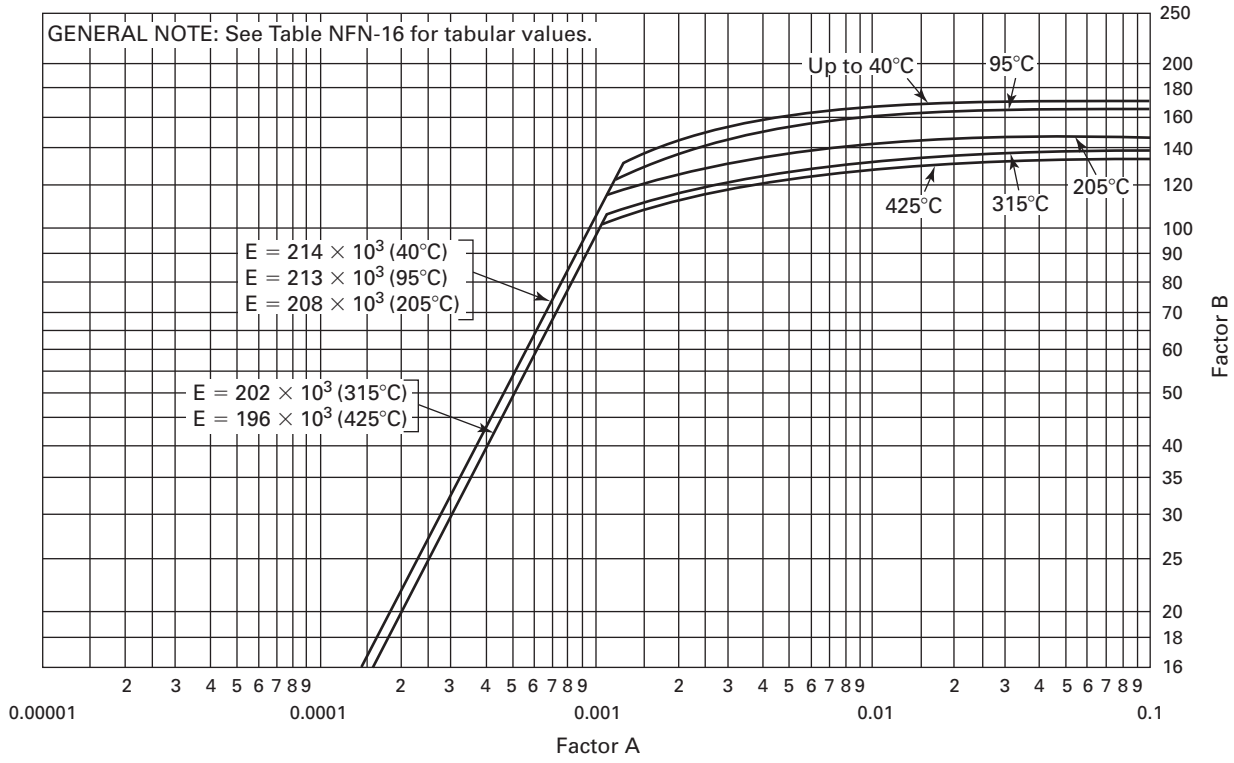


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-16
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum Alloy N10665



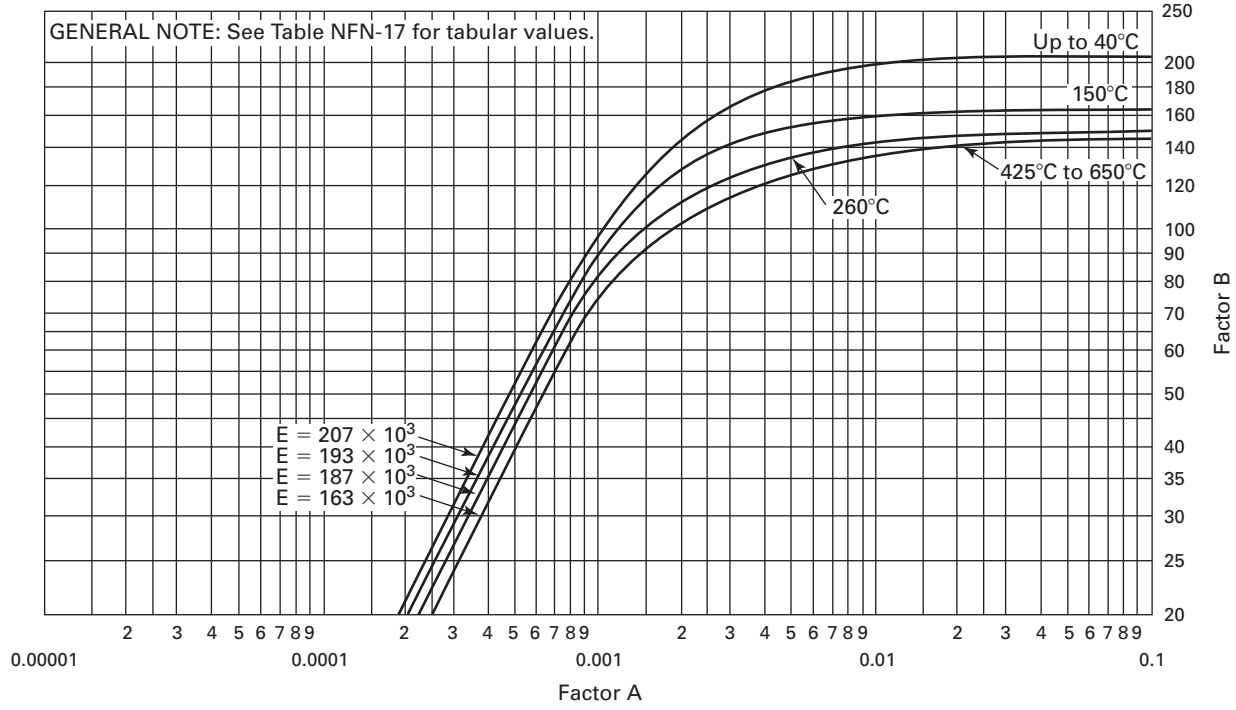
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(13)

Figure NFN-17
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel–Chromium–Molybdenum–Columbium Alloy N06625 (SB-443, SB-444, and SB-446)

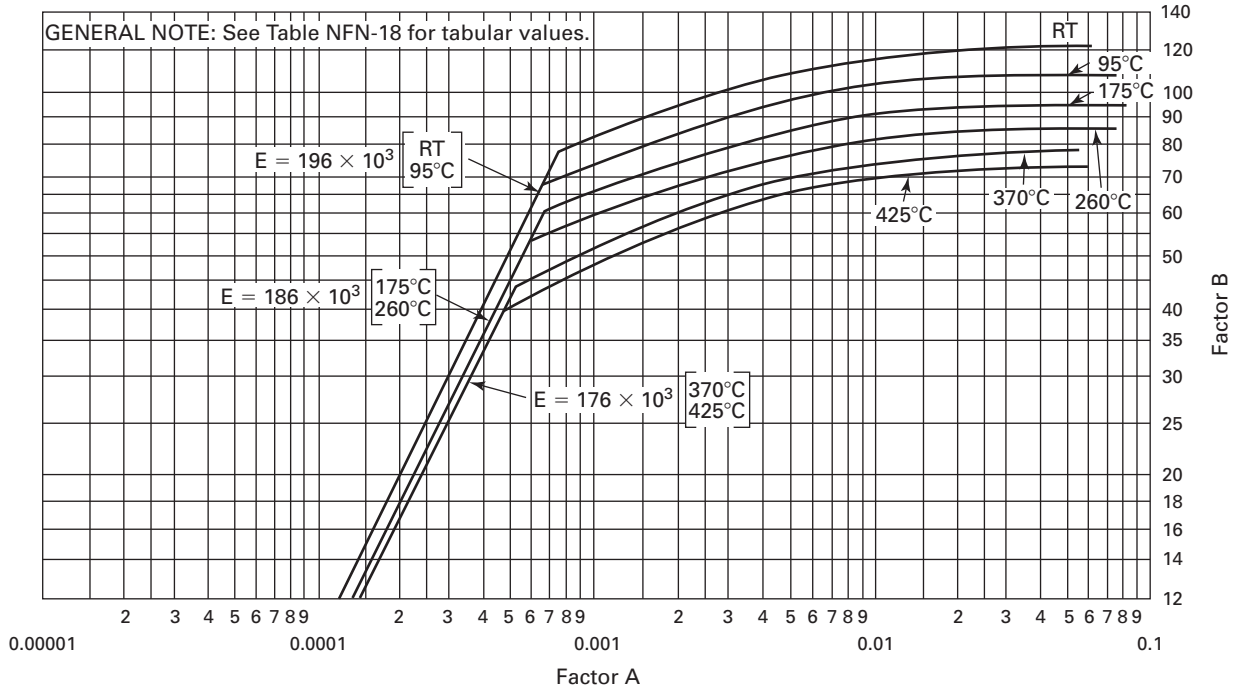


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-18
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron–Copper Alloy N06985 Having a Minimum Yield Strength of 240 MPa

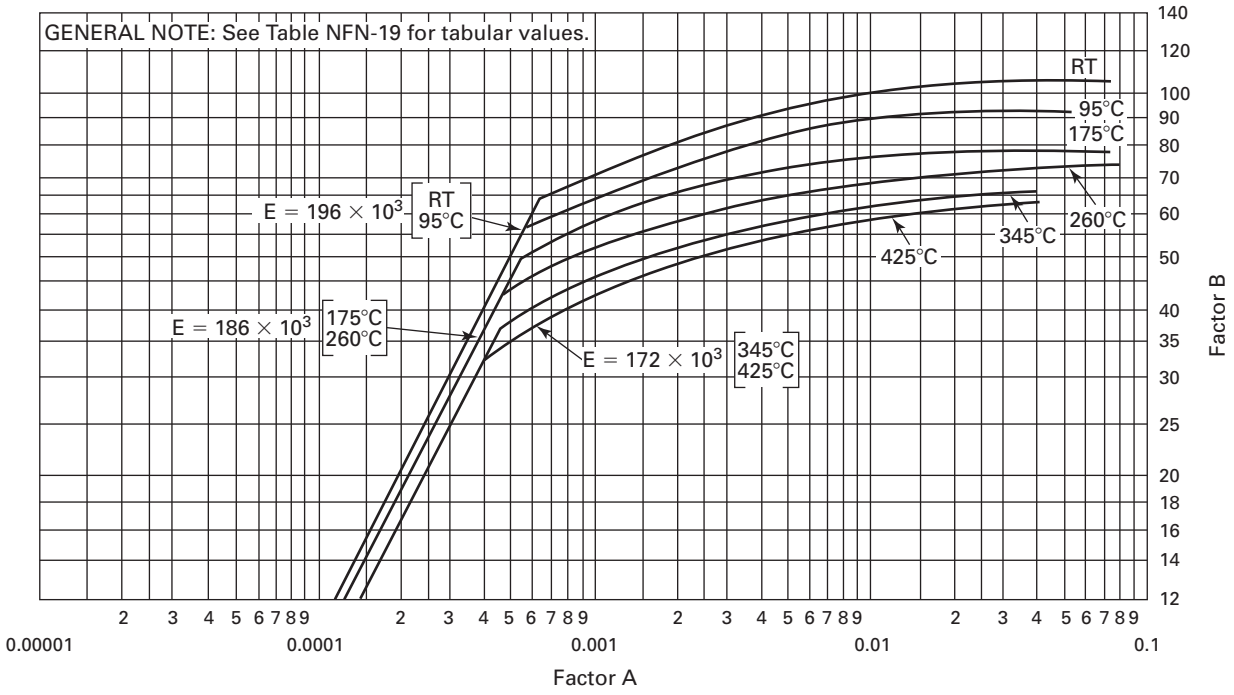


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-19
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron–Copper Alloy N06985 Having a Minimum Yield Strength of 207 MPa

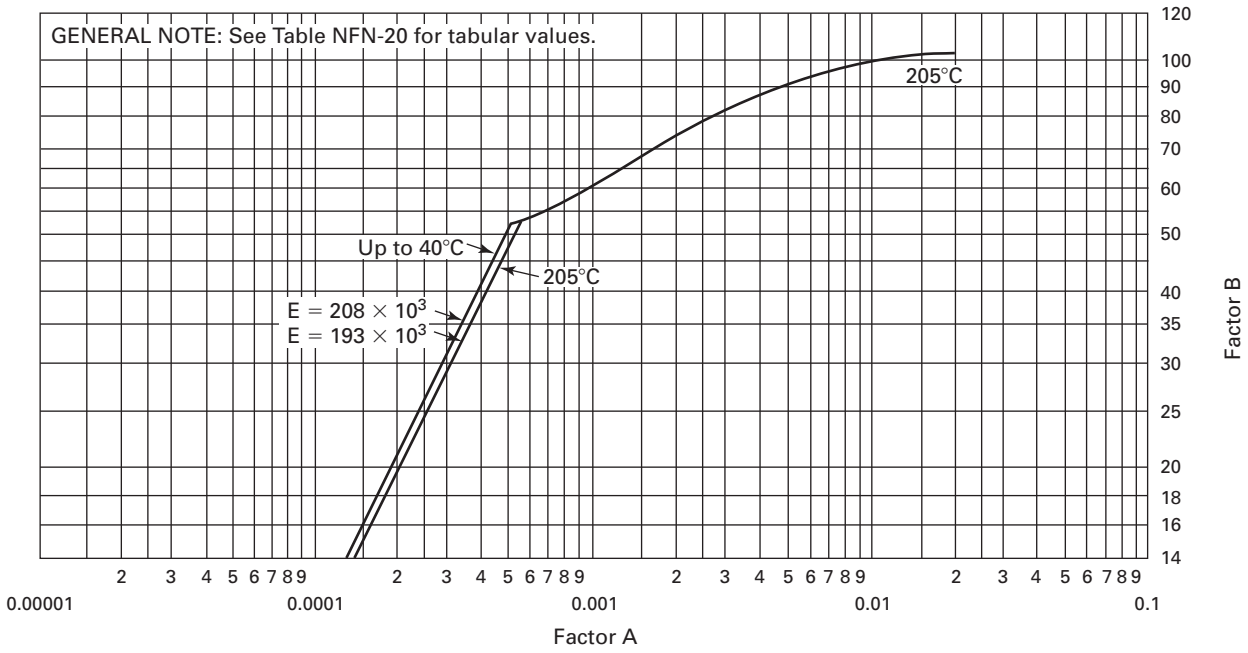


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-20
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Work-Hardened Nickel



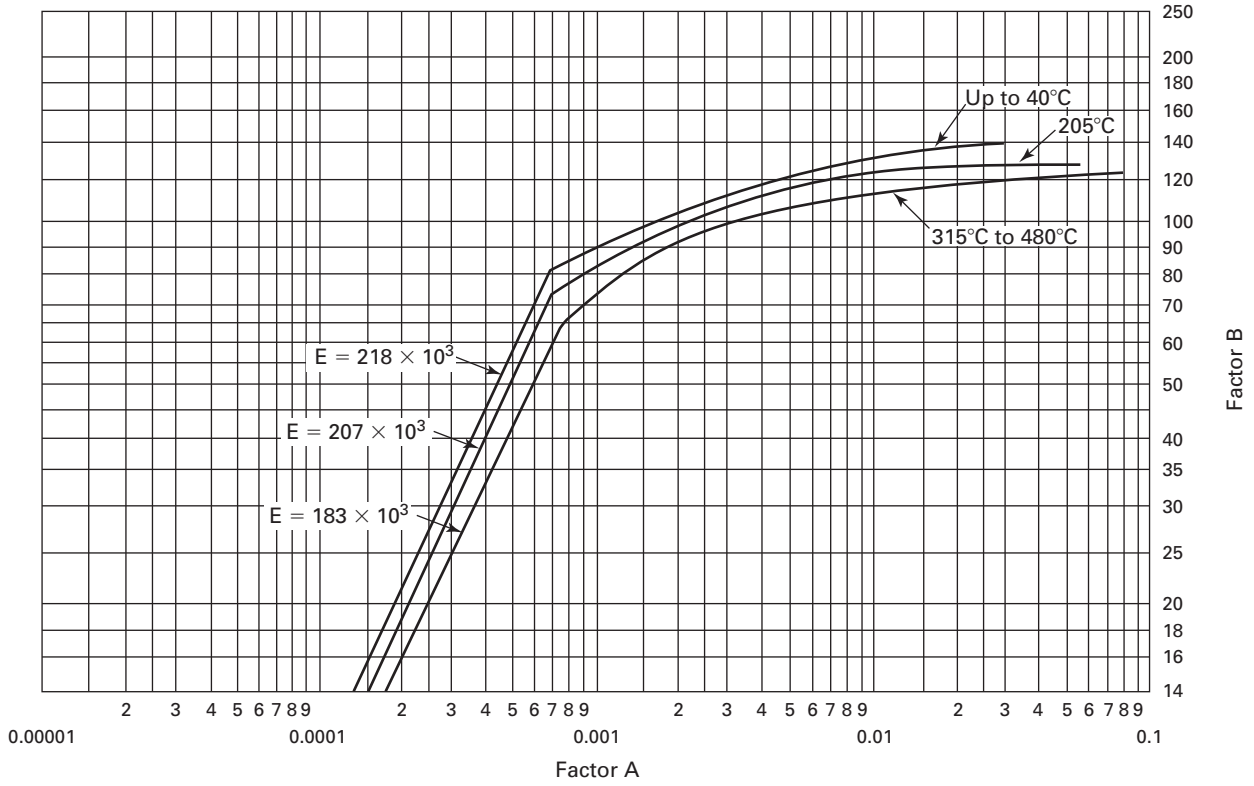
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) Vessels constructed of material covered by this chart must be subjected to an external hydrostatic test pressure of three times the maximum allowable working pressure. Thicknesses determined by this chart are minimum, and greater thickness may be required to withstand the test pressure if the planishing used does not provide an adequate degree of work-hardening.

Figure NFN-21
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Chromium–Iron Alloy N06600 (Specified Minimum Yield Strength 276 MPa)

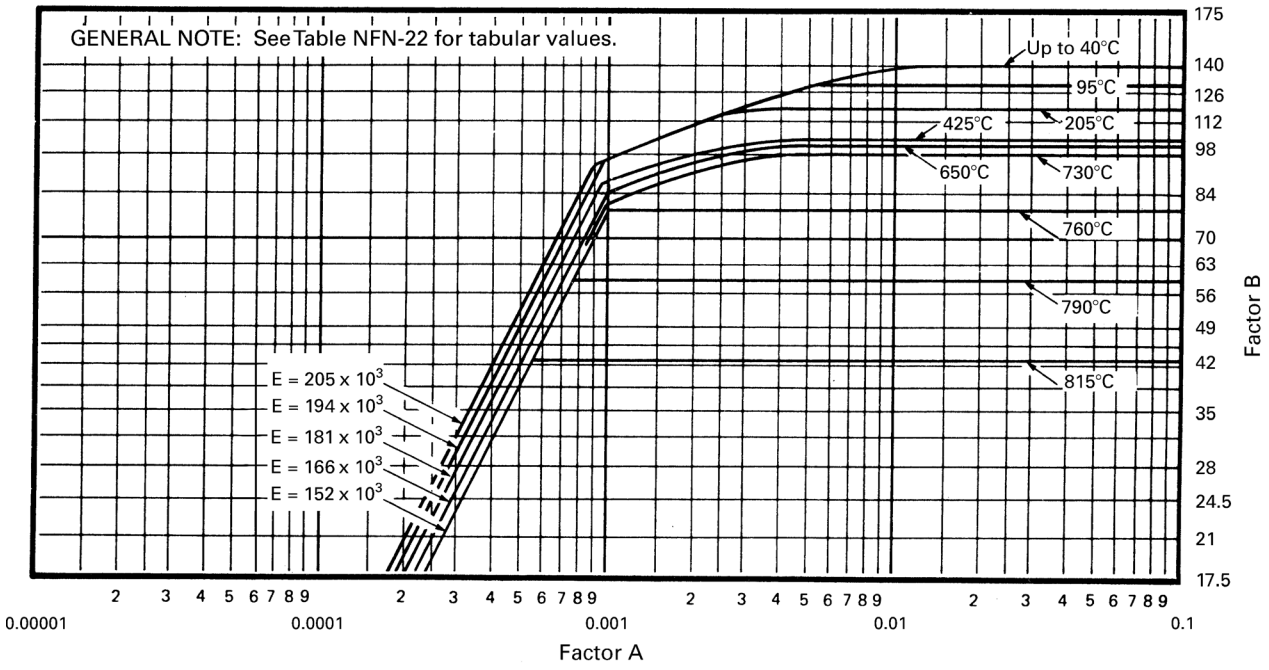


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-22
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution Annealed Ni–Cr–Mo–Cb Alloy, Grade 2 N06625



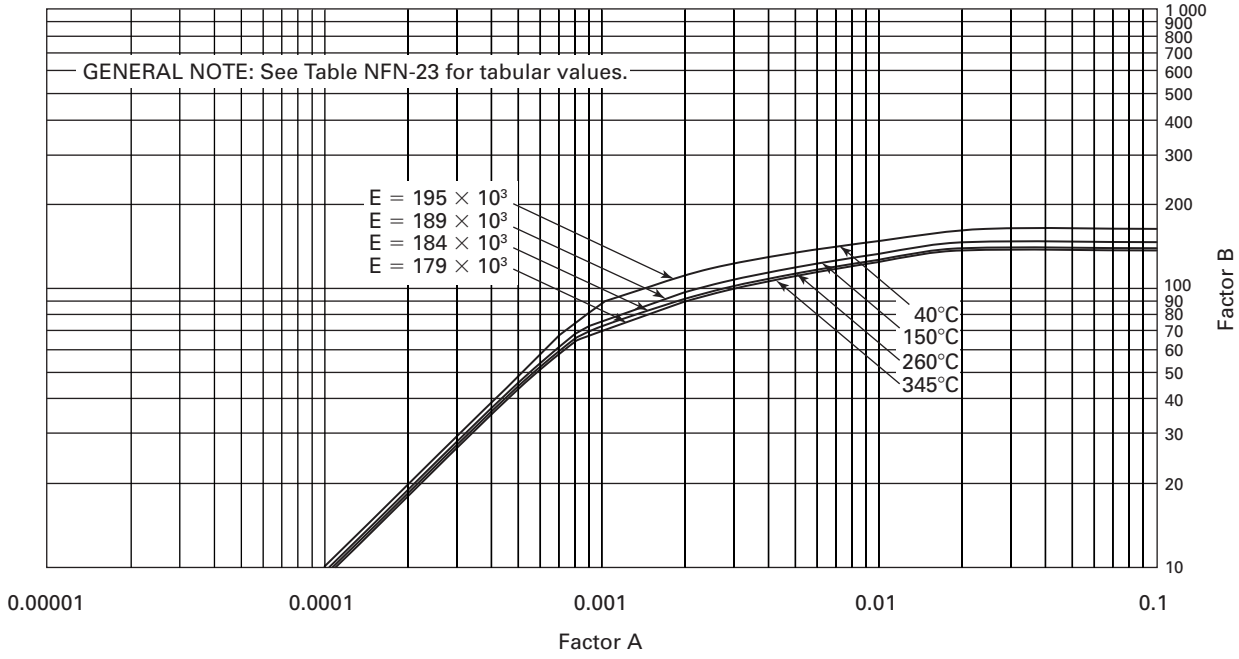
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) The external pressure chart does not account for reduction of buckling strength due to creep under long-term loads at temperatures above 650°C.

Figure NFN-23
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cold Worked Nickel–Iron–Chromium Alloy N08800

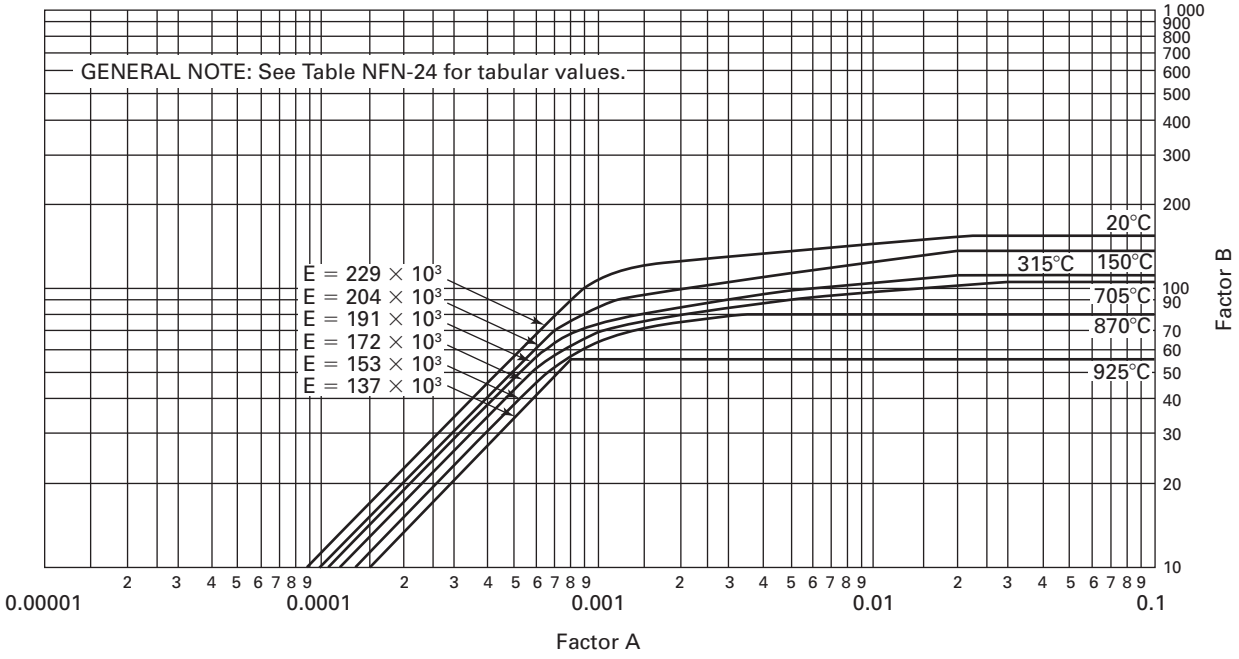


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-24
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel Alloy N06230

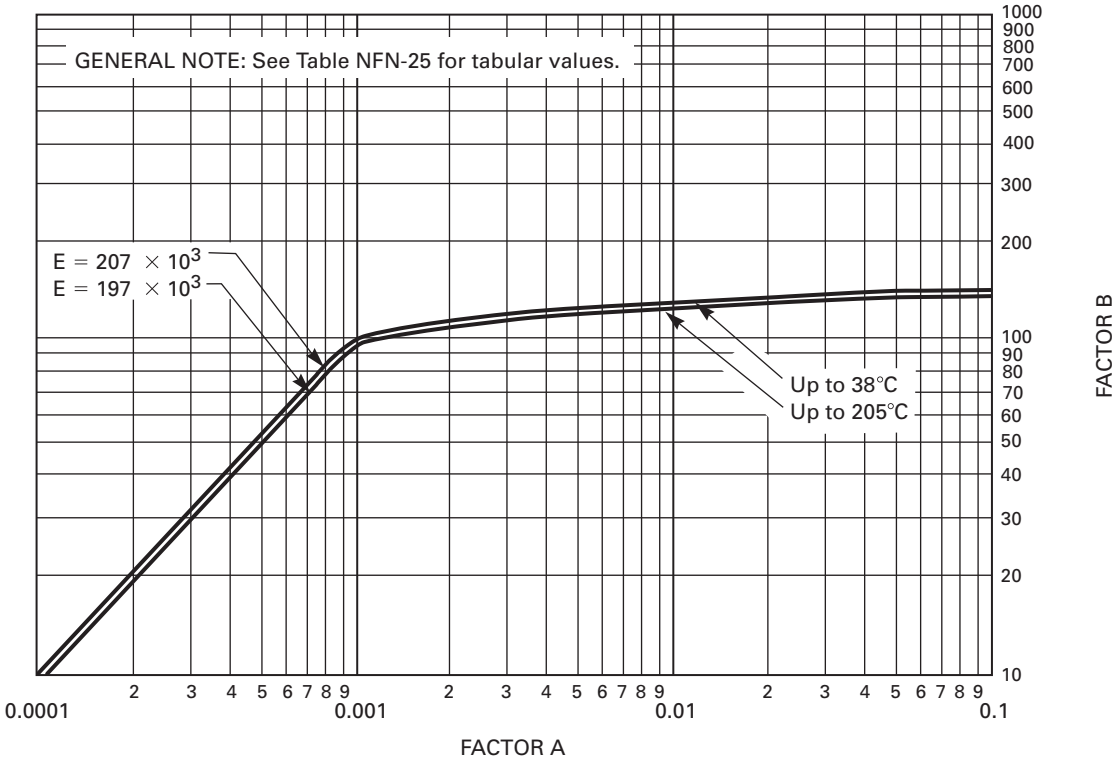


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-25
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Stress Relieved Nickel Alloy N02200

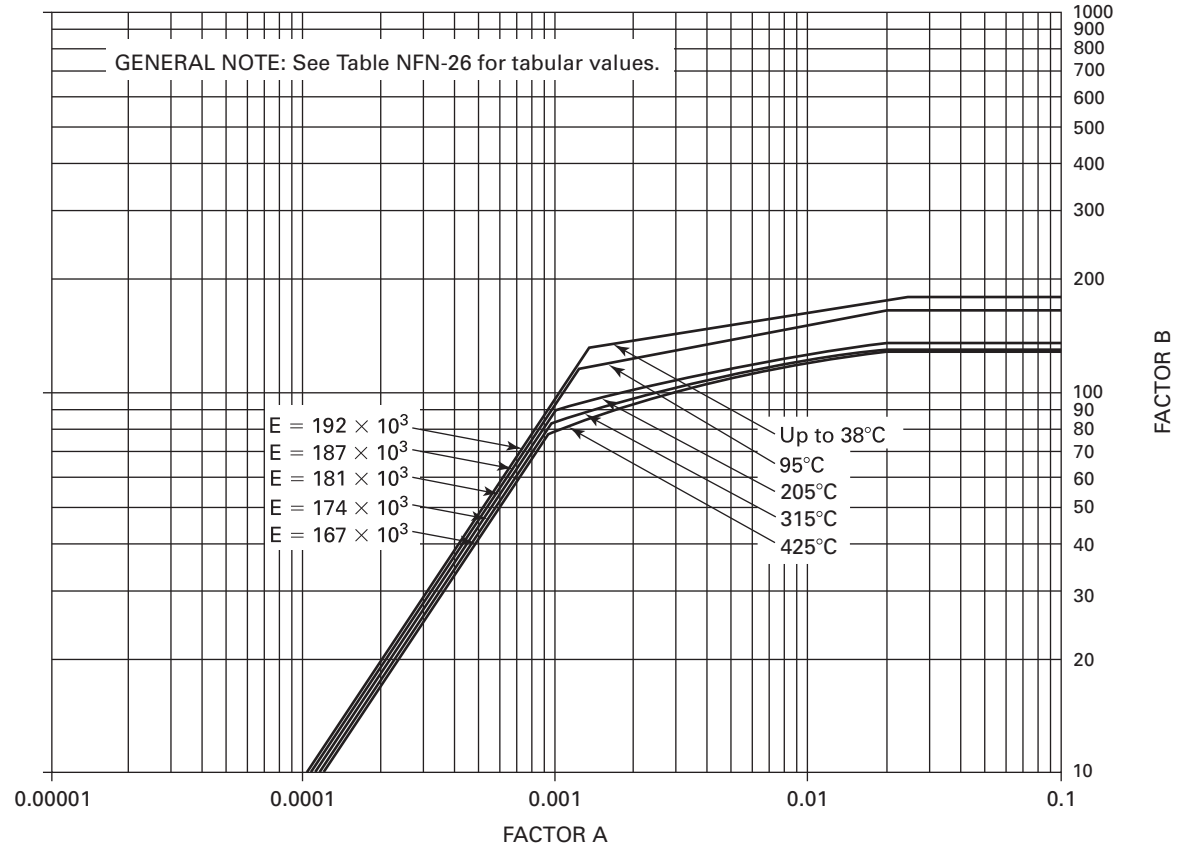


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-26
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy S31277

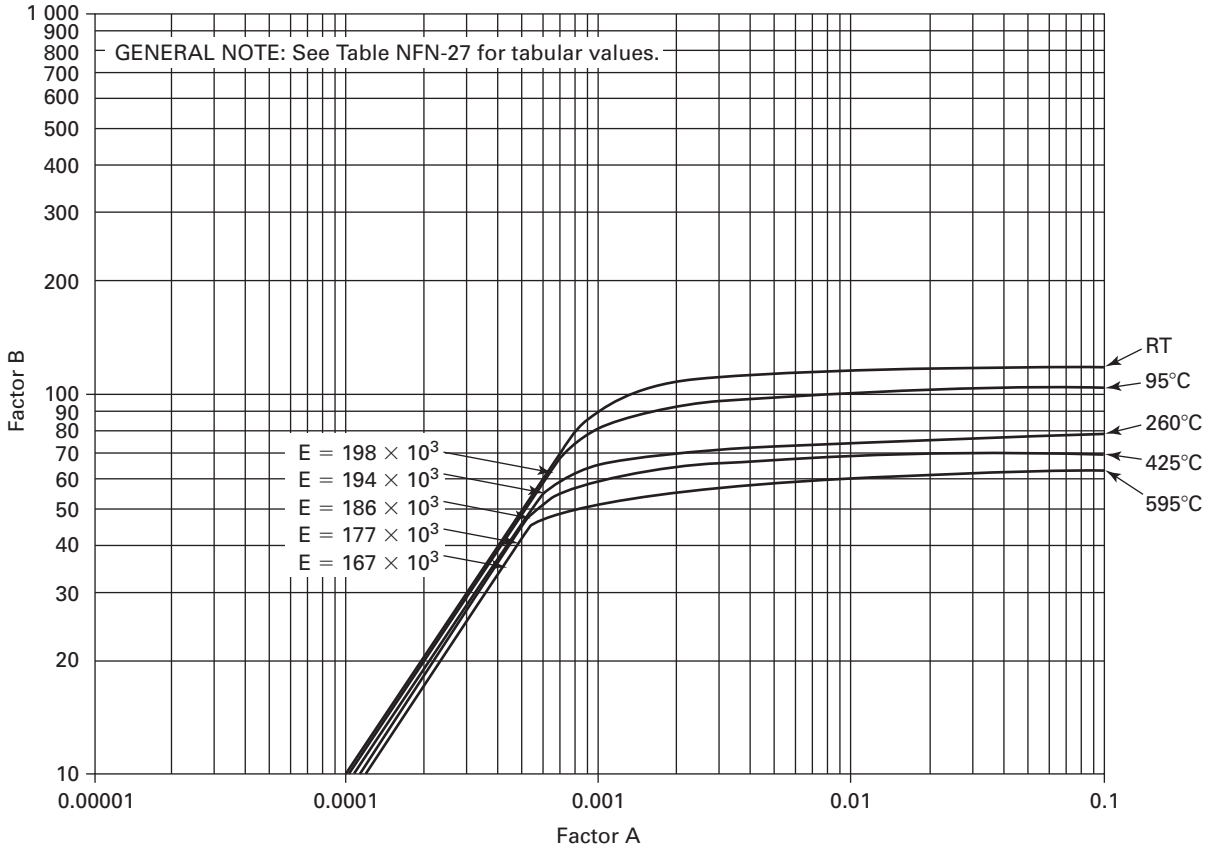


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFN-27
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy N06035

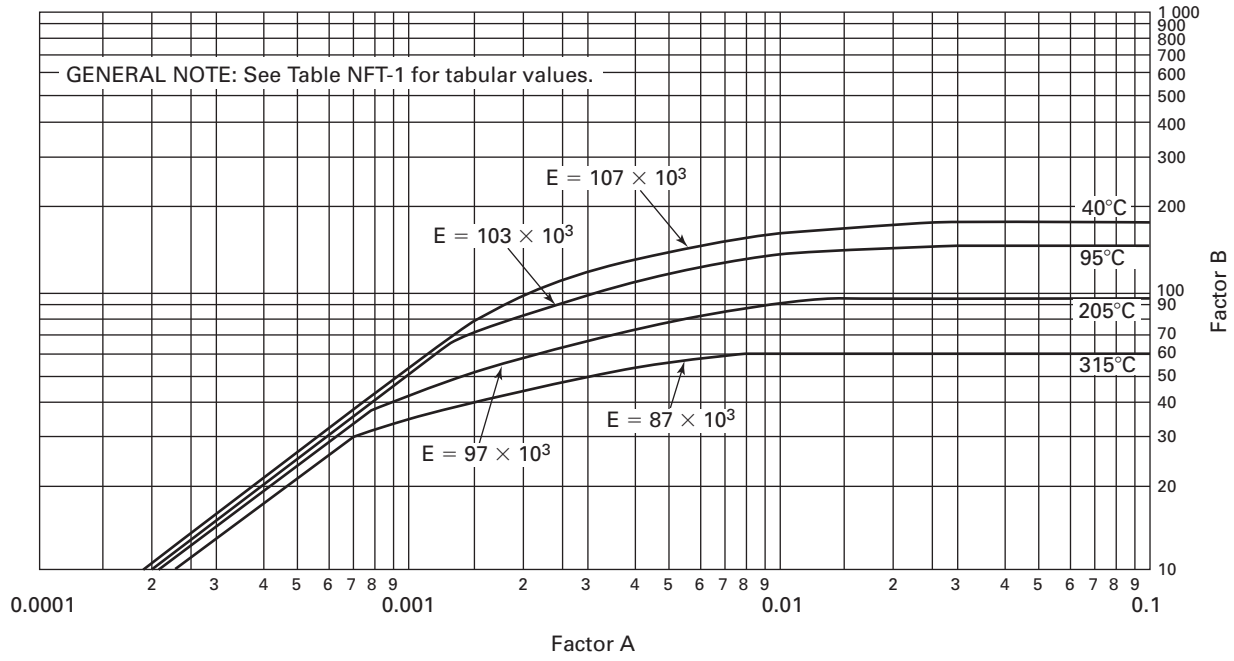


GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

Figure NFT-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Unalloyed Titanium Grade 3 (UNS R50550)



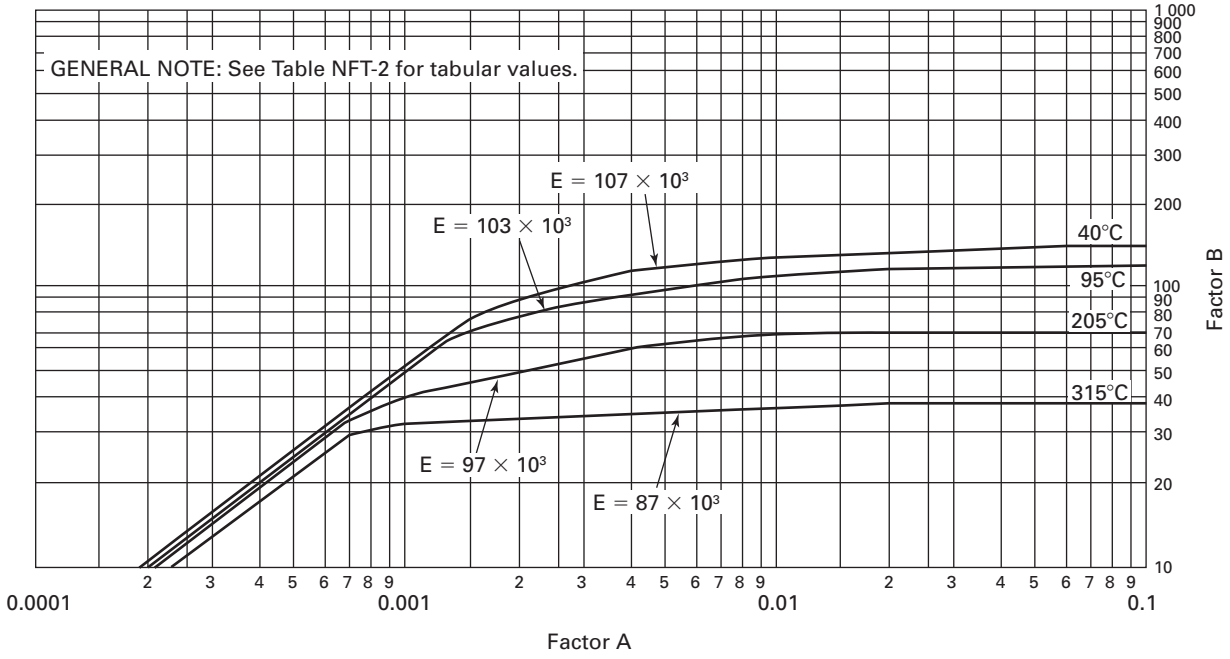
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFT-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Unalloyed Titanium Grade 2 (UNS R50400)



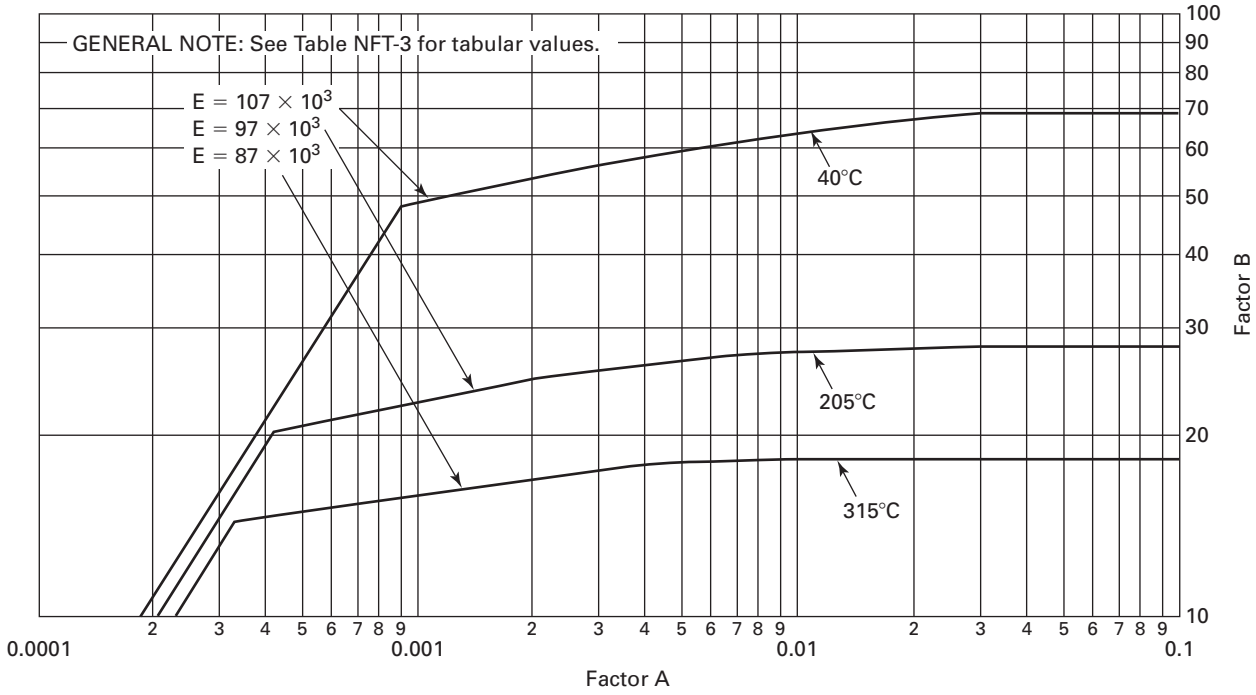
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFT-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 1 (UNS R50250)



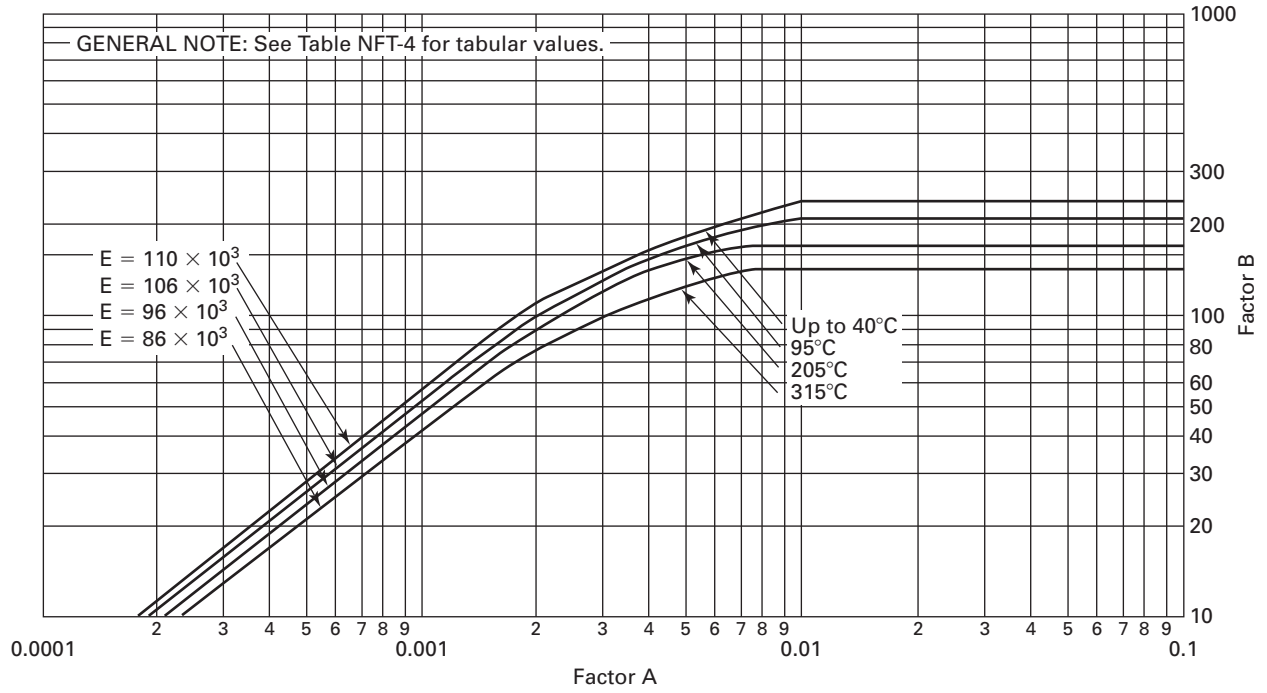
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFT-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 9 Alloy (UNS R56320)



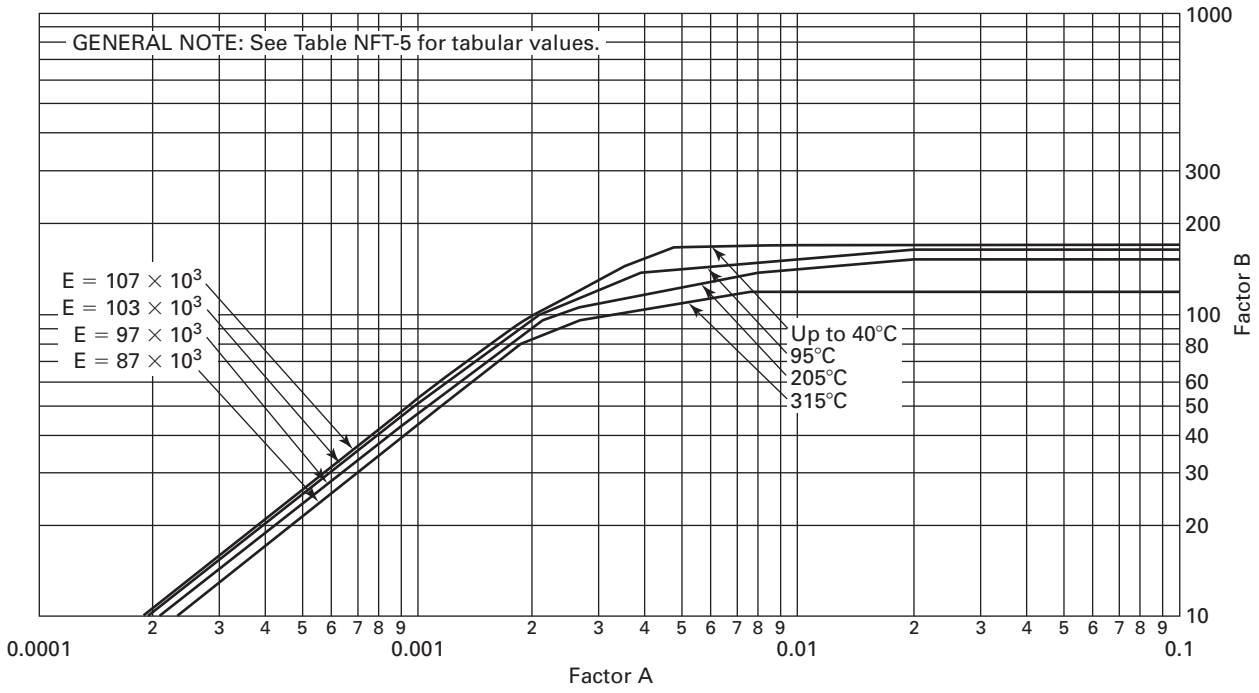
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFT-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 12 Alloy (UNS R53400)



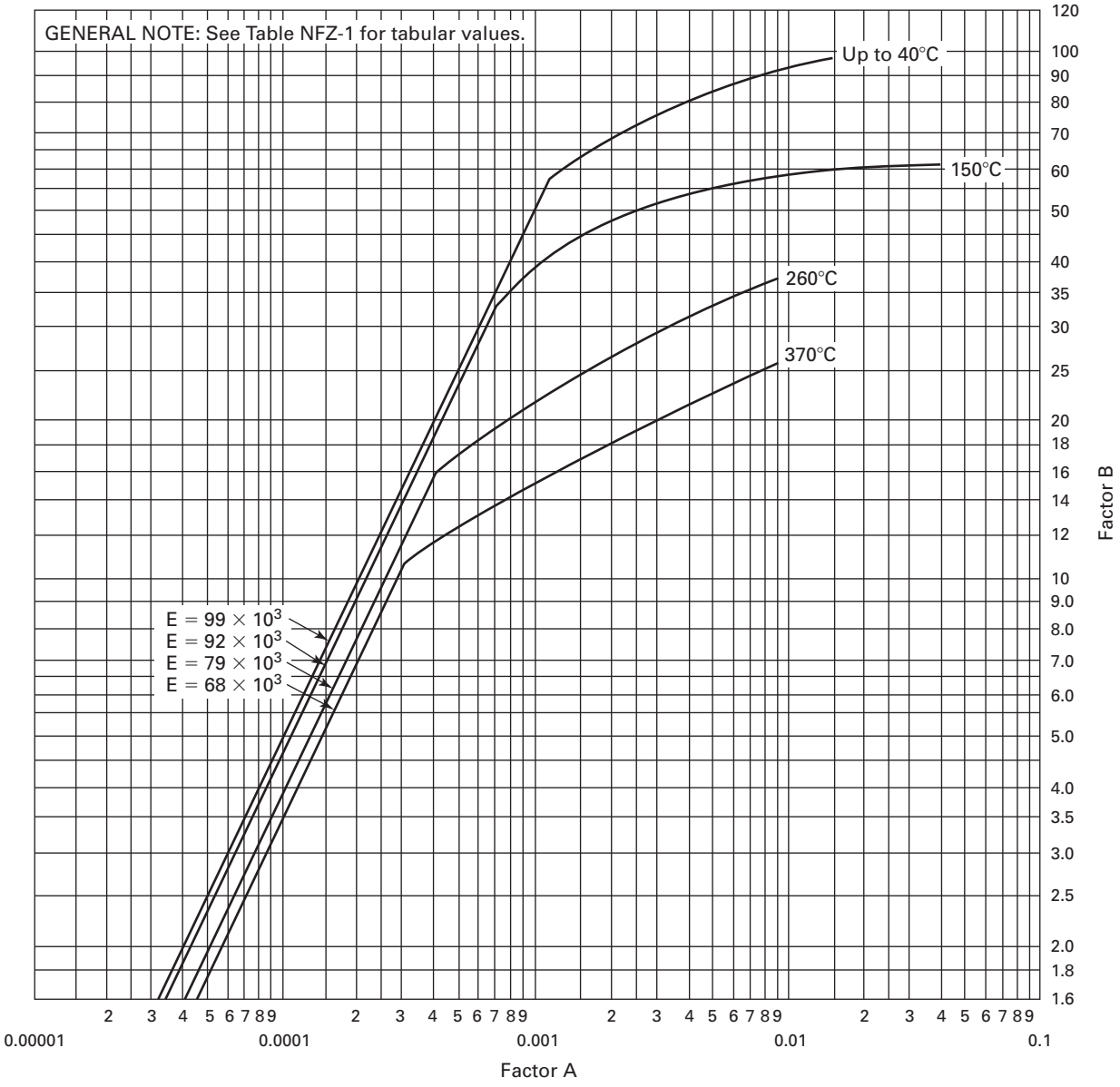
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFZ-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Zirconium Alloy (UNS R60702)



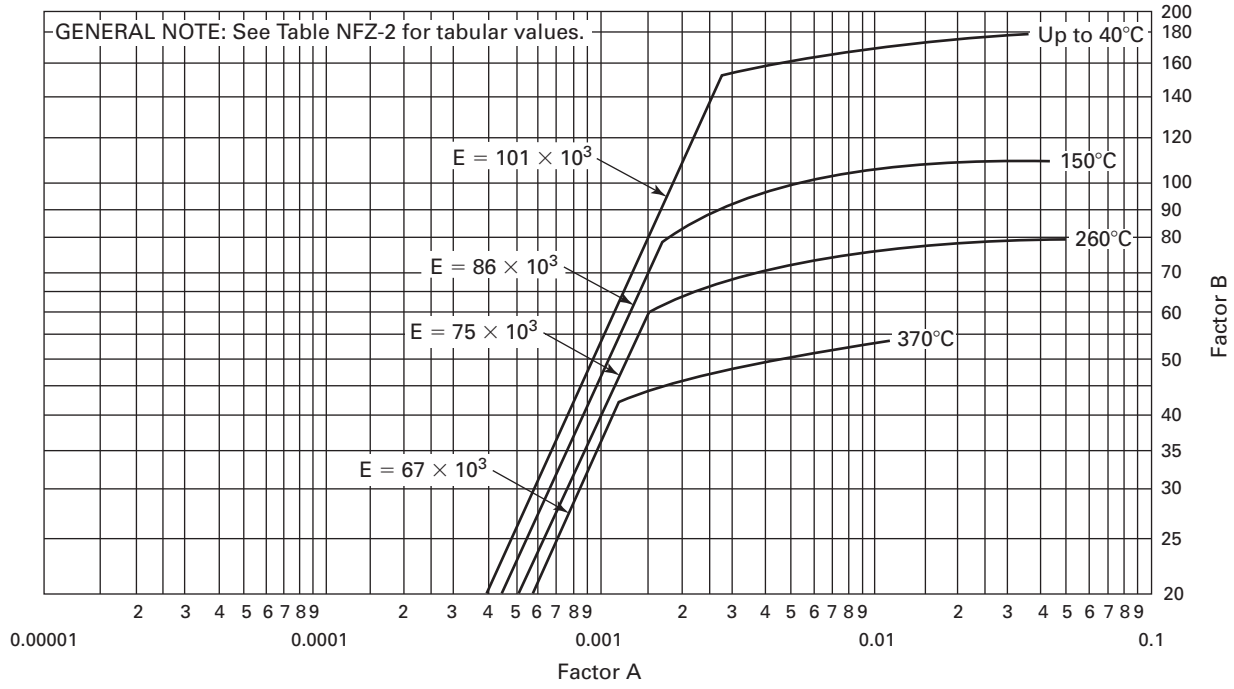
GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Figure NFZ-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Zirconium Alloy (UNS R60705)



GENERAL NOTES:

(a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 2A, 2B, 5A, and 5B.

(b) The external pressure chart assigned for a particular material is obtained from the stress tables 1A, 1B, 2A, 2B, 5A, and 5B under the column for External Pressure Chart No. for that material and is mandatory, with the exception of Tables 5A and 5B.

(c) When unidirectionally produced bar product is utilized for stiffening rings, Factor A, elastic or inelastic, shall be multiplied by 1.1 to account for reduced stiffness.

Table G
Tabular Values for Figure G

D_o/T	L/D_o	A
4	2.2	0.959 −01
	2.6	0.884
	3.0	0.839
	4.0	0.783
	5.0	0.759
	7.0	0.739
	10.0	0.729
	30.0	0.720
	50.0	0.720
5	1.4	0.929 −01
	1.6	0.802
	2.0	0.658
	2.4	0.586
	3.0	0.532
	4.0	0.494
	5.0	0.478
	7.0	0.465
	10.0	0.459
	30.0	0.454
	50.0	0.453
6	1.2	0.837 −01
	1.6	0.584
	2.0	0.469
	2.4	0.411
	3.0	0.369
	4.0	0.341
	5.0	0.329
	7.0	0.320
	10.0	0.316
	30.0	0.312
	50.0	0.312
8	0.74	0.968 −01
	0.8	0.875
	1.0	0.660
	1.6	0.372
	2.0	0.285
	2.4	0.242
	3.0	0.212
	4.0	0.192
8	5.0	0.184 −01
	7.0	0.179
	10.0	0.176
	20.0	0.174
	50.0	0.174
10	0.56	0.964 −01
	0.7	0.720
	1.0	0.463
	1.2	0.371
	2.0	0.201
	2.4	0.165
	3.0	0.139
	4.0	0.124
	5.0	0.118
	7.0	0.114
	10.0	0.112
	16.0	0.111
	50.0	0.111
15	0.34	0.968 −01
	0.4	0.770
	0.6	0.453
	1.0	0.244
	1.2	0.197
	2.0	0.109
	2.4	0.890 −02
	3.0	0.691
	4.0	0.573
	5.0	0.534
	6.0	0.516
	10.0	0.497
	40.0	0.490
	50.0	0.490
20	0.24	0.982 −01
	0.4	0.477
	0.6	0.286
	0.8	0.203
	1.0	0.156
	1.2	0.127
	2.0	0.713 −02
20	3.0	0.446 −02
	3.4	0.388
	4.0	0.342
	5.0	0.308
	7.0	0.287
	10.0	0.280
	40.0	0.275
	50.0	0.275
25	0.2	0.877 −01
	0.3	0.484
	0.5	0.250
	0.8	0.143
	1.0	0.111
	1.2	0.902 −02
	2.0	0.508
	3.0	0.323
	3.4	0.278
	4.0	0.235
	4.4	0.219
	5.0	0.204
	6.0	0.191
	7.0	0.186
	10.0	0.180
	30.0	0.176
	50.0	0.176
30	0.16	0.904 −01
	0.2	0.635
	0.3	0.357
	0.4	0.246
	0.6	0.150
	0.8	0.108
	1.0	0.838 −02
	1.2	0.683
	2.0	0.388
	3.0	0.246
	4.0	0.177
	4.4	0.161
	5.0	0.147
	6.0	0.136
	7.0	0.130
	10.0	0.125
30	30.0	0.122 −02
	50.0	0.122
40	0.12	0.864 −01
	0.2	0.385
	0.3	0.222
	0.4	0.155
	0.6	0.958 −02
	0.8	0.691
	1.0	0.539
	1.2	0.441
	2.0	0.252
	4.0	0.117
	5.0	0.912 −03
	6.0	0.804
	7.0	0.756
	8.0	0.731
	10.0	0.708
	16.0	0.692
	40.0	0.688
	50.0	0.688
50	0.088	0.930 −01
	0.1	0.782
	0.2	0.263
	0.3	0.154
	0.4	0.108
	0.6	0.677 −02
	0.8	0.490
	1.0	0.384
	2.0	0.181
	4.0	0.842 −03
	5.0	0.652
	6.0	0.548
	7.0	0.502
	8.0	0.478
	10.0	0.458
	12.0	0.449
	16.0	0.444
	40.0	0.440
	50.0	0.440
60	0.074	0.954 −01
	0.10	0.556
	0.14	0.323
	0.2	0.193
	0.4	0.812 −02
	0.6	0.510
	0.8	0.371
	1.0	0.291
	2.0	0.138
	3.0	0.886 −03
	4.0	0.645
	6.0	0.409
	7.0	0.364
	8.0	0.341
	10.0	0.322
	14.0	0.310
	40.0	0.306
	50.0	0.306
80	0.054	0.990 −01
	0.07	0.608
	0.09	0.391
	0.10	0.328
	0.14	0.196
	0.20	0.120
	0.24	0.950 −02
	0.4	0.516
	0.6	0.328
	0.8	0.239
	1.0	0.188
	2.0	0.895 −03
	4.0	0.424
	6.6	0.241
	8.0	0.205
	10.0	0.186
	14.0	0.176
	30.0	0.172
	50.0	0.172
100	0.05	0.741 −01
	0.07	0.398
	0.10	0.220
	0.14	0.133
100	0.20	0.831 −02
	0.40	0.364
	0.5	0.283
	0.8	0.170
	1.0	0.134
	2.0	0.641 −03
	4.0	0.305
	6.0	0.195
	8.0	0.142
	10.0	0.124
	14.0	0.114
	25.0	0.110
	50.0	0.110
125	0.05	0.480 −01
	0.06	0.344
	0.08	0.210
	0.10	0.148
	0.14	0.917 −02
	0.2	0.578
	0.4	0.257
	0.6	0.165
	0.8	0.121
	1.0	0.955 −03
	2.0	0.459
	4.0	0.220
	6.0	0.141
	9.0	0.904 −04
	10.0	0.837
	12.0	0.770
	14.0	0.740
	20.0	0.713
	40.0	0.704
	50.0	0.704
150	0.05	0.338 −01
	0.06	0.244
	0.08	0.151
	0.10	0.108
	0.12	0.833 −02
	0.16	0.569
	0.2	0.431
	0.4	0.194

Table G
Tabular Values for Figure G (Cont'd)

D_o/T	L/D_o	A	D_o/T	L/D_o	A	D_o/T	L/D_o	A	D_o/T	L/D_o	A	D_o/T	L/D_o	A	D_o/T	L/D_o	A
150	0.6	0.125 −02	200	12.0	0.338 −04	300	0.05	0.923 −02	400	0.4	0.429 −03	500	12.0	0.880 −05	800	0.6	0.980 −04
	1.0	0.726 −03		14.0	0.309		0.06	0.690		0.6	0.280					0.8	0.728
	2.0	0.349		16.0	0.295		0.08	0.452		0.8	0.207	600	0.05	0.270 −02		1.0	0.580
	4.0	0.168		20.0	0.283		0.10	0.334		1.0	0.165		0.06	0.208		2.0	0.286
	6.0	0.108		40.0	0.275		0.12	0.264		2.0	0.808 −04		0.08	0.142		4.0	0.140
	8.0	0.787 −04		50.0	0.275		0.2	0.143		4.0	0.393		0.10	0.108		5.0	0.112
	10.0	0.619					0.4	0.666 −03		6.0	0.257		0.12	0.868 −03		5.6	0.992 −05
	12.0	0.553	250	0.05	0.129 −01		0.6	0.433		8.0	0.189		0.16	0.624			
	16.0	0.510		0.06	0.955 −02		0.8	0.321		10.0	0.148		0.2	0.486	1000	0.05	0.113 −02
	20.0	0.498		0.08	0.617		1.0	0.254		14.0	0.102		0.4	0.231		0.06	0.891 −03
	40.0	0.489		0.10	0.452		2.0	0.124		16.0	0.882 −05		0.6	0.151		0.07	0.733
	50.0	0.489		0.14	0.293		4.0	0.602 −04					0.8	0.112		0.09	0.541
				0.2	0.191		6.0	0.393	500	0.05	0.370 −02		1.0	0.894 −04		0.12	0.388
200	0.05	0.196 −01		0.4	0.881 −03		8.0	0.287		0.06	0.284		2.0	0.439		0.16	0.282
	0.06	0.143		0.6	0.572		10.0	0.225		0.08	0.192		4.0	0.216		0.2	0.221
	0.08	0.909 −02		0.8	0.422		14.0	0.156		0.10	0.145		6.0	0.141		0.4	0.106
	0.10	0.659		1.0	0.335		16.0	0.142		0.12	0.116		8.0	0.104		0.7	0.596 −04
	0.14	0.421		2.0	0.163		20.0	0.130		0.16	0.830 −03		8.4	0.988 −05		1.0	0.414
	0.2	0.272		4.0	0.789 −04		40.0	0.123		0.2	0.645					2.0	0.204
	0.3	0.171		6.0	0.513		50.0	0.122		0.4	0.305					4.0	0.101
	0.5	0.976 −03		8.0	0.377					0.6	0.199	800	0.05	0.165 −02		4.2	0.957 −05
	0.8	0.592		10.0	0.293	400	0.05	0.549 −02		0.8	0.148		0.06	0.129			
	1.0	0.469		12.0	0.238		0.06	0.417		1.0	0.118		0.08	0.892 −03			
	2.0	0.227		14.0	0.210		0.08	0.278		2.0	0.579 −04		0.10	0.682			
	4.0	0.110		16.0	0.196		0.10	0.208		4.0	0.282		0.12	0.551			
	6.0	0.711 −04		20.0	0.184		0.12	0.166		6.0	0.185		0.16	0.398			
	8.0	0.520		40.0	0.176		0.16	0.118		8.0	0.137		0.2	0.312			
	10.0	0.403		50.0	0.176		0.2	0.914 −03		10.0	0.107		0.4	0.149			

GENERAL NOTE: Extrapolation is not permitted except as explicitly allowed by the Construction Code.

Table CS-1
Tabular Values for Figure CS-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
150	1.35 −05	1.38 +00	370	9.00	4.48
	6.45 −04	6.48 +01		1.00 −03	4.59
	7.00	6.83		1.50	5.00
	8.00	7.24		2.00	5.24
	9.00	7.52		2.12 −02	7.58
	1.00 −03	7.72		1.00 −01	7.58
	1.50	8.23			
	2.00	8.48	425	1.78 −05	1.38 +00
	9.50	9.51		3.67 −04	2.87 +01
	2.00 −02	9.51		4.00	3.00
	1.00 −01	9.51		5.00	3.21
				6.00	3.34
260	1.43 −05	1.38 +00		7.00	3.52
	5.13 −04	4.83 +01		1.00 −03	3.86
	6.00	5.15		1.50	4.17
	8.00	5.58		2.00	4.41
	1.00 −03	5.86		2.25 −02	6.72
	1.50	6.45		1.00 −01	6.72
	2.50	6.86			
	1.95 −02	9.03	480	1.88 −05	1.38 +00
	1.00 −01	9.03		3.31 −04	2.41 +01
				5.00	2.72
370	1.57 −05	1.38 +00		7.00	2.96
	4.13 −04	3.54 +01		1.00 −03	3.25
	5.00	3.83		1.50	3.56
	6.00	4.00		2.50	3.96
	7.00	4.21		2.13 −02	5.86
	8.00	4.34		1.00 −01	5.86

Table CS-2
Tabular Values for Figure CS-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
150	1.76 −05	1.72 +00	370	5.64 −04	4.69 +01
	7.83 −04	7.79 +01		1.00 −03	5.52
	8.00	7.86		3.00	6.96
	9.00	8.14		1.00 −02	8.34
	1.00 −03	8.48		2.64	9.51
	2.00	1.03 +02		1.00 −01	9.51
	3.00	1.12			
	4.00	1.16	425	2.23 −05	1.72 +00
	5.00	1.19		5.05 −04	3.94 +01
	2.50 −02	1.21		1.00 −03	4.90
	1.00 −01	1.21		1.50	5.48
				2.00	5.79
260	1.94 −05	1.72 +00		3.00	6.14
	6.75 −04	6.21 +01		3.19 −02	8.55
	9.00	6.65		1.00 −01	8.55
	1.00 −03	6.89			
	2.50	8.27			
	3.00	8.55	480	2.37 −05	1.72 +00
	8.00	9.79		4.28 −04	3.10 +01
	1.00 −02	1.01 +02		1.00 −03	4.14
	1.50	1.07		1.50	4.69
	2.00	1.11		2.00	5.07
	2.80	1.17		3.00	5.45
	1.00 −01	1.17		8.00	6.34
				3.00 −02	7.65
370	2.13 −05	1.72 +00		1.00 −01	7.65

Table CS-3
Tabular Values for Figure CS-3

Yield Strength, MPa	A	B, MPa
414	4.00 −05	4.00 +00
	1.00 −03	1.00 +02
	1.66	1.65
	1.00 −01	2.07
379	4.00 −05	4.00 +00
	1.00 −03	1.00 +02
	1.52	1.52
	1.00 −01	1.86
345	4.00 −05	4.00 +00
	1.00 −03	1.00 +02
	1.38	1.38
	1.00 −01	1.72
310	4.00 −05	4.00 +00
	1.00 −03	1.00 +02
	1.24	1.24
	1.00 −01	1.55
262 to 276	4.00 −05	4.00 +00
	1.00 −03	1.00 +02
	1.10	1.10
	1.00 −01	1.38

Table CS-4
Tabular Values for Figure CS-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.03 +00	150	1.00 −05	9.79 −01
(Cl. 2)	1.56 −03	1.74 +02	(Cl. 2)	1.35 −03	1.41 +02
	3.00	1.85		6.00	1.59
	7.00	1.98		1.00 −02	1.65
	9.00	2.00		4.00	1.77
	3.00 −02	2.10		1.00 −01	1.84
	4.00	2.12			
	1.00 −01	2.12			
			150	1.00 −05	9.79 −01
40	1.00 −05	1.03 +00	(Cl. 1)	1.18 −03	1.22 +02
(Cl. 1)	1.36 −03	1.49 +02		3.00	1.29
	4.00	1.61		4.00	1.31
	1.00 −02	1.68		3.00 −02	1.39
	3.00	1.74		7.00	1.41
	1.00 −01	1.74		1.00 −01	1.41

Table CS-5
Tabular Values for Figure CS-5

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.99 −04	2.07 +01	205	3.00	1.46
	1.60 −03	1.69 +02		7.00	1.52
	2.00	1.70		9.00	1.52
	3.00	1.71		1.00 −02	1.54
	5.00	1.72		5.00	1.54
	6.00	1.72			
	5.00 −02	1.72	290	2.15 −04	2.07 +01
				1.08 −03	1.03 +02
95	2.00 −04	2.07 +01		2.00	1.13
	1.57 −03	1.62 +02		4.00	1.27
	5.00 −02	1.62		1.00 −02	1.38
				2.00	1.43
150	2.03 −04	2.07 +01		5.00	1.47
	1.50 −03	1.52 +02			
	3.00	1.55	345	2.20 −04	2.07 +01
	6.00	1.55		1.21 −03	1.03 +02
	5.00 −02	1.55		2.00	1.13
				4.00	1.23
205	2.10 −04	2.07 +01		1.00 −02	1.34
	1.54 −03	1.43 +02		5.00	1.43

Table CS-6
Tabular Values for Figure CS-6

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.50 −04	1.52 +01	95	2.00 −02	6.21
	2.00	2.07			
	3.00	3.10	150	1.50 −04	1.52 +01
	6.00	4.14		2.00	2.07
	8.00	4.48		5.00	3.45
	2.00 −03	5.52		1.00 −03	4.14
	4.20	6.21		2.50	4.83
	4.00 −02	6.89		9.00	5.52
	7.00	6.89		2.50 −02	5.72
95	1.50 −04	1.52 +01	205	1.80 −04	1.72 +01
	2.00	2.07		3.00	2.76
	4.20	3.45		1.00 −03	3.79
	8.00	4.14		7.00	4.83
	1.50 −03	4.83		2.50 −02	5.17
	4.00	5.52			

Table HT-1
Tabular Values for Figure HT-1

Temp., °C	A	B, MPa
Up to	1.00 −05	1.01 +00
95	2.45 −03	2.54 +02
	4.00	2.80
	7.00	3.04
	1.00 −02	3.17
	2.00	3.32
	5.00	3.45
205	1.00 −05	9.45 −01
	2.45 −03	2.39 +02
	4.00	2.65
	7.00	2.90
	1.00 −02	3.04
	4.00	3.32
345	1.00 −05	8.55 −01
	2.43 −03	2.17 +02
	4.00	2.46
	7.00	2.75
	1.00 −02	2.88
	3.00	3.20

Table HT-2
Tabular Values for Figure HT-2

Temp., °C	A	B, MPa
40	3.37 −04	3.45 +01
	2.83 −03	2.90 +02
	4.00	2.98
	6.00	3.03
	8.00	3.09
	1.00 −02	3.13
	1.50	3.23
	2.00	3.28
	2.50	3.32
	3.00	3.36
	4.00	3.41
	5.00	3.43
	6.00	3.43
	7.00	3.45
	1.00 −01	3.45

Table HA-1
Tabular Values for Figure HA-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.42 −05	1.38 +00	480	1.81 −05	1.38 +00
	4.63 −04	4.48 +01		3.15 −04	2.41 +01
	1.50 −03	7.31		4.00	2.66
	2.00	7.93		5.00	2.87
	3.00	8.62		1.50 −03	3.78
	1.00 −02	9.65		3.00	4.22
	6.31	1.09 +02		1.00 −02	4.87
	1.00 −01	1.09		2.00	5.12
				7.84	5.47
205	1.59 −05	1.38 +00		1.00 −01	5.47
	3.91 −04	3.45 +01			
	2.00 −03	5.65	650	2.00 −05	1.38 +00
	3.00	6.27		2.83 −04	1.96 +01
	4.00	6.68		1.00 −03	2.87
	5.00	6.89		2.00	3.33
	1.00 −02	7.31		5.00	3.82
	5.38	8.00		1.00 −02	4.10
	1.00 −01	8.00		2.00	4.38
				4.88	4.62
370	1.70 −05	1.38 +00		1.00 −01	4.62
	3.38 −04	2.76 +01			
	4.00	2.99	815	1.00 −04	6.2
	5.00	3.25		1.60	10.0
	6.00	3.45		3.12	19.5
	1.00 −03	3.97		4.00	20.7
	2.00	4.60		1.27 −03	24.1
	5.00	5.27		5.06	27.6
	6.00	5.38		4.00 −02	32.1
	1.00 −02	5.58		1.00 −01	32.1
	5.42	6.21			
	1.00 −01	6.21			

Table HA-2
Tabular Values for Figure HA-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.84 −05	1.72 +00	370	5.00	8.76
	6.05 −04	5.79 +01		5.92	8.89
	1.50 −03	7.65		1.00 −01	8.89
	2.00	8.07			
	2.50	8.41	480	2.28 −05	1.72 +00
	3.00	8.69		5.10 −04	3.90 +01
	4.00	8.96		6.00	4.21
	5.00	9.17		1.00 −03	4.96
	7.00	9.38		3.00	6.24
	1.00 −02	9.65		4.00	6.48
	2.00	1.01 +02		1.00 −02	7.10
	7.26	1.08		5.22	8.07
	1.00 −01	1.08		1.00 −01	8.07
205	1.99 −05	1.72 +00	650	2.47 −05	1.72 +00
	5.85 −04	5.17 +01		4.60 −04	3.21 +01
	1.00 −03	6.00		1.00 −03	4.14
	1.50	6.69		2.00	4.96
	2.00	7.17		3.00	5.38
	3.00	7.72		4.00	5.65
	4.00	8.07		5.00	5.79
	5.00	8.27		1.00 −02	6.17
	6.00	8.41		7.00	6.89
	1.00 −02	8.76		1.00 −01	6.89
	5.74	9.86			
	1.00 −01	9.86	815	1.00 −04	6.2
370	2.18 −05	1.72 +00		1.60	10.0
	5.33 −04	4.31 +01		3.95	24.6
	7.00	4.83		1.45 −03	29.3
	1.00 −03	5.38		2.54	31.0
	3.00	6.89		5.62	33.2
	4.00	7.24		3.50 −02	37.6
	1.00 −02	7.86		1.00 −01	37.6

Table HA-3
Tabular Values for Figure HA-3

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.39 −05	1.38 +00	315	1.65 −05	1.38 +00
	5.35 −04	5.21 +01		3.19 −04	2.68 +01
	2.00 −03	6.96		1.00 −03	3.28
	6.00	8.55		1.00 −02	4.90
	4.00 −02	1.03 +02		2.81	5.83
	1.00 −01	1.03		1.00 −01	5.83
205	1.58 −05	1.38 +00	425	1.74 −05	1.38 +00
	3.61 −04	3.19 +01		2.75 −04	2.19 +01
	1.00 −03	3.79		1.50 −03	2.94
	1.00 −02	5.62		1.00 −02	4.07
	2.83	6.72		3.00	4.96
	1.00 −01	6.72		1.00 −01	4.96

Table HA-4
Tabular Values for Figure HA-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.43 −05	1.38 +00	205	7.00 −03	6.17
	6.00 −04	5.79 +01		1.00 −02	6.48
	7.00 −03	9.17		4.29	7.31
	1.00 −02	9.65		1.00 −01	7.31
	2.00	1.05 +02			
	5.00	1.12	315	1.69 −05	1.38 +00
	1.00 −01	1.12		3.63 −04	3.02 +01
				5.00 −03	4.96
150	1.53 −05	1.38 +00		1.00 −02	5.45
	4.75 −04	4.31 +01		4.56	6.21
	5.00 −03	6.86		1.00 −01	6.21
	6.00	7.03			
	1.00 −02	7.58	425	1.76 −05	1.38 +00
	4.58	8.69		3.17 −04	2.50 +01
	1.00 −01	8.69		5.00 −03	4.10
				1.00 −02	4.55
205	1.54 −05	1.38 +00		4.68	5.31
	4.10 −04	3.71 +01		1.00 −01	5.31

Table HA-5
Tabular Values for Figure HA-5

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	0.000141	14	205	0.004	134
	0.00134	131 P.L.		0.006	145
	0.0015	133		0.01	155
	0.002	142		0.015	160
	0.0025	155		0.023	165
	0.003	164			
	0.004	179	345	0.00016	14
	0.006	195		0.0012	103 P.L.
	0.01	210		0.0015	107
	0.015	217		0.002	112
	0.021	225		0.0025	117
				0.003	123
205	0.0001509	14		0.004	131
	0.001166	107 P.L.		0.006	140
	0.0015	109		0.01	151
	0.002	114		0.015	155
	0.0025	121		0.034	157
	0.003	126			

Table HA-6
Tabular Values for Figure HA-6

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	7.07 −05	6.89 +00	345	7.98 −05	6.89 +00
	5.00 −04	4.88 +01		4.99 −04	4.31 +01
	1.00 −03	9.72		8.85	6.15
	1.44	1.24 +02		1.44 −03	6.65
	1.81	1.30		1.81	6.83
	4.48	1.39		4.66	7.38
	9.42	1.44		9.80	7.72
	1.89 −02	1.49		2.00 −02	8.14
	5.00	1.55		5.00	8.27
	1.00 −01	1.55		1.00 −01	8.27
95	7.25 −05	6.89 +00	510	8.62 −05	6.89 +00
	5.00 −04	4.76 +01		4.99 −04	3.99 +01
	9.71	8.48		9.64	6.10
	1.37 −03	9.45		1.09 −03	6.24
	1.95	1.00 +02		1.27	6.38
	4.81	1.10		4.84	7.10
	9.81	1.17		9.68	7.45
	1.96 −02	1.23		1.99 −02	7.72
	5.00	1.27		5.00	7.93
	1.00 −01	1.27		1.00 −01	7.93
205	7.55 −05	6.89 +00	650	9.64 −05	6.89 +00
	5.00 −04	4.56 +01		4.98 −04	3.56 +01
	9.76	7.45		9.32	5.55
	1.31 −03	7.86		1.38 −03	6.00
	1.97	8.20		1.90	6.25
	4.44	8.76		4.88	6.78
	9.57	9.17		9.94	7.17
	1.99 −02	9.51		1.94 −02	7.45
	5.00	9.93		5.00	7.79
	1.00 −01	9.93		1.00 −01	7.79

Table HA-7
Tabular Values for Figure HA-7

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	7.00 −05	6.89 +00	150	7.00 −05	6.89 +00
	5.00 −04	5.03 +01		5.00 −04	4.81 +01
	7.50	7.58		7.50	7.24
	1.00 −03	1.01 +02		1.00 −03	9.58
	1.25	1.26		1.25	1.20 +02
	1.50	1.51		1.50	1.44
	1.74	1.75		1.74	1.67
	1.98	1.99		1.98	1.89
	2.89	2.71		2.71	2.32
	4.07	2.96		4.62	2.62
	6.41	3.13		6.19	2.72
	7.49	3.17		7.63	2.78
	1.57 −02	3.35		1.99 −02	3.01
	5.00	3.59		5.00	3.19
	1.00 −01	3.62		1.00 −01	3.21

Table HA-8
Tabular Values for Figure HA-8

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	7.07 −05	6.89 +00	100	3.37	1.52
	4.03 −04	3.92 +01		4.76	1.61
	6.06	5.80		7.42	1.70
	8.36	7.65		9.85	1.77
	1.13 −03	9.58		1.99 −02	1.92
	1.48	1.12 +02		5.00	1.94
	1.64	1.17		1.00 −01	1.94
	1.82	1.23			
	3.46	1.56	400	8.78 −05	6.89 +00
	4.87	1.72		5.00 −04	4.21 +01
	7.30	1.92		7.50	6.32
	9.89	2.06		1.00 −03	8.27
	2.00 −02	2.24		1.25	9.65
	5.00	2.24		1.47	1.07 +02
	1.00 −01	2.24		1.70	1.15
				1.92	1.21
100	7.27 −05	6.89 +00		3.29	1.43
	4.73 −04	4.49 +01		4.99	1.47
	7.07	6.71		7.36	1.50
	9.50	8.62		9.37	1.52
	1.25 −03	1.04 +02		1.97 −02	1.59
	1.46	1.14		5.00	1.64
	1.74	1.23		1.00 −01	1.65
	1.95	1.28			

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Table HA-9
Tabular Values for Figure HA-9

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	0.100 −04	0.488 +01	150	0.100 −04	0.465 +01
	0.707	0.689		0.741	0.689
	0.103 −03	0.100 +02		0.108 −03	0.100 +02
	0.500	0.488		0.500	0.465
	0.750	0.731		0.750	0.696
	0.992	0.965		0.923	0.855
	0.121 −02	0.118 +03		0.109 −02	0.993
	0.143	0.139		0.128	0.114 +03
	0.166	0.159		0.153	0.128
	0.197	0.181		0.198	0.141
	0.284	0.208		0.269	0.152
	0.491	0.230		0.392	0.163
	0.697	0.238		0.721	0.177
	0.849	0.246		0.893	0.182
	0.192 −01	0.267		0.190 −01	0.198
	0.500	0.276		0.500	0.204
	0.100 +00	0.276		0.100 +00	0.204
95	0.100 −04	0.476 +01	370	0.100 −04	0.427 +01
	0.725	0.689		0.806	0.689
	0.105 −03	0.100 +02		0.117 −03	0.100 +02
	0.500	0.476		0.500	0.427
	0.750	0.710		0.750	0.641
	0.939	0.889		0.933	0.800
	0.112 −02	0.106 +03		0.108 −02	0.924
	0.133	0.123		0.124	0.105 +03
	0.163	0.139		0.143	0.117
	0.194	0.148		0.171	0.130
	0.272	0.167		0.277	0.150
	0.431	0.183		0.375	0.158
	0.683	0.192		0.701	0.172
	0.872	0.199		0.934	0.178
	0.187 −01	0.215		0.192 −01	0.191
	0.500	0.222		0.500	0.197
	0.100 +00	0.222		0.100 +00	0.197

Table CI-1
Tabular Values for Figure CI-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Class 60 up to 345	1.00 −05	7.58 −01	Class 30 up to 345	1.00 −05	4.94 −01
	1.60 −03	1.25 +02		1.22 −03	6.26 +01
	1.00 −01	1.25		1.00 −01	6.26
Class 50 up to 345	1.00 −05	6.87 −01	Class 20 up to 345	1.00 −05	4.10 −01
	1.47 −03	1.03 +02		9.91 −04	4.19 +01
	1.00 −01	1.03		1.00 −01	4.19
Class 40 up to 345	1.00 −05	6.01 −01			
	1.35 −03	8.27 +01			
	1.00 −01	8.27			

Table CD-1
Tabular Values for Figure CD-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 40	1.00 −05	8.41 −01	205	3.00	1.34
	1.24 −03	1.03 +02		6.00	1.40
	2.00	1.09			
	4.00	1.19	345	1.00 −05	7.72 −01
	1.00 −02	1.32		8.92 −04	6.77 +01
	2.50	1.43		2.00 −03	8.20
				4.00	9.51
205	1.00 −05	8.41 −01		6.00	1.01 +02
	1.07 −03	8.96 +01		8.00	1.05
	2.00	1.02 +02		1.00 −02	1.07
	3.00	1.08		2.00	1.12
	4.00	1.13		4.00	1.17
	1.00 −02	1.24			

(13)

Table CD-2
Tabular Values for Figure CD-2

Temp., °C	A	B	Temp., °C	A	B
40	1.00 −05	8.00 −01	100	2.50	6.72
	1.26 −04	1.00 +01		7.00	7.72
	6.28	5.00		3.00 −02	8.69
	1.00 −03	6.07		1.00 −01	8.69
	2.00	7.31			
	7.00	8.96	200	1.00 −05	7.31 −01
	3.50 −02	1.00 +02		1.37 −04	1.00 +01
	1.00 −01	1.00		5.57	4.07
				1.00 −03	5.10
100	1.00 −05	7.72 −01		2.50	6.27
	1.30 −04	1.00 +01		7.00	7.17
	5.62	4.34		3.00 −02	8.14
	1.00 −03	5.52		1.00 −01	8.14

Table NFA-1
Tabular Values for Figure NFA-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	3.46 −01	150	1.10 −05	3.45 −01
	1.48 −04	5.12 +00		1.48 −04	4.69 +00
	2.00	6.56		2.00	5.80
	2.50	7.38		2.50	6.54
	3.00	8.00		3.00	7.03
	1.00 −03	1.08 +01		4.00	7.72
	1.50	1.18		7.00	8.76
	4.00	1.43		2.50 −03	1.08 +01
	1.00 −02	1.70		4.00 −02	1.59
	1.50	1.81		1.00 −01	1.59
	4.00	2.08			
	1.00 −01	2.08	205	1.19 −05	3.45 −01
				9.98	2.95 +00
95	1.03 −05	3.45 −01		1.50 −04	4.30
	1.48 −04	4.89 +00		2.00	5.26
	2.00	6.27		2.50	5.94
	2.50	7.03		3.00	6.39
	3.00	7.58		4.00	6.89
	4.00	8.34		5.00	7.24
	1.00 −03	1.02 +01		1.00 −03	8.34
	3.00	1.26		3.00	9.86
	6.00	1.43		1.00 −02	1.13 +01
	2.00 −02	1.72		4.00	1.32
	4.00	1.92		1.00 −01	1.32
	1.00 −01	1.92			

Table NFA-2
Tabular Values for Figure NFA-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	3.45 −01	150	1.99 −04	6.21 +00
	4.05 −04	1.38 +01		2.50	7.65
	5.00	1.71		3.00	9.24
	6.00	2.01		4.00	1.16 +01
	7.00	2.28		5.00	1.36
	8.00	2.52		6.00	1.54
	9.00	2.76		7.00	1.68
	1.00 −03	2.94		1.00 −03	2.06
	1.50	3.59		1.50	2.48
	2.00	4.03		2.50	2.93
	2.50	4.29		3.00	3.10
	3.00	4.50		4.00	3.34
	4.00	4.79		5.00	3.50
	5.00	5.01		1.00 −02	3.88
	6.00	5.10		1.50	4.08
	1.00 −02	5.47		1.00 −01	4.08
	2.00	5.82			
	4.00	6.10	205	1.18 −05	3.45 −01
	5.00	6.19		1.47 −04	4.16 +00
	1.00 −01	6.19		2.00	5.48
				2.50	6.57
95	1.02 −05	3.45 −01		3.00	7.45
	3.01 −04	9.86 +00		4.00	8.83
	6.00	1.82 +01		5.00	1.00 +01
	7.00	2.06		1.00 −03	1.38
	1.00 −03	2.63		1.50	1.61
	1.50	3.23		2.00	1.79
	2.00	3.62		2.50	1.92
	2.50	3.90		3.00	2.03
	3.00	4.08		5.00	2.30
	4.00	4.30		6.00	2.36
	5.00	4.45		7.00	2.41
	6.00	4.54		1.00 −02	2.54
	1.00 −02	4.79		1.50	2.65
	5.00	5.52		2.00	2.70
	1.00 −01	5.52		2.50	2.75
150	1.10 −05	3.45 −01		1.00 −01	2.75

Table NFA-3
Tabular Values for Figure NFA-3

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	3.49 −01	150	3.48 −04	1.10 +01
	3.53 −04	1.23 +01		4.00	1.24
	4.00	1.34		5.00	1.41
	5.00	1.50		6.00	1.52
	6.00	1.60		7.00	1.61
	7.00	1.68		8.00	1.68
	8.00	1.73		1.00 −03	1.77
	1.00 −03	1.82		1.50	1.94
	1.50	1.94		1.50 −02	2.92
	1.50 −02	2.92		1.00 −01	2.92
	1.00 −01	2.92			
95	1.04 −05	3.45 −01	205	1.16 −05	3.45 −01
	3.75 −04	1.23 +01		3.34 −04	9.72 +00
	4.00	1.29		4.00	1.16 +01
	5.00	1.44		5.00	1.36
	6.00	1.55		6.00	1.49
	7.00	1.64		7.00	1.58
	8.00	1.70		8.00	1.65
	1.00 −03	1.80		9.00	1.71
	1.50	1.94		1.00 −03	1.76
	1.50 −02	2.92		1.50	1.94
	1.00 −01	2.92		1.50 −02	2.92
150	1.07 −05	3.45 −01		1.00 −01	2.92

Table NFA-4
Tabular Values for Figure NFA-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	3.50 −01	150	6.98 −04	2.28 +01
	1.26 −03	4.50 +01		1.00 −03	3.10
	1.50	5.14		1.50	3.99
	2.00	6.03		2.00	4.52
	2.50	6.54		2.50	4.90
	3.00	6.88		3.00	5.12
	4.00	7.24		4.00	5.39
	5.00	7.52		5.00	5.60
	6.00	7.72		6.00	5.73
	1.00 −02	8.07		1.00 −02	6.01
	1.50	8.20		1.50	6.21
	2.50	8.41		1.00 −01	6.21
	4.00	8.55			
	1.00 −01	8.55	205	1.17 −05	3.45 −01
95	1.01 −05	3.45 −01		2.48 −04	7.31 +00
	1.31 −03	4.50 +01		3.00	8.69
	1.50	4.96		4.00	1.10 +01
	2.00	5.77		5.00	1.28
	2.50	6.25		6.00	1.42
	3.00	6.60		7.00	1.54
	4.00	6.96		9.00	1.75
	5.00	7.24		1.00 −03	1.85
	6.00	7.45		1.50	2.17
	7.00	7.58		2.00	2.41
	1.00 −02	7.79		2.50	2.60
	2.50	8.14		3.00	2.72
	3.00	8.20		4.00	2.94
	4.00	8.27		1.00 −02	3.53
	1.00 −01	8.27		1.50	3.79
150	1.07 −05	3.45 −01		1.00 −01	3.79

Table NFA-5
Tabular Values for Figure NFA-5

Temp., °C	A	B, MPa
40	1.00 −05	3.54 −01
	4.92 −04	1.76 +01
	6.00	2.07
	7.00	2.25
	8.00	2.39
	9.00	2.48
	1.00 −03	2.53
	1.71 −02	3.79
	1.00 −01	3.79

Table NFA-6
Tabular Values for Figure NFA-6

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 40	1.00 −05	3.61 −01	150	4.99 −04	1.57 +01
	6.87 −04	2.45 +01		6.00	1.82
	8.00	2.80		7.00	2.03
	9.00	3.03		8.00	2.21
	1.00 −03	3.14		1.00 −03	2.45
	1.50	3.43		1.50	2.81
	2.00	3.53		2.00	2.98
	3.00	3.62		3.00	3.17
	1.00 −02	3.93		1.00 −02	3.59
	3.00	4.21		3.00	3.87
95	1.01 −05	3.45 −01			
	4.99 −04	1.68 +01	205	1.26 −05	3.45 −01
	7.00	2.22		3.98 −04	1.10 +01
	8.00	2.44		5.00	1.30
	9.00	2.63		7.00	1.65
	1.00 −03	2.74		1.00 −03	2.03
	1.50	3.08		1.50	2.42
	2.00	3.25		2.00	2.62
	3.00	3.45		3.00	2.83
	1.00 −02	3.90		5.00	3.05
	3.00	4.21		1.00 −02	3.26
150	1.10 −05	3.45 −01		2.50	3.52

Table NFA-7
Tabular Values for Figure NFA-7

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
95	1.01 −05	3.45 −01	150	7.00	4.37
	9.01	3.21 +00		1.50 −03	4.99
	5.00 −04	4.83		3.00	5.50
	7.00	5.18		6.00	5.94
	1.50 −03	6.07		1.00 −02	6.25
	4.00	7.24		1.00 −01	6.25
	7.00	7.93			
	1.00 −02	8.27	205	1.19 −05	3.45 −01
	1.50	8.48		7.46	2.25 +00
	2.00	8.62		1.50 −03	4.16
	1.00 −01	8.62		3.00	4.69
				5.00	4.96
150	1.12 −05	3.45 −01		7.00	5.07
	8.85	2.86 +00		9.00	5.14
	5.00 −04	4.10		1.00 −01	5.14

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Table NFA-8
Tabular Values for Figure NFA-8

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	3.50 −01	150	1.00 −05	3.10 −01
	2.86	1.00 +00		3.23	1.00 +00
	2.78 −04	9.79		3.38 −04	1.05 +01
	3.00	1.05 +01		4.00	1.21
	4.00	1.27		1.00 −03	1.83
	1.00 −03	1.83		2.50	2.44
	2.50	2.44		5.00	2.86
	5.00	2.86		6.00	2.95
	6.00	2.95		7.00	3.02
	7.00	3.02		8.00	3.06
	8.00	3.06		9.00	3.12
	9.00	3.12		1.00 −02	3.14
	1.00 −02	3.14		1.50	3.28
	1.50	3.28		2.00	3.35
	2.00	3.35		1.00 −01	3.35
	1.00 −01	3.35			
			205	1.00 −05	2.75 −01
95	1.00 −05	3.40 −01		3.64	1.00 +00
	2.94	1.00 +00		2.88 −04	8.00
	2.83 −04	9.72		3.00	8.34
	3.00	1.02 +01		4.00	1.05 +01
	4.00	1.25		6.00	1.36
	1.00 −03	1.83		1.00 −03	1.65
	2.50	2.44		2.50	2.21
	5.00	2.86		3.00	2.32
	6.00	2.95		4.00	2.48
	7.00	3.02		5.00	2.61
	8.00	3.06		6.00	2.68
	9.00	3.12		7.00	2.76
	1.00 −02	3.14		8.00	2.83
	1.50	3.28		9.00	2.88
	2.00	3.35		1.00 −02	2.92
	1.00 −01	3.35		1.00 −01	2.92

Table NFA-9
Tabular Values for Figure NFA-9

Temp., °C	A	B, MPa
65	1.00 −05	3.45 −01
	7.92 −04	2.81 +01
	9.00	2.99
	1.00 −03	3.13
	1.50	3.48
	2.00	3.66
	4.00	4.06
	6.00	4.31
	2.00 −02	4.93
	1.00 −01	4.93

Table NFA-10
Tabular Values for Figure NFA-10

Temp., °C	A	B, MPa
40	1.00 −05	3.57 −01
	1.34 −03	4.99 +01
	1.50	5.35
	2.00	5.79
	2.50	5.92
	3.00	6.01
	5.00	6.12
	1.00 −02	6.21
	1.50	6.28
	2.50	6.31
	3.00	6.34
	4.00	6.35
	5.00	6.38
	1.00 −01	6.38

Table NFA-11
Tabular Values for Figure NFA-11

Temp., °C	A	B, MPa
65	1.00 −05	3.51 −01
(Curve 1)	3.01 −04	1.08 +01
	5.00	1.78
	6.00	2.12
	7.00	2.43
	1.00 −03	3.19
	1.50	3.84
	2.00	4.23
	2.50	4.50
	3.00	4.73
	4.00	5.03
	5.00	5.23
	9.00	5.76
	1.50 −02	6.16
	1.74	6.25
	1.00 −01	6.25
65	1.00 −05	3.51 −01
(Curve 2)	3.01 −04	1.08 +01
	5.00	1.78
	8.00	2.58
	1.00 −03	2.96
	1.50	3.62
	2.00	3.96
	2.50	4.23
	3.00	4.43
	4.00	4.73
	5.00	4.94
	9.00	5.45
	1.00 −02	5.53
	1.74	5.94
	1.00 −01	5.94
65	1.00 −05	3.51 −01
(Curve 3)	3.01 −04	1.08 +01
	5.00	1.73
	6.00	2.00
	7.00	2.25
	1.00 −03	2.80
	1.50	3.39
	2.00	3.71
(Curve 3)	2.50	3.95
	3.00	4.16
	9.00	5.10
	1.00 −02	5.19
	1.74	5.59
	1.00 −01	5.59
65	1.00 −05	3.51 −01
(Curve 4)	3.01 −04	1.08 +01
	5.00	1.69
	6.00	1.95
	7.00	2.18
	1.00 −03	2.70
	1.50	3.21
	2.00	3.52
	2.50	3.75
	3.00	3.92
	4.00	4.18
	9.00	4.78
	1.00 −02	4.87
	1.50	5.16
	1.74	5.19
	1.00 −01	5.19
65	1.00 −05	3.51 −01
(Curve 5)	3.01 −04	1.08 +01
	5.00	1.66
	6.00	1.90
	7.00	2.10
	1.00 −03	2.56
	1.50	3.03
	2.00	3.31
	2.50	3.50
	3.00	3.68
	4.00	3.90
	9.00	4.45
	1.00 −02	4.54
	1.50	4.81
	1.74	4.87
	1.00 −01	4.87

Table NFA-12
Tabular Values for Figure NFA-12

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 95	1.00 −05	3.48 −01	150	3.00	6.01
	1.19 −03	4.23 +01		4.00	6.24
	1.50	5.03		5.00	6.34
	2.00	5.82		1.00 −02	6.52
	2.50	6.20		2.50	6.65
	3.00	6.43			
	4.00	6.67	205	1.14 −05	3.45 −01
	7.00	6.89		8.91 −04	2.79 +01
	1.00 −02	7.03		1.00 −03	3.05
	2.00	7.17		1.50	3.76
150	1.07 −05	3.45 −01		2.00	4.10
	1.22 −03	4.05 +01		3.00	4.54
	1.50	4.70		5.00	4.90
	2.00	5.42		1.00 −02	5.17
	2.50	5.78		3.00	5.43

Table NFA-13
Tabular Values for Figure NFA-13

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 95	1.00 −05	3.45 −01	150	5.00	4.71
	7.87 −04	2.81 +01		1.00 −02	4.87
	9.00	3.14		3.00	5.01
	1.00 −03	3.45			
	1.50	4.30	205	1.13 −05	3.45 −01
	2.00	4.63		4.95 −04	1.55 +01
	2.50	4.80		6.00	1.85
	3.00	4.91		7.00	2.09
	4.00	5.04		8.00	2.29
	1.00 − 02	5.23		1.00 −03	2.57
	2.50	5.39		1.50	2.97
				2.00	3.19
150	1.07 −05	3.45 −01		2.50	3.33
	7.87 −04	2.65 +01		3.00	3.43
	1.00 −03	3.21		4.00	3.56
	1.50	4.03		5.00	3.65
	2.00	4.34		1.00 −02	3.83
	2.50	4.47		2.50	3.93
	3.00	4.53			

Table NFC-1
Tabular Values for Figure NFC-1

Temp., °C	A	B, MPa
65	1.00 −05	5.50 −01
	1.63 −04	9.24 +00
	2.50	1.04 +01
	5.00	1.25
	1.00 −03	1.48
	4.00	2.01
	2.50 −02	3.00
	1.00 −01	3.00

Table NFC-2
Tabular Values for Figure NFC-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
65	1.00 −05	6.27 −01	175	1.00 −05	6.27 −01
	5.24 −04	3.34 +01		3.76 −04	2.39 +01
	4.00 −03	4.21		5.00	2.53
	1.00 −02	4.61		6.00	2.63
	2.00	4.90		7.00	2.71
	2.50	4.99		4.00 −03	3.61
	3.00	5.05		1.00 −02	4.20
	4.00	5.14		3.00	4.85
	5.00	5.21		1.00 −01	4.85
	6.00	5.25			
	7.00	5.30			
	1.00 −01	5.30			

Table NFC-3
Tabular Values for Figure NFC-3

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
65	1.00 −05	6.20 −01	315	1.00 −05	5.54 −01
	3.86 −04	2.43 +01		1.89 −04	1.06 +01
	3.00 −03	3.44		2.00	1.07
	4.00	3.59		2.50	1.14
	5.00	3.69		3.00	1.21
	1.00 −02	3.91		4.00	1.34
	2.00	4.08		5.00	1.48
	2.50	4.11		6.00	1.61
	5.00	4.22		1.00 −03	2.07
	1.00 −01	4.22		1.50	2.39
205	1.00 −05	5.77 −01		2.00	2.58
	3.58 −04	2.12 +01		2.50	2.70
	3.00 −03	3.12		3.00	2.81
	4.00	3.25		4.00	2.96
	1.00 −02	3.58		1.00 −02	3.28
	1.50	3.70		3.00	3.59
	2.00	3.79		4.00	3.65
	5.00	4.02		1.00 −01	3.65
	1.00 −01	4.02			

Table NFC-4
Tabular Values for Figure NFC-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
65	1.00 −05	7.93 −01	205	1.00 −05	7.45 −01
	2.30 −04	1.73 +01		2.48 −04	1.73 +01
	4.00	2.34		3.00	1.94
	5.00	2.59		4.00	2.18
	6.00	2.79		5.00	2.34
	1.00 −03	3.35		7.00	2.59
	1.50	3.80		1.00 −03	2.83
	3.00	4.41		1.50	3.13
	4.00	4.65		2.00	3.35
	7.00	5.04		2.50	3.47
	1.00 −02	5.27		3.00	3.59
	2.00	5.72		6.00	4.03
	4.00	6.03		1.00 −02	4.30
	1.00 −01	6.03		2.00	4.59
				4.00	4.71
120	1.00 −05	7.45 −01		1.00 −01	4.74
	2.48 −04	1.73 +01			
	3.00	1.93	370	1.00 −05	6.81 −01
	4.00	2.22		2.69 −04	1.73 +01
	5.00	2.42		3.00	1.81
	7.00	2.71		4.00	2.02
	1.00 −03	3.01		5.00	2.18
	1.50	3.36		7.00	2.37
	2.00	3.61		1.00 −03	2.58
	3.00	3.92		1.50	2.82
	4.00	4.14		2.00	2.98
	7.00	4.52		2.50	3.08
	1.00 −02	4.71		3.00	3.17
	1.50	4.96		6.00	3.32
	3.00	5.29		1.00 −02	3.63
	4.00	5.34		2.00	3.70
	1.00 −01	5.34		1.00 −01	3.72

Table NFC-5
Tabular Values for Figure NFC-5

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.50 −04	9.03 +00	40	1.00 −02	5.00
	2.00	1.21 +01		1.50	5.27
	2.50	1.51		1.90	5.31
	3.00	1.81			
	3.25	1.97			
	4.00	2.07	150	1.50 −04	8.69 +00
	1.00 −03	2.72		2.00	1.16 +01
	4.00	4.14		2.50	1.45
	5.00	4.41		3.00	1.74
	6.00	4.55		3.45	2.00
	8.00	4.83			

Table NFC-6
Tabular Values for Figure NFC-6

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
95	3.01 −04	1.72 +01	150	4.42	2.48
	6.69	3.83		7.00	3.14
	1.00 −03	4.48		1.00 −03	3.72
	2.00	5.65		2.00	4.96
	4.00	6.89		4.00	6.21
	6.00	7.58		6.00	6.89
	8.00	8.17		8.00	7.31
	1.00 −02	8.55		1.00 −02	7.65
	2.00	9.58		2.00	8.41
	4.00	1.03 +02		4.00	8.83
	6.00	1.03		6.00	8.96
150	3.07 −04	1.72 +01			

Table NFC-7
Tabular Values for Figure NFC-7

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	1.18 −05	6.89 −01	95	1.50	1.96
	1.00 −04	5.61 +00		1.75	1.99
	1.25	7.00		2.00	2.01
	2.00	1.12 +01		3.50	2.10
	3.00	1.68		5.00	2.16
	4.00	1.99		7.50	2.23
	6.00	2.17		1.00 −02	2.28
	8.00	2.26		2.00	2.41
	1.00 −03	2.32		3.71	2.52
	1.25	2.38			
	1.50	2.42	205	1.23 −05	6.89 −01
	1.75	2.46		1.00 −04	5.19 +00
	2.00	2.48		1.35	7.00
	3.50	2.61		2.00	1.03 +01
	5.00	2.68		3.00	1.41
	7.50	2.76		4.00	1.50
	1.00 −02	2.82		6.00	1.61
	2.00	2.96		8.00	1.66
	3.71	3.10		1.00 −03	1.70
				1.25	1.74
95	1.20 −05	6.89 −01		1.50	1.77
	1.00 −04	5.34 +00		1.75	1.79
	1.32	7.00		2.00	1.81
	2.00	1.06 +01		3.50	1.90
	3.00	1.52		5.00	1.96
	4.00	1.65		7.50	2.02
	6.00	1.77		1.00 −02	2.06
	8.00	1.83		2.00	2.17
	1.00 −03	1.88		3.67	2.28
	1.25	1.93			

Table NFC-8
Tabular Values for Figure NFC-8

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
65	1.00 −05	6.31 −01	205	2.00	6.25
	5.85 −04	3.79 +01		3.00	6.84
	7.00	4.38		4.00	7.24
	8.00	4.85		7.00	7.86
	1.00 −03	5.52		1.00 −02	8.14
	1.50	6.45		1.50	8.41
	2.00	6.96		3.00	8.89
	3.00	7.52		4.00	9.03
	4.00	7.86		1.00 −01	9.03
	7.00	8.34			
	1.00 −02	8.62	315	1.00 −05	3.65 −01
	1.50	8.83		7.88 −04	2.91 +01
	3.00	9.03		9.00	3.28
	5.00	9.17		1.00 −03	3.54
	1.00 −01	9.17		1.50	4.58
				2.00	5.16
205	1.00 −05	5.29 −01		2.50	5.54
	5.85 −04	3.18 +01		4.00	6.29
	7.00	3.68		6.00	6.84
	8.00	4.12		1.00 −02	7.45
	1.00 −03	4.76		2.50	8.34
	1.51	5.71		1.00 −01	8.34

Table NFN-1
Tabular Values for Figure NFN-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.05 +00	315	1.00 −02	4.08
	1.97 −04	2.10 +01		1.84	4.52
	1.00 −03	2.79		1.00 −01	4.52
	1.00 −02	4.14			
	1.65	4.52	425	1.00 −05	9.10 −01
	1.00 −01	4.52		1.87 −04	1.74 +01
				1.00 −03	2.32
205	1.00 −05	9.79 −01		1.00 −02	3.43
	2.01 −04	2.01 +01		3.00	4.16
	1.00 −03	2.68		1.00 −01	4.16
	1.00 −02	4.08			
	1.84	4.52	540	1.00 −05	8.62 −01
	1.00 −01	4.52		1.62 −04	1.41 +01
				1.00 −03	1.98
315	1.00 −05	9.79 −01		1.00 −02	3.06
	2.01 −04	2.01 +01		3.00	3.77
	1.00 −03	2.68		1.00 −01	3.77

Table NFN-2
Tabular Values for Figure NFN-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.05 +00	205	1.00 −05	9.86 −01
	2.57 −04	2.80 +01		2.76 −04	2.79 +01
	5.00	3.03		5.00	3.03
	1.78 −02	4.73		1.78 −02	4.73
	1.00 −01	4.73		1.00 −01	4.73
95	1.00 −05	1.02 +00	315	1.01 −05	9.51 −01
	2.65 −04	2.79 +01		2.91 −04	2.79 +01
	5.00	3.03		5.00	3.03
	1.78 −02	4.73		1.78 −02	4.73
	1.00 −01	4.73		1.00 −01	4.73

Table NFN-3
Tabular Values for Figure NFN-3

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	9.10 −01	95	1.00 −01	8.27 +01	315	3.00 −02	7.38 +01
	5.23 −04	4.97 +01					1.00 −01	7.38
	7.00	5.32	205	1.00 −05	9.10 −01			
	1.00 −03	5.86		4.23 −04	4.01 +01	425	1.00 −05	7.58 −01
	2.00	6.81		7.00	4.50		5.00 −04	3.96 +01
	2.50	7.10		1.00 −03	4.91		1.00 −03	4.65
	3.00	7.38		1.50	5.35		2.00	5.35
	5.00	8.00		2.50	5.89		3.00	5.81
	6.00	8.20		3.00	6.08		4.00	6.05
	7.00	8.34		4.00	6.40		6.00	6.46
	8.00	8.41		6.00	6.78		8.00	6.67
	1.00 −02	8.62		7.00	6.89		1.00 −02	6.85
	2.00	8.96		9.00	7.10		1.50	7.10
	2.50	9.10		1.00 −02	7.17		2.00	7.24
	4.00	9.17		1.50	7.38		3.00	7.38
	1.00 −01	9.17		2.00	7.58		1.00 −01	7.38
95	1.00 −05	9.10 −01		3.00	7.72			
	4.68 −04	4.43 +01		1.00 −01	7.72	480	1.00 −05	6.88 −01
	6.00	4.67					5.28 −04	3.90 +01
	9.00	5.14	315	1.00 −05	8.41 −01		1.00 −03	4.56
	1.00 −03	5.29		4.37 −04	3.87 +01		2.00	5.33
	1.50	5.75		5.00	3.96		3.00	5.81
	2.00	6.07		1.00 −03	4.65		4.00	6.05
	3.00	6.55		2.00	5.35		6.00	6.46
	4.00	6.86		3.00	5.81		8.00	6.64
	5.00	7.10		4.00	6.05		1.00 −02	6.85
	7.00	7.38		6.00	6.46		1.50	7.10
	1.00 −02	7.65		8.00	6.67		2.00	7.24
	1.50	7.93		1.00 −02	6.85		3.00	7.38
	2.50	8.14		1.50	7.10		1.00 −01	7.38
	4.00	8.27		2.00	7.24			

Table NFN-4
Tabular Values for Figure NFN-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.10 +00	315	4.00	7.45
	5.31 −04	5.96 +01		5.00	7.65
	1.00 −03	6.78		1.00 −02	8.07
	3.00	8.07		3.00	8.48
	4.00	8.41		1.00 −01	8.48
	1.00 −02	9.17			
	2.00	9.51	425	1.00 −05	9.93 −01
	1.00 −01	9.51		4.87 −04	4.98 +01
				1.00 −03	5.75
95	1.00 −05	1.10 +00		4.00	7.03
	4.94 −04	5.46 +01		1.50 −02	7.86
	1.00 −03	6.25		3.00	8.14
	2.00	7.03		1.00 −01	8.14
	3.00	7.45			
	9.00	8.34	540	1.00 −05	9.31 −01
	2.00 −02	8.69		4.71 −04	4.50 +01
	1.00 −01	8.83		1.00 −03	5.24
				2.00	5.83
205	1.00 −05	1.03 +00		5.00	6.49
	5.00 −04	5.30 +01		1.00 −02	6.85
	1.00 −03	6.09		3.00	7.31
	2.00	6.79		1.00 −01	7.31
	4.00	7.45			
	5.00	7.65	595	1.00 −05	8.83 −01
	1.00 −02	8.07		3.72 −04	3.35 +01
	3.00	8.48		4.00	3.35
	1.00 −01	8.48		1.00 −01	3.35
315	1.00 −05	1.03 +00	650	1.00 −05	8.83 −01
	5.00 −04	5.30 +01		2.50 −04	2.26 +01
	1.00 −03	6.09		1.00 −01	2.26
	2.00	6.79			

Table NFN-5
Tabular Values for Figure NFN-5

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.02 +00	205	2.50	1.17
	5.51 −04	5.86 +01		1.00 −01	1.17
	2.50 −03	1.08 +02			
	3.00	1.15	315–345	1.00 −05	9.45 −01
	4.00	1.23		3.12 −04	3.01 +01
	5.00	1.28		9.00 −03	5.06
	7.00	1.32		1.50	6.61
	1.00 −02	1.35		2.00	7.45
	5.00	1.47		2.50	8.07
	1.00 −01	1.47		3.00	8.41
				4.00	8.96
205	1.00 −05	1.02 +00		5.00	9.31
	5.09 −04	5.40 +01		7.00	9.72
	4.00 −03	9.79		1.00 −02	1.01 +02
	5.00	1.03 +02		1.50	1.04
	9.00	1.11		2.50	1.07
	1.50 −02	1.14		1.00 −01	1.07

Table NFN-6
Tabular Values for Figure NFN-6

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.11 +00	425	1.00 −03	8.00
	8.79 −04	1.01 +02		2.00	8.48
	1.00 −03	1.03		4.00	8.89
	1.00 −02	1.37		1.00 −02	9.31
	1.50	1.40		5.00	9.93
205	1.00 −05	1.01 +00	595	1.00 −05	8.55 −01
	8.47 −04	8.89 +01		7.86 −04	6.96 +01
	1.00 −03	9.03		1.00 −03	7.17
	3.00	9.93		2.00	7.58
	1.00 −02	1.09 +02		4.00	8.00
	4.00	1.16		1.00 −02	8.27
				2.00	8.48
315	1.00 −05	9.79 −01		6.00	8.69
	8.20 −04	8.34 +01			
	1.00 −03	8.55	650	1.00 −05	8.00 −01
	5.00	9.65		8.39 −04	6.85 +01
	1.00 −02	1.00 +02		1.00 −01	6.85
	3.00	1.03			
	1.00 −01	1.07	705	1.00 −05	7.72 −01
425	1.00 −05	8.89 −01		4.93 −04	3.91 +01
	8.51 −04	7.86 +01		1.00 −01	3.91

Table NFN-7
Tabular Values for Figure NFN-7

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	9.65 −01	205	1.00 −05	9.10 −01
	8.25 −04	8.34 +01		7.45 −04	7.17 +01
	1.00 −03	8.55		1.00 −03	7.31
	2.00	9.17		4.00	8.00
	6.00	1.04 +02		1.00 −02	8.48
	1.00 −02	1.10		4.00	9.24
	2.00	1.19			
	2.50	1.23	370	1.00 −05	8.62 −01
				7.22 −04	6.57 +01
95	1.00 −05	9.86 −01		1.00 −03	6.67
	7.77 −04	7.79 +01		2.00	6.89
	1.00 −03	8.00		8.00	7.45
	4.00	9.17		2.00 −02	7.79
	1.00 −02	9.93		6.00	8.27
	4.00	1.08 +02			

Table NFN-8
Tabular Values for Figure NFN-8

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	9.86 −01	425	6.87 −04	6.10 +01
	7.79 −04	8.07 +01		1.00 −03	6.38
	1.00 −03	8.34		2.00	6.76
	2.00	9.17		4.00	7.10
	4.00	9.72		1.00 −02	7.52
	1.00 −02	1.02 +02		2.50	7.86
	4.00	1.06		1.00 −01	7.86
	1.00 −01	1.06			
			540	1.00 −05	7.86 −01
205	1.00 −05	9.10 −01		6.72 −04	5.52 +01
	7.37 −04	7.03 +01		1.00 −03	5.87
	1.00 −03	7.24		2.00	6.43
	4.00	8.14		4.00	6.87
	1.00 −02	8.62		1.00 −02	7.24
	3.00	9.03		3.00	7.65
	1.00 −01	9.03		1.00 −01	7.65
315	1.00 −05	9.10 −01	595	1.00 −05	7.86 −01
	6.97 −04	6.60 +01		5.26 −04	4.31 +01
	1.00 −03	6.80		1.00 −03	5.05
	3.00	7.52		2.00	5.74
	1.00 −02	8.14		4.00	6.23
	3.00	8.62		1.00 −02	6.80
	1.00 −01	8.62		2.50	7.31
425	1.00 −05	8.41 −01		1.00 −01	7.31

Table NFN-9
Tabular Values for Figure NFN-9

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	1.00 −05	1.0	595	1.00 −05	0.8
	1.02	1.0		1.21	1.0
	5.26 −04	51.7		3.78 −04	31.0
	8.80	55.8		7.84	34.8
	1.53 −03	61.0		1.64 −03	38.8
	3.54	69.0		2.83	41.5
	6.96	75.8		5.02	44.8
	1.22 −02	82.7		9.91	48.8
	1.63	86.2		1.63 −02	51.7
	1.00 −01	86.2		1.00 −01	51.7
95	1.00 −05	1.0	760	1.00 −05	0.8
	1.04	1.0		1.32	1.0
	4.95 −04	47.6		3.38 −04	25.5
	1.43 −03	55.0		5.63	27.6
	1.98	57.4		1.24 −03	30.9
	3.57	62.7		3.17	34.6
	5.28	66.0		6.99	37.9
	1.15 −02	73.1		1.92 −02	42.4
	2.02	79.3		1.00 −01	42.4
	1.00 −01	79.3			
260	1.00 −05	0.9	870	1.00 −05	0.7
	1.09	1.0		1.50	1.0
	4.34 −04	40.0		1.93 −04	12.9
	7.30	43.8		7.71	15.9
	1.18 −03	47.6		1.28 −03	17.1
	3.46	55.2		1.97	18.1
	1.04 −02	62.2		4.52	20.5
	2.08	66.5		8.12	22.4
	1.00 −01	66.5		1.49 −02	24.5
				1.00 −01	24.5
425	1.00 −05	0.9	900	1.00 −05	0.7
	1.14	1.0		1.53	1.0
	3.94 −04	34.5		1.39 −04	9.1
	1.33 −03	42.4		6.00	11.0
	2.10	45.2		1.17 −03	12.2
	3.29	47.9		2.46	13.8
	6.43	51.7		6.62	16.5
	1.35 −02	55.5		8.33	17.2
	2.06	57.6		1.00 −01	17.2
	1.00 −01	57.6			

Table NFN-10
Tabular Values for Figure NFN-10

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	1.03 +00	315	6.92 −04	6.47 +01
	8.97 −04	9.45 +01		1.00 −03	6.76
	2.00 −03	1.10 +02		2.00	7.45
	4.00	1.21		4.00	8.07
	6.00	1.25		6.00	8.41
	1.00 −02	1.30		1.00 −02	8.83
	2.00	1.35		2.00	9.31
	4.00	1.39		5.00	9.72
95	1.00 −05	1.03 +00	425	1.00 −05	8.62 −01
	8.22 −04	8.62 +01		6.67 −04	5.95 +01
	2.00 −03	1.00 +02		1.00 −03	6.26
	4.00	1.11		2.00	6.87
	6.00	1.16		4.00	7.45
	1.00 −02	1.21		6.00	7.72
	2.00	1.25		1.00 −02	8.14
	5.00	1.30		2.00	8.55
205	1.00 −05	9.24 −01		6.00	8.96
	7.32 −04	6.89 +01			
	1.00 −03	7.17	540	1.00 −05	8.62 −01
	2.00	7.93		6.55 −04	5.81 +01
	4.00	8.69		1.00 −03	6.09
	6.00	9.10		2.00	6.62
	1.00 −02	9.65		4.00	7.10
	2.00	1.02 +02		6.00	7.45
	6.00	1.08		1.00 −02	7.72
				2.00	8.07
315	1.00 −05	9.24 −01		6.00	8.48

Table NFN-11
Tabular Values for Figure NFN-11

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	9.58 −01	205	6.35 −04	5.83 +01
	7.61 −04	7.45 +01		2.00 −03	6.54
	2.00 −03	8.27		6.00	7.17
	6.00	9.24		1.00 −02	7.38
	1.00 −02	9.65		2.00	7.65
	2.00	1.02 +02		3.00	7.79
	4.00	1.05			
95	1.00 −05	9.58 −01	425 to 540	1.00 −05	8.00 −01
	6.87 −04	6.69 +01		5.76 −04	4.69 +01
	2.00 −03	7.45		2.00 −03	5.50
	6.00	8.20		6.00	6.18
	1.00 −02	8.48		1.00 −02	6.41
	2.00	8.89		2.00	6.63
	5.00	9.10		3.00	6.75
205	1.00 −05	9.03 −01		5.00	6.85

Table NFN-12
Tabular Values for Figure NFN-12

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	2.00 −04	2.07 +01	205	2.00 −03	6.89
	4.00	4.14		4.00	8.27
	8.00	6.21		8.50	9.65
	3.00 −03	9.65			
	5.00	1.10 +02	315	3.00 −04	2.76 +01
	1.00 −02	1.24		4.50	4.14
				6.00	4.48
95	2.50 −04	2.48 +01		2.50 −03	6.83
	8.00	5.52		2.00 −02	9.65
	1.00 −03	6.89			
	5.00	9.65	425	4.00 −04	3.45 +01
	1.00 −02	1.10 +02		5.00	4.14
	2.50	1.17		2.00 −03	6.21
				3.00	6.89
205	4.00 −04	3.79 +01		7.00	8.27
	5.00	4.48		1.50 −02	8.96

Table NFN-13
Tabular Values for Figure NFN-13

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	2.00 −04	1.93 +01	205	4.00	6.89
	5.00	4.83		2.50 −02	7.79
	1.00 −03	6.41			
	3.00	8.27	425	2.50 −04	2.07 +01
	1.00 −02	9.65		5.00	4.14
	2.50	1.02 +02		6.00	5.03
				1.20 −03	5.52
95	2.00 −04	1.93 +01		5.00	6.21
	5.00	4.83		2.60 −02	6.62
	1.00 −03	6.21			
	1.80	6.89	650	6.00 −04	4.48 +01
	7.00	8.27		2.00 −03	4.83
	2.50 −02	8.96		4.00	4.93
				5.90	5.08
205	2.30 −04	2.07 +01		8.50	5.21
	5.00	4.48		1.15 −02	5.36
	8.00	5.52		1.70	5.58
	1.50 −03	6.21		3.00	5.76

Table NFN-14
Tabular Values for Figure NFN-14

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	2.00 −04	1.93 +01	205	8.50	8.27
	8.00	8.14		4.00 −03	9.65
	1.00 −03	1.03 +02		2.50 −02	1.10 +02
	2.00	1.10			
	6.00	1.24	315	2.50 −04	2.36 +01
	4.00 −02	1.38		5.00	4.83
				7.65	7.45
95	2.00 −04	1.93 +01		2.00 −03	8.27
	8.00	8.14		1.00 −02	9.65
	9.20	9.45		5.00	1.03 +02
	5.00 −03	1.10 +02			
	1.50 −02	1.17	540	2.70 −04	2.41 +01
	4.00	1.24		7.00	6.21
				1.50 −03	6.89
205	2.50 −04	2.36 +01		6.50	8.27
	5.00	4.83		3.00 −02	8.96

Table NFN-15
Tabular Values for Figure NFN-15

Temperature up to 40°C, $E = 2.0 \times 10^5$ MPa		Temperature 95°C, $E = 1.9 \times 10^5$ MPa		Temperature 205°C, $E = 1.9 \times 10^5$ MPa		Temperature 315°C, $E = 1.8 \times 10^5$ MPa		Temperature 425°C, $E = 1.8 \times 10^5$ MPa		Temperature 540°C, $E = 1.7 \times 10^5$ MPa	
A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa
0.00021	21	0.00022	21	0.00022	21	0.00023	21	0.00024	21	0.00025	21
0.00042	41	0.00043	41	0.00044	41	0.00045	41	0.00047	41	0.0005	41
0.00084	83 P.L.	0.00081	78 P.L.	0.00068	63 P.L.	0.00061	55 P.L.	0.00067	59 P.L.	0.00062	52 P.L.
0.001	84	0.001	80	0.0009	66	0.0008	61	0.0009	59	0.0009	53
0.0015	91	0.0015	85	0.001	68	0.001	63	0.001	61	0.001	54
0.002	96	0.002	88	0.0015	72	0.0015	65	0.0015	63	0.0015	57
0.003	101	0.003	92	0.002	74	0.002	69	0.002	66	0.002	59
0.004	105	0.004	97	0.003	79	0.003	72	0.0025	67	0.0025	61
0.006	110	0.006	98	0.004	83	0.004	73	0.003	68	0.003	63
0.008	112	0.008	100	0.006	84	0.006	75	0.004	70	0.004	65
0.01	115	0.01	101	0.008	86	0.008	78	0.006	71	0.006	67
0.02	121	0.015	103	0.01	88	0.01	79	0.008	73	0.008	68
0.03	122	0.02	104	0.015	90	0.015	80	0.01	74	0.01	70
0.04	123	0.04	107	0.02	92	0.02	81	0.015	74	0.015	71
0.06	123	0.06	108	0.03	93	0.03	81	0.02	75	0.02	73
0.08	123	0.08	108	0.04	94	0.04	81	0.03	76	0.04	74
0.1	123	0.1	108	0.06	94	0.06	81	0.04	76	0.06	74
...	...	...	...	0.08	94	0.08	81	0.06	76	0.08	74
...	...	...	...	0.1	94	0.08	81	0.06	76	0.1	74
...	...	...	...	...	...	...	...	0.08	76	...	...

Table NFN-16
Tabular Values for Figure NFN-16

Temperature up to 40°C, $E = 2.1 \times 10^5$ MPa		Temperature 95°C, $E = 2.1 \times 10^5$ MPa		Temperature 205°C, $E = 2.1 \times 10^5$ MPa		Temperature 315°C, $E = 2.0 \times 10^5$ MPa		Temperature 425°C, $E = 2.0 \times 10^5$ MPa	
A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa
0.00019	21	0.000195	21	0.0002	21	0.0002	21	0.00021	21
0.00038	41	0.00039	41	0.0004	41	0.00041	41	0.00042	41
0.00058	62	0.00058	62	0.0006	62	0.00061	62	0.00063	62
0.00077	83	0.00078	83	0.0008	83	0.00082	83	0.00085	83
0.00115	124	0.00114	121	0.00108	112	0.001	104	0.001	98
0.0012	131	0.0015	128	0.0015	116	0.0015	110	0.0015	108
0.0015	134	0.002	135	0.002	120	0.002	114	0.002	112
0.002	141	0.003	143	0.003	125	0.003	117	0.003	120
0.003	149	0.004	148	0.004	130	0.004	121	0.004	123
0.004	157	0.006	152	0.006	135	0.006	127	0.006	125
0.005	159	0.008	156	0.008	138	0.008	128	0.008	127
0.007	163	0.01	157	0.01	139	0.01	132	0.01	128
0.01	169	0.02	161	0.02	144	0.02	137	0.02	130
0.012	170	0.04	164	0.04	145	0.04	137	0.04	131
0.03	172	0.06	165	0.06	146	0.06	137	0.06	132
0.05	176	0.08	165	0.08	147	0.08	137	0.08	132
0.1	176	0.1	165	0.1	148	0.1	137	0.1	132

Table NFN-17
Tabular Values for Figure NFN-17

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	2.00 −04	2.07 +01	260	6.60 −04	6.21 +01
	9.30	9.65		8.00	7.58
	1.08 −03	1.10 +02		9.00	8.27
	1.16	1.17		9.50	8.62
	1.25	1.24		1.00 −03	8.96
	1.40	1.31		1.12	9.31
	1.60	1.38		1.25	9.65
	1.82	1.45		1.39	1.00 +02
	2.05	1.52		1.55	1.03
	2.40	1.59		1.90	1.10
	2.80	1.65		2.50	1.17
	3.50	1.72		3.40	1.24
	7.00	1.90		5.00	1.31
	2.00 −02	2.07		8.00	1.38
	1.00 −01	2.07		1.50 −02	1.45
				1.00 −01	1.45
150	2.10 −04	2.07 +01			
	8.50	8.27	425 to 650	2.50 −04	2.07 +01
	9.50	8.96		8.00	6.21
	1.05 −03	9.65		1.05 −03	7.58
	1.25	1.03 +02		1.25	8.27
	1.42	1.10		1.35	8.62
	1.65	1.17		1.48	8.96
	1.90	1.24		1.63	9.31
	2.30	1.31		1.80	9.65
	3.00	1.38		2.00	1.00 +02
	4.00	1.45		2.25	1.03
	5.20	1.52		2.80	1.10
	1.00 −02	1.59		3.70	1.17
	4.00	1.65		5.40	1.24
	8.00	1.68		8.30	1.31
	1.00 −01	1.68		1.65 −02	1.38
				3.00	1.41
260	2.20 −04	2.07 +01		1.00 −01	1.41

Table NFN-18
Tabular Values for Figure NFN-18

Temperature 20°C, $E = 2.0 \times 10^5$ MPa		Temperature 95°C, $E = 2.0 \times 10^5$ MPa		Temperature 175°C, $E = 1.9 \times 10^5$ MPa		Temperature 260°C, $E = 1.9 \times 10^5$ MPa		Temperature 345°C, $E = 1.8 \times 10^5$ MPa		Temperature 425°C, $E = 1.8 \times 10^5$ MPa	
A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa
0.0002	16	0.0002	20	0.0002	19	0.002	19	0.0002	18	0.0002	18
0.00079	78	0.00068	67	0.00064	59	0.00057	53	0.00049	43	0.00045	40
0.0008	79	0.0007	68	0.0007	61	0.0006	54	0.0005	44	0.0005	41
0.0009	80	0.0008	70	0.0008	63	0.0007	56	0.0006	46	0.0006	44
0.001	83	0.0009	72	0.0009	65	0.0008	58	0.0007	48	0.0007	46
0.0015	88	0.001	73	0.001	67	0.0009	59	0.0008	50	0.0008	48
0.002	95	0.0015	80	0.0015	72	0.001	61	0.0009	52	0.0009	50
0.0025	97	0.002	85	0.002	76	0.0015	62	0.001	54	0.001	51
0.003	100	0.0025	89	0.0025	79	0.002	70	0.0015	59	0.0015	55
0.004	104	0.003	92	0.003	81	0.0025	71	0.002	62	0.002	58
0.005	108	0.004	96	0.004	85	0.003	73	0.0025	64	0.0025	61
0.006	110	0.005	99	0.005	87	0.004	76	0.003	66	0.003	62
0.007	113	0.006	101	0.006	88	0.005	78	0.004	69	0.004	63
0.008	114	0.007	103	0.007	90	0.006	79	0.005	71	0.005	66
0.009	114	0.008	103	0.008	90	0.007	79	0.006	72	0.006	66
0.01	116	0.009	104	0.009	91	0.008	80	0.007	72	0.007	67
0.015	118	0.01	105	0.01	92	0.009	81	0.008	73	0.008	68
0.02	120	0.015	106	0.015	93	0.01	81	0.009	74	0.009	68
0.025	121	0.02	107	0.02	94	0.015	83	0.01	74	0.01	69
0.03	121	0.025	108	0.025	94	0.02	83	0.015	76	0.015	70
0.04	121	0.03	108	0.03	94	0.025	84	0.02	76	0.02	70
0.05	121	0.04	108	0.04	95	0.03	85	0.025	77	0.025	71
0.06	121	0.05	108	0.05	95	0.04	86	0.03	77	0.03	72
0.07	121	0.06	108	0.06	95	0.05	87	0.04	79	0.04	72
...	...	0.07	108	0.07	95	0.06	87	0.05	79	0.05	72
...	...	...	...	0.08	95	0.07	87	0.06	79	0.06	72
...	...	...	...	0.09	95	0.08	87	...	...	...	...

Table NFN-19
Tabular Values for Figure NFN-19

Temperature 20°C, $E = 2.0 \times 10^5$ MPa		Temperature 95°C, $E = 2.0 \times 10^5$ MPa		Temperature 175°C, $E = 1.9 \times 10^5$ MPa		Temperature 260°C, $E = 1.9 \times 10^5$ MPa		Temperature 345°C, $E = 1.7 \times 10^5$ MPa		Temperature 425°C, $E = 1.7 \times 10^5$ MPa	
A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa
0.0002	20	0.0002	20	0.0002	19	0.0002	19	0.0002	17	0.0002	17
0.00061	63	0.00056	55	0.00051	48	0.00045	42	0.0004	34	0.00037	32
0.0007	65	0.0006	56	0.0006	50	0.0005	43	0.0005	38	0.0004	33
0.0008	67	0.0007	59	0.0007	53	0.0006	46	0.0006	40	0.0005	35
0.0009	69	0.0008	60	0.0008	54	0.0007	48	0.0007	41	0.0006	36
0.001	71	0.0009	62	0.0009	56	0.0008	50	0.0008	43	0.0007	39
0.0015	78	0.001	63	0.001	57	0.0009	51	0.0009	44	0.0008	40
0.002	83	0.0015	69	0.0015	62	0.001	52	0.001	45	0.0009	41
0.0025	86	0.002	72	0.002	64	0.0015	55	0.0015	49	0.001	42
0.003	89	0.0025	76	0.0025	67	0.002	58	0.002	52	0.0015	46
0.004	92	0.003	78	0.003	69	0.0025	59	0.0025	54	0.002	49
0.005	95	0.004	81	0.004	71	0.003	61	0.003	55	0.0025	50
0.006	96	0.005	83	0.005	72	0.004	63	0.004	57	0.003	52
0.007	97	0.006	85	0.006	74	0.005	65	0.005	59	0.004	54
0.008	99	0.007	85	0.007	74	0.006	66	0.006	60	0.005	55
0.009	99	0.008	86	0.008	75	0.007	66	0.007	61	0.006	56
0.01	100	0.009	87	0.009	75	0.008	67	0.008	61	0.007	57
0.015	103	0.01	88	0.01	75	0.009	68	0.009	62	0.008	58
0.02	103	0.015	89	0.015	77	0.01	68	0.01	62	0.009	59
0.025	103	0.02	91	0.02	79	0.015	69	0.015	63	0.01	59
0.03	104	0.025	92	0.025	79	0.02	70	0.02	66	0.015	60
0.04	104	0.03	92	0.03	79	0.025	70	0.025	66	0.02	61
0.05	104	0.04	92	0.04	79	0.03	70	0.03	66	0.025	62
0.06	104	0.05	92	0.05	79	0.04	71	0.04	66	0.03	64
0.07	105	0.06	92	0.06	79	0.05	71	...	...	0.04	64
0.08	105	0.07	92	0.07	79	0.06	72	...	...	...	...
...	...	0.08	92	0.08	79	0.07	72	...	...	...	...
...	...	0.09	92	...	...	0.08	72	...	...	...	...

Table NFN-20
Tabular Values for Figure NFN-20

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.32 −04	1.38 +01	205	1.43 −04	1.38 +01
	5.13	5.34		5.54	5.34
	6.00	5.45		6.00	5.45
	1.00 −03	6.21		1.00 −03	6.21
	3.00	8.20		3.00	8.20
	4.00	8.69		4.00	8.69
	5.00	9.10		5.00	9.10
	6.00	9.38		6.00	9.38
	7.00	9.65		7.00	9.65
	8.00	9.79		8.00	9.79
	9.00	9.93		9.00	9.93
	1.00 −02	1.00 +02		1.00 −02	1.00 +02
	1.50	1.03		1.50	1.03
	2.00	1.03		2.00	1.03

Table NFN-22
Tabular Values for Figure NFN-22

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	0.0002	21	425	0.004	102
	0.0009	92		0.005	103
	0.002	108		0.1	103
	0.003	117			
	0.004	122	650	0.00025	21
	0.005	127		0.001	83
	0.007	132		0.002	94
	0.009	135		0.003	99
	0.012	138		0.004	100
	0.1	138		0.005	101
				0.1	101
95	0.0002	21			
	0.0009	92	730	0.00025	19
	0.002	108		0.001	79
	0.003	117		0.002	90
	0.004	122		0.003	94
	0.005	127		0.004	97
	0.1	127		0.1	97
205	0.0002	19			
	0.00095	94	760	0.00025	19
	0.002	108		0.001	78
	0.0025	112		0.1	78
	0.003	114			
	0.004	117	790	0.00025	19
	0.1	117		0.001	59
				0.1	59
425	0.0002	17			
	0.00095	86	815	0.00025	19
	0.002	97		0.001	42
	0.003	101		0.1	42

Table NFN-23
Tabular Values for Figure NFN-23

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.02 −05	1	260	1.00 −05	1
	1.03 −04	10		1.09 −04	10
	6.76	65		6.27	54
	7.74	73		7.41	61
	8.90	81		8.89	68
	1.04 −03	89		1.09 −03	75
	1.25	98		1.37	82
	2.06	114		2.37	95
	4.09	130		4.47	109
	9.27	146		8.92	122
	2.32 −02	163		1.88 −02	136
	1.00 −01	163		1.00 −01	136
150	1.00 −05	1	345	1.01 −05	1
	1.06 −04	10		1.12 −04	10
	6.37	57		6.35	53
	7.49	65		7.51	60
	8.91	72		9.03	67
	1.08 −03	79		1.11 −03	73
	1.36	86		1.40	80
	2.34	100		2.41	93
	4.44	115		4.50	112
	9.01	129		8.91	124
	1.94 −02	144		1.86 −02	134
	1.00 −01	144		1.00 −01	134

Table NFN-24
Tabular Values for Figure NFN-24

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
20	1.00 −05	1.14	705	1.00 −05	0.862
	8.74	10.0		1.16 −04	10.0
	7.48 −04	85.5		6.00	51.7
	9.68	106.9		8.48	64.8
	1.20 −03	117.2		1.20 −03	73.1
	1.65	124.1		2.88	85.5
	5.00	137.9		1.00 −02	98.6
	2.30 −02	155.1		3.00	107.6
	1.00 −01	155.1		1.00 −01	107.6
150	1.00 −05	1.02	870	1.00 −05	0.765
	9.80	10.0		1.31 −04	10.0
	6.00 −04	61.2		5.00	38.3
	7.28	71.7		7.50	55.2
	9.24	82.7		1.20 −03	69.0
	1.28 −03	93.1		1.90	75.2
	3.22	108.9		3.00	79.3
	2.00 −02	136.5		1.00 −01	79.3
	1.00 −01	136.5			
315	1.00 −05	0.952	925	1.00 −05	0.686
	1.05 −04	10.0		1.46 −04	10.0
	6.00	57.3		5.00	34.3
	7.05	63.7		8.14	55.8
	9.50	73.1		1.00 −01	55.8
	1.30 −03	80.0			
	4.60	97.9			
	2.00 −02	113.1			
	1.00 −01	113.1			

Table NFN-25
Tabular Values for Figure NFN-25

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
38	0.100 −04	0.103 +01	205	0.100 −04	0.983 +00
	0.100 −03	0.103 +02		0.100 −03	0.983 +01
	0.500	0.517		0.500	0.491 +02
	0.750	0.775		0.750	0.736
	0.100 −02	0.984		0.990	0.929
	0.124	0.106 +03		0.125 −02	0.101 +03
	0.145	0.109		0.145	0.104
	0.174	0.112		0.173	0.107
	0.192	0.113		0.192	0.108
	0.295	0.117		0.288	0.112
	0.465	0.121		0.493	0.117
	0.677	0.124		0.663	0.119
	0.927	0.126		0.972	0.122
	0.188 −01	0.131		0.194 −01	0.127
	0.500	0.137		0.500	0.132
	0.100 +00	0.138		0.100 +00	0.132

Table NFN-26
Tabular Values for Figure NFN-26

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 38	1.00 −05	0.958	205	8.90 −03	124.1
	1.04 −04	10.0		2.10 −02	136.5
	1.37 −03	131.0		1.00 −01	136.5
	2.00	137.9			
	5.00	151.7	315	1.00 −05	0.869
	1.10 −02	165.5		1.15 −04	10.0
	2.40	179.3		9.50	82.7
	1.00 −01	179.3		2.00 −03	96.5
				4.50	110.3
95	1.00 −05	0.938		1.20 −02	124.1
	1.07 −04	10.0		2.10	131.0
	1.22 −03	114.5		1.00 −01	131.0
	2.10	124.1			
	4.70	137.9	425	1.00 −05	0.834
	2.10 −02	166.2		1.20 −04	10.0
	1.00 −01	166.2		9.27	77.6
				1.70 −03	89.6
205	1.00 −05	0.903		3.50	103.4
	1.11 −04	10.0		8.50	117.2
	9.92	89.6		2.00 −02	128.9
	2.20 −03	103.4		1.00 −01	128.9
	5.50	117.2			

Table NFN-27
Tabular Values for Figure NFN-27

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Room temp.	1.00 −05	0.986	260	1.10 −03	65.5
	1.01 −04	10.0		1.90	69.0
	8.01	79.3		4.61	72.4
	1.00 −03	89.6		1.83 −02	75.8
	1.55	103.4		1.00 −01	78.9
	3.00	110.3			
	1.65 −02	117.2	425	1.00 −05	0.883
	1.00 −01	120.7		1.13 −04	10.0
				5.47	48.3
95	1.00 −05	0.972		7.60	55.2
	1.03 −04	10.0		1.50 −03	62.1
	7.20	69.0		3.11	65.5
	9.50	79.3		1.26 −02	69.0
	1.30 −03	86.2		1.00 −01	71.7
	2.20	93.1			
	3.50	96.5	595	1.00 −05	0.834
	7.60	100.0		1.20 −04	10.0
	2.68 −02	103.4		4.96	41.4
	1.00 −01	105.5		5.60	44.8
				7.37	48.3
260	1.00 −05	0.786		2.20 −03	55.2
	1.08 −04	10.0		2.57 −02	62.1
	6.15	55.2		1.00 −01	63.4
	8.50	62.1			

Table NFT-1
Tabular Values for Figure NFT-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	5.34 −01	205	1.00 −05	4.83 −01
	1.16 −03	6.20 +01		7.88 −04	3.80 +01
	1.50	8.02		9.00	4.07
	2.00	9.72		1.00 −03	4.29
	2.50	1.10 +02		1.50	5.21
	3.00	1.18		2.00	5.83
	4.00	1.31		2.50	6.29
	5.00	1.40		3.00	6.69
	6.00	1.45		4.00	7.38
	7.00	1.51		5.00	7.79
	8.00	1.55		6.00	8.20
	9.00	1.58		7.00	8.41
	1.00 −02	1.60		8.00	8.69
	1.50	1.69		9.00	8.96
	2.00	1.71		1.00 −02	9.10
	2.50	1.74		1.26	9.45
	1.00 −01	1.74		1.00 −01	9.45
95	1.00 −05	5.17 −01			
	1.22 −03	6.31 +01	315	1.00 −05	4.34 −01
	1.50	7.30		6.92 −04	3.01 +01
	2.00	8.27		8.00	3.23
	2.50	9.10		1.00 −03	3.53
	3.00	9.72		1.50	4.05
	4.00	1.09 +02		2.00	4.46
	5.00	1.19		2.50	4.77
	6.00	1.25		3.00	5.02
	7.00	1.29		4.00	5.34
	8.00	1.32		5.00	5.60
	9.00	1.34		7.00	5.90
	1.00 −02	1.37		9.00	5.90
	1.50	1.40		1.00 −02	5.90
	2.00	1.42		1.50	5.90
	2.50	1.43		1.00 −01	5.90
	3.00	1.44			
	1.00 −01	1.44			

Table NFT-2
Tabular Values for Figure NFT-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	5.34 −01	205	6.85 −04	3.31 +01
	1.28 −03	6.84 +01		1.00 −03	4.10
	1.50	7.61		2.00	4.96
	2.00	8.94		4.00	5.97
	3.00	1.03 +02		6.00	6.46
	5.00	1.15		9.00	6.64
	8.00	1.23		1.00 −02	6.72
	1.00 −02	1.25		1.30	6.76
	2.00	1.30		1.00 −01	6.76
	6.00	1.38			
	1.00 −01	1.38	315	1.00 −05	4.34 −01
				6.41 −04	2.79 +01
95	1.00 −05	5.17 −01		6.85	2.95
	1.23 −03	6.36 +01		8.00	3.17
	1.50	7.03		1.00 −03	3.31
	2.00	7.79		2.00	3.44
	4.00	9.24		3.00	3.55
	7.00	1.02 +02		5.00	3.65
	1.00 −02	1.07		8.00	3.72
	2.00	1.12		1.00 −02	3.79
	4.00	1.16		1.50	3.86
	1.00 −01	1.16		1.80	3.90
205	1.00 −05	4.83 −01		1.00 −01	3.93

Table NFT-3
Tabular Values for Figure NFT-3

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	0.100 −04	0.534 +00	205	0.900	0.276
	0.129 −03	0.689 +01		0.200 −01	0.279
	0.187	0.100 +02		0.300	0.283
	0.900	0.481		0.400	0.283
	0.900	0.481		0.500	0.283
	0.250 −02	0.552		0.100 +00	0.283
	0.550	0.607			
	0.110 −01	0.642	315	0.100 −04	0.434 +00
	0.200	0.672		0.159 −03	0.689 +01
	0.300	0.688		0.230	0.100 +02
	0.400	0.689		0.330	0.143
	0.500	0.689		0.100 −02	0.159
	0.600	0.689		0.150	0.165
	0.100 +00	0.689		0.250	0.173
				0.400	0.179
205	0.100 −04	0.438 +00		0.700	0.183
	0.143 −03	0.689 +01		0.100 −01	0.183
	0.207	0.100 +02		0.200	0.183
	0.420	0.203		0.300	0.183
	0.200 −02	0.248		0.400	0.183
	0.400	0.262		0.100 +00	0.183
	0.700	0.274			

Table NFT-4
Tabular Values for Figure NFT-4

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	0.100 −04	0.574 +00	205	0.100 −04	0.478 +00
	0.120 −03	0.689 +01		0.144 −03	0.689 +01
	0.179	0.100 +02		0.209	0.100 +02
	0.735	0.414		0.745	0.356
	0.977	0.552		0.994	0.475
	0.124 −02	0.717		0.125 −02	0.594
	0.149	0.862		0.146	0.689
	0.173	0.979		0.167	0.786
	0.198	0.110 +03		0.189	0.876
	0.350	0.155		0.342	0.132 +03
	0.499	0.186		0.497	0.157
	0.749	0.214		0.749	0.172
	0.100 −01	0.241		0.993	0.172
	0.200	0.241		0.200 −01	0.172
	0.100 +00	0.241		0.100 +00	0.172
95	0.100 −04	0.526 +00	315	0.100 −04	0.428 +00
	0.131 −03	0.689 +01		0.161 −03	0.689 +01
	0.190	0.100 +02		0.233	0.100 +02
	0.781	0.414		0.748	0.319
	0.100 −02	0.525		0.992	0.421
	0.125	0.652		0.122 −02	0.512
	0.149	0.779		0.146	0.603
	0.173	0.889		0.172	0.689
	0.198	0.993		0.199	0.779
	0.346	0.145 +03		0.342	0.108 +03
	0.494	0.171		0.500	0.127
	0.746	0.198		0.748	0.143
	0.991	0.211		0.997	0.143
	0.200 −01	0.211		0.200 −01	0.143
	0.100 +00	0.211		0.100 +00	0.143

Table NFT-5
Tabular Values for Figure NFT-5

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	0.100 −03	0.534 +01	205	0.100 −03	0.483 +01
	0.129	0.689		0.143	0.689
	0.188	0.100 +02		0.207	0.100 +02
	0.998	0.530		0.244	0.118
	0.125 −02	0.658		0.295	0.143
	0.150	0.779		0.347	0.168
	0.174	0.889		0.398	0.192
	0.200	0.100 +03		0.449	0.216
	0.348	0.146		0.757	0.365
	0.470	0.169		0.213 −02	0.965
	0.750	0.172		0.265	0.107 +03
	0.100 −01	0.172		0.750	0.138
	0.200	0.172		0.200 −01	0.154
	0.500	0.172		0.500	0.154
	0.100 +00	0.172		0.100 +00	0.154
95	0.100 −03	0.517 +01	315	0.100 −03	0.434 +01
	0.133	0.689		0.159	0.689
	0.193	0.100 +02		0.230	0.100 +02
	0.298	0.154		0.549	0.239
	0.364	0.188		0.680	0.295
	0.430	0.223		0.810	0.352
	0.497	0.256		0.941	0.409
	0.563	0.291		0.107 −02	0.465
	0.961	0.496		0.186	0.807
	0.136 −02	0.689		0.265	0.965
	0.206	0.100 +03		0.750	0.120 +03
	0.380	0.139		0.100 −01	0.120
	0.200 −01	0.166		0.200	0.120
	0.500	0.166		0.500	0.120
	0.100 +00	0.166		0.100 +00	0.120

Table NFZ-1
Tabular Values for Figure NFZ-1

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 −05	4.90 −01	150	2.00 −02	6.11 +01
	1.08 −03	5.80 +01		4.00	6.28
	2.00	6.96			
	4.00	8.14			
	6.00	8.83	260	1.00 −05	3.96 −01
	1.00 −02	9.58		3.83 −04	1.54 +01
	1.50	1.00 +02		1.00 −03	2.14
				3.00	2.97
150	1.00 −05	4.54 −01		9.00	3.78
	6.72 −04	3.22 +01			
	1.00 −03	3.85	370	1.00 −05	3.48 −01
	1.50	4.42		2.93 −04	1.05 +01
	2.00	4.73		1.00 −03	1.48
	4.00	5.32		3.00	1.99
	6.00	5.59		9.00	2.59
	1.00 −02	5.83			

Table NFZ-2
Tabular Values for Figure NFZ-2

Temperature up to 40°C, $E = 1.0 \times 10^5$ MPa		Temperature 150°C, $E = 8.6 \times 10^4$ MPa		Temperature 260°C, $E = 7.5 \times 10^4$ MPa		Temperature 370°C, $E = 6.4 \times 10^4$ MPa	
A	B, MPa	A	B, MPa	A	B, MPa	A	B, MPa
0.00002	1	0.00002	0.86	0.00002	0.75	0.00002	0.67
0.00289	145	0.00196	84	0.00151	57	0.00126	42
0.003	148	0.0025	85	0.002	66	0.0015	43
0.004	153	0.003	90	0.0025	68	0.002	46
0.005	157	0.004	94	0.003	70	0.0025	47
0.006	159	0.005	97	0.004	72	0.003	48
0.007	163	0.006	99	0.005	74	0.004	49
0.008	165	0.007	101	0.006	74	0.005	50
0.009	166	0.008	103	0.007	75	0.006	51
0.01	167	0.009	104	0.008	76	0.007	52
0.015	169	0.01	105	0.009	76	0.008	52
0.02	172	0.015	106	0.01	77	0.009	53
0.03	173	0.02	107	0.015	77	0.01	54
0.035	174	0.03	108	0.02	77	0.012	54
...	...	0.04	108	0.03	78	...	...
...	...	0.045	109	0.04	78	...	...
...	...	...	...	0.05	78	...	...

MANDATORY APPENDIX 1
BASIS FOR ESTABLISHING STRESS VALUES IN TABLES 1A AND 1B

1-100 DERIVATION OF ALLOWABLE STRESS VALUES

The values in Tables 1A and 1B are established by the Committee only. In the determination of allowable stress values for materials, the Committee is guided by successful experience in service, insofar as evidence of satisfactory performance is available. Such evidence is considered equivalent to test data where operating conditions are known with reasonable certainty. In the evaluation of new materials, the Committee is guided to a certain extent by the comparison of test information with available data on successful applications of similar materials.

Nomenclature:

F_{avg} = multiplier applied to average stress for rupture in 100 000 h. At 815°C and below, F_{avg} = 0.67. Above 815°C, it is determined from the slope of the log time-to-rupture versus log stress plot at 100 000 h such that log $F_{avg} = 1/n$, but it may not exceed 0.67.

R_T = ratio of the average temperature dependent trend curve value of tensile strength to the room temperature tensile strength

R_Y = ratio of the average temperature dependent trend curve value of yield strength to the room temperature yield strength

S_C = average stress to produce a creep rate of 0.01%/1 000 h

S_{Ravg} = average stress to cause rupture at the end of 100 000 h

S_{Rmin} = minimum stress to cause rupture at the end of 100 000 h

S_T = specified minimum tensile strength at room temperature, MPa

S_Y = specified minimum yield strength at room temperature, MPa

n = a negative number equal to Δ log time-to-rupture divided by Δ log stress at 100 000 h

NA = not applicable

The maximum allowable stress shall be the lowest value obtained from the criteria in Table 1-100 . The mechanical properties considered, and the factors applied to establish the maximum allowable stresses, are as given below.

(a) At temperatures below the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value is the lowest of the following:

(1) the specified minimum tensile strength at room temperature divided by 3.5

(2) the tensile strength at temperature divided by 3.5

(3) two-thirds of the specified minimum yield strength at room temperature

(4) two-thirds of the yield strength at temperature

In the application of these criteria, the Committee considers the yield strength at temperature to be $S_Y R_Y$, and the tensile strength at temperature to be $1.1 S_T R_T$.

Two sets of allowable stress values are provided in Tables 1A and 1B for austenitic materials and specific nonferrous alloys. The higher alternative allowable stresses are identified by a footnote to the tables. These stresses exceed two-thirds but do not exceed 90% of the minimum yield strength at temperature. The higher stress values should be used only where slightly higher deformation is not in itself objectionable. These higher stresses are not recommended for the design of flanges or other strain sensitive applications.

(b) At temperatures in the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value for all materials is established by the Committee not to exceed the lowest of the following:

(1) 100% of the average stress to produce a creep rate of 0.01%/1 000 h

(2) $100F_{avg}$% of the average stress to cause rupture at the end of 100 000 h

(3) 80% of the minimum stress to cause rupture at the end of 100 000 h

Stress values for high temperatures are based, whenever possible, on representative uniaxial properties of the materials obtained under standard ASTM testing conditions or equivalent. The stress values are based on basic properties of the materials and no consideration is given for corrosive environment, for abnormal temperature and stress conditions, or for other design considerations.

Table 1-100
Criteria for Establishing Allowable Stress Values for Tables 1A and 1B

Product/Material	Room Temperature and Below		Above Room Temperature						
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength		Stress Rupture		Creep Rate
Wrought or cast ferrous and nonferrous	$\frac{S_T}{3.5}$	$\frac{2}{3}\ S_Y$	$\frac{S_T}{3.5}$	$\frac{1.1}{3.5}\ S_T R_T$	$\frac{2}{3}\ S_Y$	$\frac{2}{3}\ S_Y R_Y$ or $0.9\ S_Y R_Y$ [Note (1)]	$F_{\text{avg}} S_{R\ \text{avg}}$	$0.8 S_{R\ \text{min}}$	$1.0 S_c$
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{3.5}\ S_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{0.85}{3.5}\ S_T$	$\frac{(1.1 \times 0.85)}{3.5}\ S_T R_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{2}{3} \times 0.85 S_Y R_Y$ or $0.9 \times 0.85 S_Y R_Y$ [Note (1)]	$(F_{\text{avg}} \times 0.85) S_{R\ \text{avg}}$	$(0.8 \times 0.85) S_{R\ \text{min}}$	$0.85 S_c$

NOTE:

(1) Two sets of allowable stress values may be provided in Table 1A for austenitic materials and in Table 1B for specific nonferrous alloys. The lower values are not specifically identified by a footnote. These lower values do not exceed two-thirds of the minimum yield strength at temperature. The higher alternative allowable stresses are identified by a footnote. These higher stresses may exceed two-thirds but do not exceed 90% of the minimum yield strength at temperature. The higher values should be used only where slightly higher deformation is not in itself objectionable. These higher stresses are not recommended for the design of flanges or for other strain sensitive applications.

MANDATORY APPENDIX 2
BASIS FOR ESTABLISHING DESIGN STRESS INTENSITY VALUES FOR TABLES 2A, 2B, AND 4, AND ALLOWABLE STRESS VALUES FOR TABLE 3

2-100 DERIVATION OF STRESS INTENSITY VALUES

The values in Tables 2A, 2B, 3, and 4 are established by the Committee only. In the determination of design stress intensity values for nonnuclear materials, the Committee is guided by successful experience in service, insofar as evidence of satisfactory performance is available. Such evidence is considered equivalent to test data where operating conditions are known with reasonable certainty. In the evaluation of new materials for both nuclear and nonnuclear applications, it is sometimes necessary to be guided to a certain extent by the comparison of test information with available data on successful applications of similar materials.

The factors employed to determine design stress intensity values are provided in Tables 2-100(a), 2-100(b), and 2-100(c). Nomenclature for these Tables is as follows:

F_{avg} = multiplier applied to average stress for rupture in 100 000 h. At 815°C and below, F_{avg} = 0.67. Above 815°C, it is determined from the slope of the log time-to-rupture versus log stress plot at 100 000 h such that log F_{avg} = $1/n$, but it may not exceed 0.67.

R_T = ratio of the average temperature dependent trend curve value of tensile strength to the room temperature tensile strength

R_Y = ratio of the average temperature dependent trend curve value of yield strength to the room temperature yield strength

S_T = specified minimum tensile strength at room temperature, MPa

S_Y = specified minimum yield strength at room temperature, MPa

n = a negative number equal to Δ log time-to-rupture divided by Δ log stress at 100 000 h

NA = not applicable

The maximum design stress intensity shall be the lowest value obtained from the criteria in Tables 2-100(a), 2-100(b), and 2-100(c). The mechanical properties considered, and the factors applied to establish the maximum allowable stresses, are given in 2-110 through 2-130.

2-110 CRITERIA FOR MATERIALS OTHER THAN BOLTING: TABLES 2A AND 2B

The design stress intensity values at any temperature are no larger than the least of the following:

(a) One-third of the specified minimum tensile strength at room temperature.

(b) One-third of the tensile strength at temperature.

(c) Two-thirds of the specified minimum yield strength at room temperature.

(d) Two-thirds of the yield strength at temperature, except that for austenitic stainless steels and specific nonferrous materials, as indicated in Tables 2A and 2B, this value may be as large as 90% of the yield strength at temperature (but never more than two-thirds of the specified minimum yield strength).

(e) In the application of these criteria, the Committee considers the yield strength at temperature to be $S_Y R_Y$, and the tensile strength at temperature to be $1.1 S_T R_T$.

(f) When, in the judgment of the Committee, values have been in use for a sufficient period of time to have demonstrated successful experience in service, even at temperatures at which the behavior of the material is time dependent, such values shall be retained, but shall be identified by a different typeface (normally italics) and a note in the tables that indicates at what temperature the use of such values begins.

2-120 CRITERIA FOR BOLTING MATERIALS IN TABLE 3 FOR USE WITH SECTION III (CLASS 2 AND 3 RULES); SECTION VIII, DIVISION 1; SECTION VIII, DIVISION 2 (PART 4.16 RULES); AND SECTION XII

(a) For materials whose strength has not been enhanced by heat treatment or by strain hardening, the allowable stress value shown at any temperature in Table 3 is the least of the following:

(1) one-fourth of the specified minimum tensile strength at room temperature

(2) one-fourth of the tensile strength at temperature

(3) two-thirds of the specified minimum yield strength at room temperature

(4) two-thirds of the yield strength at temperature

(b) For materials whose strength has been enhanced by heat treatment or by strain hardening, the allowable stress value shown at any temperature in Table 3 is the least of the following, unless these values are lower than the annealed values, in which case the annealed values shall be used:

(1) one-fifth of the specified minimum tensile strength at room temperature

(2) one-fourth of the tensile strength at temperature

(3) one-fourth of the specified minimum yield strength at room temperature

(4) two-thirds of the yield strength at temperature

(c) In the application of these criteria, the Committee considers the yield strength at temperature to be $S_Y R_Y$, and the tensile strength at temperature to be $1.1 S_T R_T$.

(d) At temperatures in the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value for all materials is established by the Committee not to exceed the lowest of the following:

(1) 100% of the average stress to produce a creep rate of 0.01%/1 000 h

(2) $100F_{avg}$% of the average stress to cause rupture at the end of 100 000 h

(3) 80% of the minimum stress to cause rupture at the end of 100 000 h

Stress values for high temperatures are based, whenever possible, on representative uniaxial properties of the materials obtained under standard ASTM testing conditions or equivalent. The stress values are based on basic properties of the materials and no consideration is given for corrosive environment, for abnormal temperature and stress conditions, or for other design considerations.

2-130 CRITERIA FOR BOLTING MATERIALS FOR USE WITH PART 5 AND ANNEX 5.F OF SECTION VIII, DIVISION 2 AND SECTION III, SUBSECTIONS NB AND WB

The design stress intensity value shown at any temperature in Table 4 is the least of the following, with credit being granted for enhancement of properties by heat treatment or by strain hardening:

(a) one-third of the specified minimum yield strength at room temperature

(b) one-third of the yield strength at temperature

Table 2-100(a)
Criteria for Establishing Design Stress Intensity Values for Tables 2A and 2B

Product/Material	Room Temperature and Below		Above Room Temperature			
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength	
Wrought or cast, ferrous and nonferrous	$\frac{S_T}{3}$	$\frac{2}{3}S_Y$	$\frac{S_T}{3}$	$\frac{1.1}{3}S_T R_T$	$\frac{2}{3}S_Y$	$\frac{2}{3}S_Y R_Y$ or $0.9S_Y R_Y$ [Note (1)]
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{3}S_T$	$\frac{2}{3} \times 0.85S_Y$	$\frac{0.85}{3}S_T$	$\frac{1.1 \times 0.85}{3}S_T R_T$	$\frac{2}{3} \times 0.85S_Y$	$\frac{2}{3} \times 0.85S_Y R_Y$ or $0.9 \times 0.85S_Y R_Y$ [Note (1)]

NOTE:
(1) For austenitic materials in Table 2A and for specific nonferrous alloys in Table 2B, the design stress intensity values may exceed two-thirds and may be as high as 90% of the yield strength at temperature.

Table 2-100(b)
Criteria for Establishing Allowable Stress Values for Table 3

Product/Material	Room Temperature and Below		Above Room Temperature						
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength		Stress Rupture		Creep Rate
Bolting, annealed ferrous and nonferrous	$\frac{S_T}{4}$	$\frac{2}{3}\ S_Y$	$\frac{S_T}{4}$	$\frac{1.1}{4}\ S_T R_T$	$\frac{2}{3}\ S_Y$	$\frac{2}{3}\ S_Y R_Y$	$F_{avg} S_{R\ avg}$	$0.8 S_{R\ min}$	$1.0 S_c$
Bolting, with strength enhanced by heat treatment or strain hardening, ferrous and nonferrous [Note (1)]	$\frac{S_T}{5}$	$\frac{S_Y}{4}$	$\frac{1}{5}\ S_T$	$\frac{1.1}{4}\ S_T R_T$	$\frac{1}{4}\ S_Y$	$\frac{2}{3}\ S_Y R_Y$	$F_{avg} S_{R\ avg}$	$0.8 S_{R\ min}$	$1.0 S_c$

NOTE:
(1) For materials whose strength has been enhanced by heat treatment or by strain hardening, the criteria shown shall govern unless the values are lower than for the annealed material, in which case the annealed values shall be used.

Table 2-100(c)
Criteria for Establishing Design Stress Intensity Values for Table 4

Product/Material	Tensile Strength		Yield Strength	
Bolting, with strength enhanced by heat treatment or strain hardening	NA	NA	$\frac{1}{3}\ S_Y$	$\frac{1}{3}\ S_Y R_Y$

MANDATORY APPENDIX 3
BASIS FOR ESTABLISHING EXTERNAL PRESSURE CHARTS

3-100 GENERAL

The charts in Subpart 3 were established in order to facilitate a conservative approach in determining external pressure ratings for components covering a wide range of geometries, materials, and conditions. The methods provide for a uniform basis of calculation for the referencing Section; the use of the charts eliminates the need for complex calculations by equations and incorporates realistic factors of safety for components of widely varying length-to-diameter and diameter-to-thickness ratios.

(13) 3-200 BASIS OF CHARTS IN SUBPART 3

Rules for allowable longitudinal compressive stress, rules for shells and tubes under external pressure, rules for stiffening rings, and rules for formed heads under external pressure make reference to and use material in Subpart 3, Charts and Tables for Determining Shell Thickness of Components Under External Pressure. Entrance into the charts is via the Factor A, abscissa, which is a nondimensional term related to certain geometrical considerations of the part in question, such as thickness, diameter, and length. These geometrical considerations are independent of material properties; thus a single geometry chart, Figure G, applies to all materials and is used in conjunction with the materials charts in Subpart 3.

3-300

External pressure capability of cylinders, spheres, and formed heads, as well as allowable compressive stress for cylinders subject to axial compression, is obtained by reference to the charts in Subpart 3 along with instructions and equations given in the appropriate paragraphs in the body of the referencing Section.

(13) 3-400 BACKGROUND AND DEVELOPMENT OF THEORY

The development of the present rules for external pressure has a long history. Among the principal references used in developing these rules are Timoshenko's *Theory of Elasticity* (3-900 [1]), *Theory of Plates and Shells* (3-900 [2]), and *Theory of Elastic Stability* (3-900 [3]); a group of papers reprinted as Section 9 in ASME's publication *Pressure Vessel and Piping Design — Collected Papers 1927–1959* (3-900 [4]); and Sturm's 1941 University of Illinois Bulletin 329, *A Study of the Collapsing Pressure of Thin Walled Cylinders* (3-900 [5]). The format for the charts in Subpart 3 is detailed in Sturm's University of Illinois Bulletin 329 3-900 [5], with additional comments in Bergman's 1952 paper, The New Type Code Chart for the Design of Vessels Under External Pressure (included in 3-900 [4]). The Sturm and Bergman papers detail the mechanics involved in combining the materials and geometrical factors into a nomograph format; an important companion paper to those of Sturm and Bergman is Sturm and O'Brien's 1946 ASME paper, Computing Strength of Vessels Subjected to External Pressure (3-900 [6]).

Alternative rules for determining allowable compressive stress are given in BPVC Section VIII, Division 2. An equation is given (3.D.5) for the tangent modulus of the stress–strain curve that could be used to develop external pressure charts as in Subpart 3. The tangent modulus is derived from generic stress–strain relations, represented in equation form, to represent broad classes of materials.

3-500 DESIGN BASIS (13)

As noted previously, stress and strain values for components are analytically and geometrically distilled into the two chart parameters A and B. The design is based on the following considerations.

(a) External Pressure on Cylinders. The geometric chart, Figure G,[2] for components is used in conjunction with the appropriate material chart and an equation for B to obtain a design external pressure. This is based on the following considerations.

(1) The assumed critical buckling stress without any reduction for tolerance, etc., is based upon the reference in 3-900 [5], assuming pressure on the ends of the vessel as well as radial to the cylinder, and assuming the ends of the cylinder are simply supported.

(2) The parameters and stresses are those at the design temperature.

(3) The tangent modulus is used for buckling stresses above the proportional limit. The point at which yield or creep governs (beyond the transition) is chosen at a relatively high value of A (i.e., t/R).

(4) The allowable tolerances are based on empirical relationships intended to limit the buckling pressure to not less than 80% of that for a perfectly uniform vessel.

(b) External Pressure on Spheres. The material charts are used together with equations to determine A from the geometry and to determine the pressure using B determined

from the chart to determine a design external pressure. This procedure is based upon the following considerations.

(1) The assumed critical elastic buckling stress including a reduction for tolerance, theory versus tests, etc., is based on

$$0.125\frac{Et}{R_0}$$

(2) The parameters and stresses are those at the design temperature.

(3) The tangent modulus is used for buckling stresses above the proportional limit [see (a)(3) above].

(4) The allowable tolerances are based upon empirical relationships intended to limit (along with reduction factors based on tests) the buckling pressure to not less than 60% of that obtained using the equation in (1) above.

NOTE: This gives results similar to those for the cylinder in the elastic range. However, the present material charts give more restrictive results for spheres than for cylinders in the plastic range.

(c) Axial Compression on Cylinders.[3] An equation is used to determine A from the geometry. Then A is used with the material chart to determine B, the allowable compressive stress for that geometry. This is based upon the following considerations.

(1) The assumed critical elastic buckling stress including a reduction for tolerance, theory versus tests, etc., is based upon

$$0.125\frac{Et}{R_0}$$

(2) The parameters and stresses are those at the design temperature.

(3) The tangent modulus is used for buckling stresses above the proportional limit [see (a)(3) above].

(4) The allowable tolerances are based upon empirical relationships intended to limit (along with reduction factors based upon tests) the critical buckling stress to not less than that obtained using the equation in (1) above for R/t values.

(d) Elevated Temperature Effects

(1) The design basis described here does not include the effects of creep on buckling. The Subpart 3 external pressure charts and tables are based on stress–strain properties that do not include time-dependent effects. At elevated temperatures, the effect of creep is to reduce buckling stress depending on the magnitude of load and time at load. At some temperatures for which limits are provided in the Subpart 3 charts, the material is in the creep range and buckling stresses are reduced, with the reduction increasing with time at load. The result is that for temperatures in the creep range, the actual design margins will be less than those intended by this design basis and the associated criteria for allowable stresses (see 3-600). However, the design margins may still be adequate due to conservatism of the design limits and the specific nature of creep buckling.

(2) Design limits for elevated temperature buckling and instability are given in Section III, Division 1 — Subsection NH, Appendix T, T-1500. Design guidance is given that may be used to address creep buckling for components designed to the limits of the Subpart 3 external pressure charts. However, if the design temperature of a component is less than the temperature limits provided in Figure 3-500.1 for a cylinder under external pressure, Figure 3-500.2 for a cylinder under axial compression, or Figure 3-500.3 for a sphere under external pressure, the design margin of the Subpart 3 charts is not reduced by creep.

(3) The temperature limits of Figures 3-500.1, 3-500.2, and 3-500.3 were obtained using the analysis method of WRC Bulletin 443, *External Pressure: Effect of Initial Imperfections and Temperature Limits* (see 3-900 [7]); the design limits of Subsection NH; and 100,000 h materials property data except as noted for SA-533. Limits were developed only for materials where the necessary creep properties were available.

3-600 CRITERIA FOR ALLOWABLE STRESSES

In establishing allowable stresses for preparing the material charts, consideration is given not only to the available mechanical property data but also to service experience. The external pressure charts are based on short-term tensile properties and may not adequately account for creep effects. Creep reduces the critical buckling stress. In evaluating new or modified materials, reliance is also placed on comparison with test data and service experience for similar materials. Except for the overriding consideration of experience, the allowable stresses are based on the factors and properties given below.

(a) For cylindrical shells, under external pressures, the allowable stress is the least of

(1) 33% of the assumed critical buckling stress as defined in 3-500(a)(1) but limited by allowable tolerances defined in 3-500(a)(4)

(2) 33% of the specified minimum yield strength and yield strength at temperature

(3) 66% of the average stress to produce a creep rate of 0.01% per 1,000 h

(4) 100% of the allowable stress in tension

(b) For spheres and spherical portions of heads under external pressure, the allowable stress is the least of

(1) 25% of the assumed critical buckling stress as defined in 3-500(b)(1) but limited by allowable tolerances defined in 3-500(b)(4)

(2) 25% of the specified minimum yield strength and yield strength at temperature

(3) 50% of the average stress to produce a creep rate of 0.01% per 1,000 h

(4) 100% of the allowable stress in tension

Figure 3-500.1
Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under External Pressure

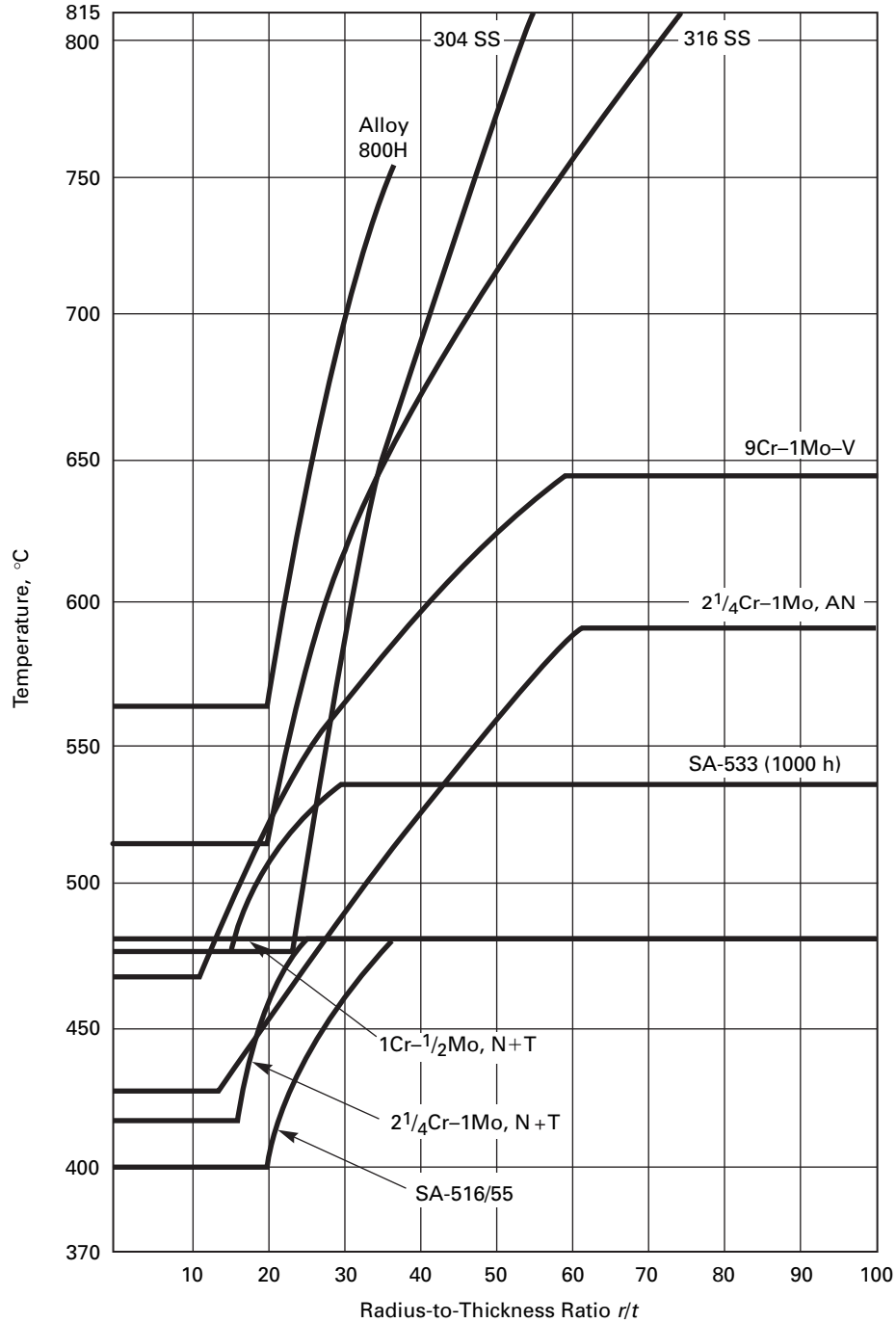
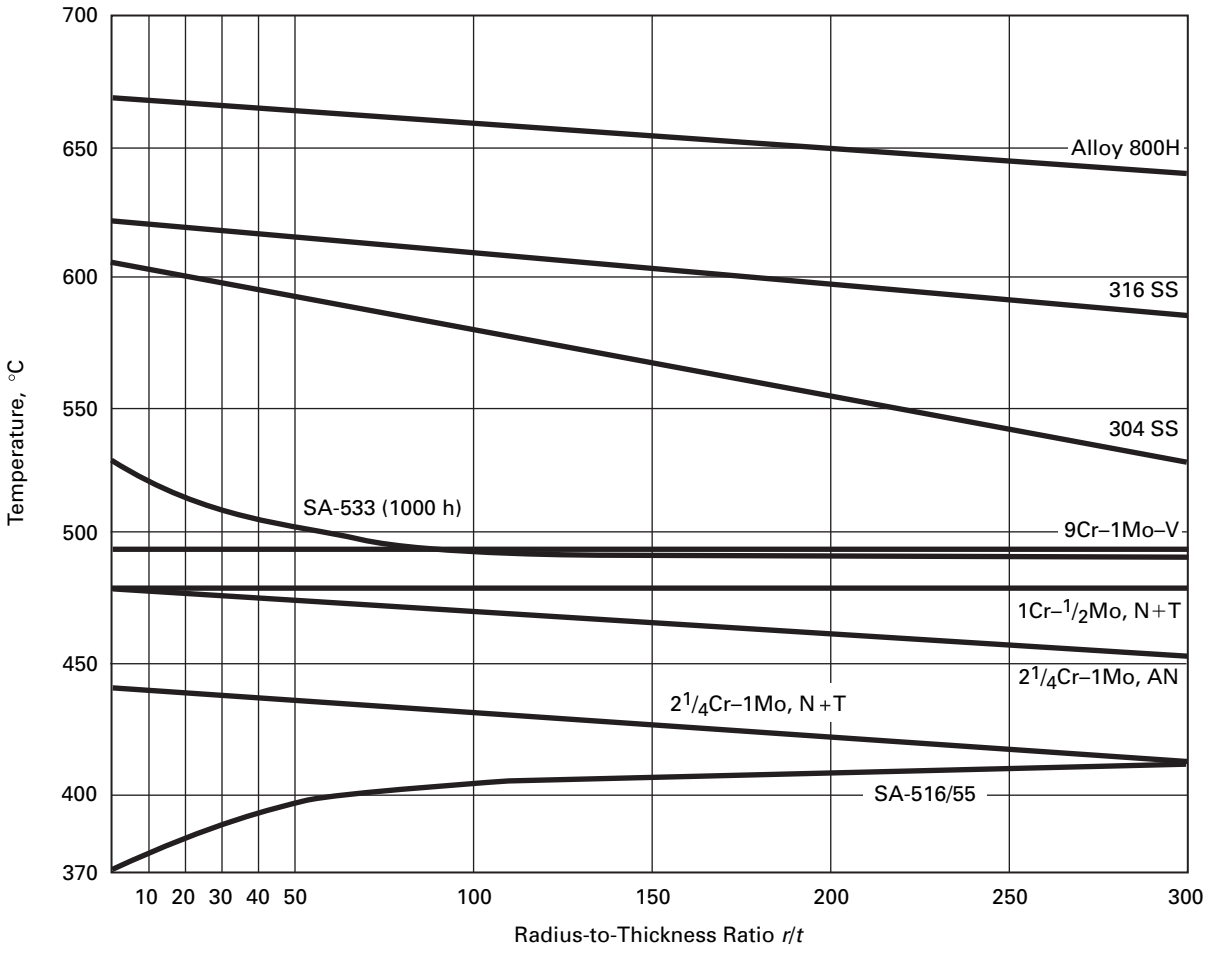


Figure 3-500.2
Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under Axial Compression



(c) For cylindrical shells under axial compression, the allowable stress is the least of

(1) 50% of the assumed critical buckling stress as defined in 3-500(c)(1) but limited by allowable tolerances defined in 3-500(c)(4)

(2) 50% of the specified minimum yield strength and yield strength at temperature

(3) 100% of the average stress to produce a creep rate of 0.01% per 1,000 h

(4) 100% of the allowable stress in tension

(13) 3-700 PROCEDURE AND RESPONSIBILITY FOR CHART DEVELOPMENT

Development of an external pressure chart for a new material requires materials data as specified in Mandatory Appendix 5, Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code. The requestor is responsible for providing these data in the specified form.

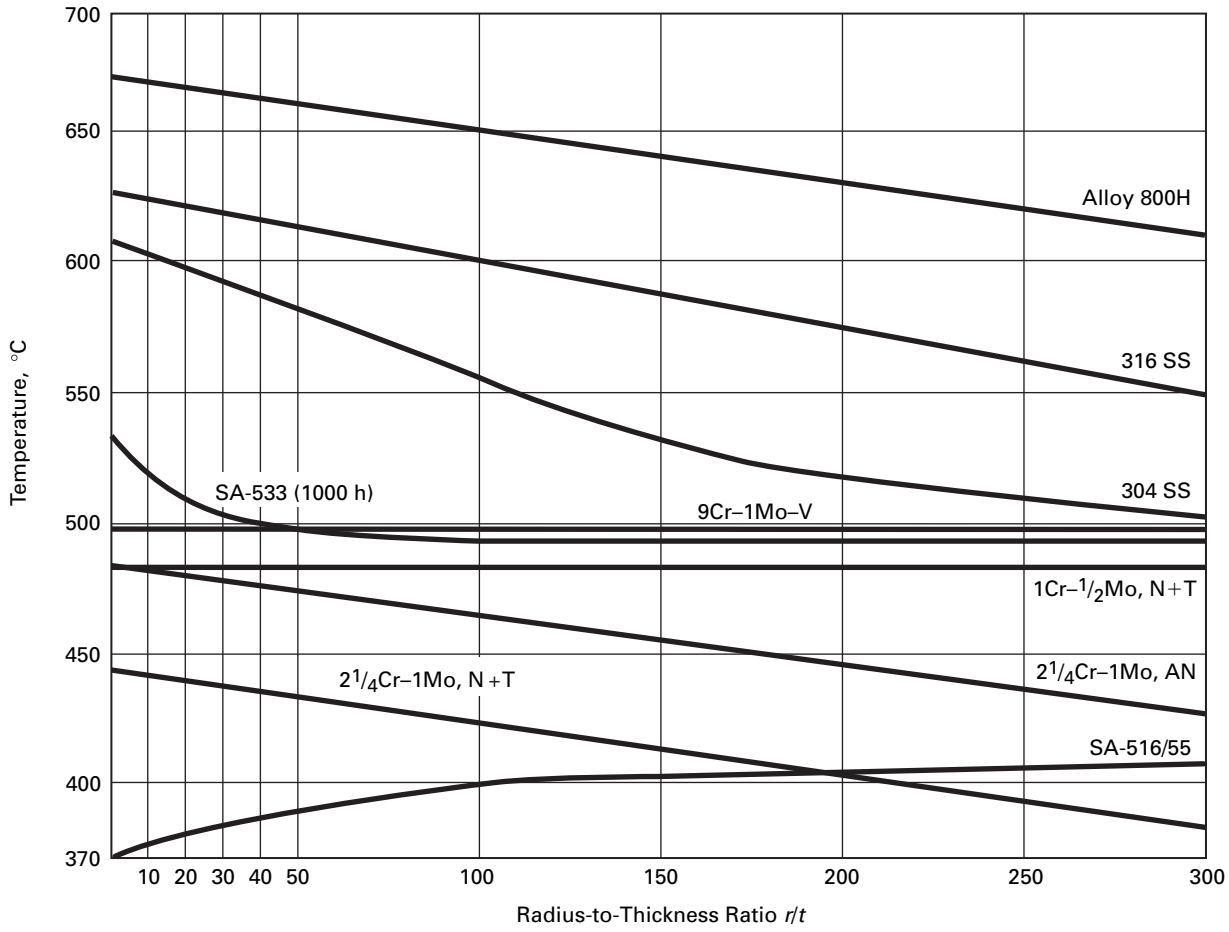
The following data are required for each temperature of interest:

(a) Elastic modulus, E, usually obtained by a dynamic test, and included in, or approved to be included in, Table TM-1, TM-2, TM-3, TM-4, or TM-5 of Section II, Part D.

(b) Minimum yield strength, $\sigma_{y\ \min}$, from the Section II, Part D yield strength table, Table Y-1, or approved for inclusion in Table Y-1.

(c) A representative stress–strain, σ–ε, curve that covers the range of strain from 0 to 1.0%.

Figure 3-500.3
Temperature Limits for Application of Section II External Pressure Charts for Sphere Under External Pressure



(1) Procedure. The procedure for developing the chart parameters, A and B, from the $\sigma-\varepsilon$ plots is described in the following:

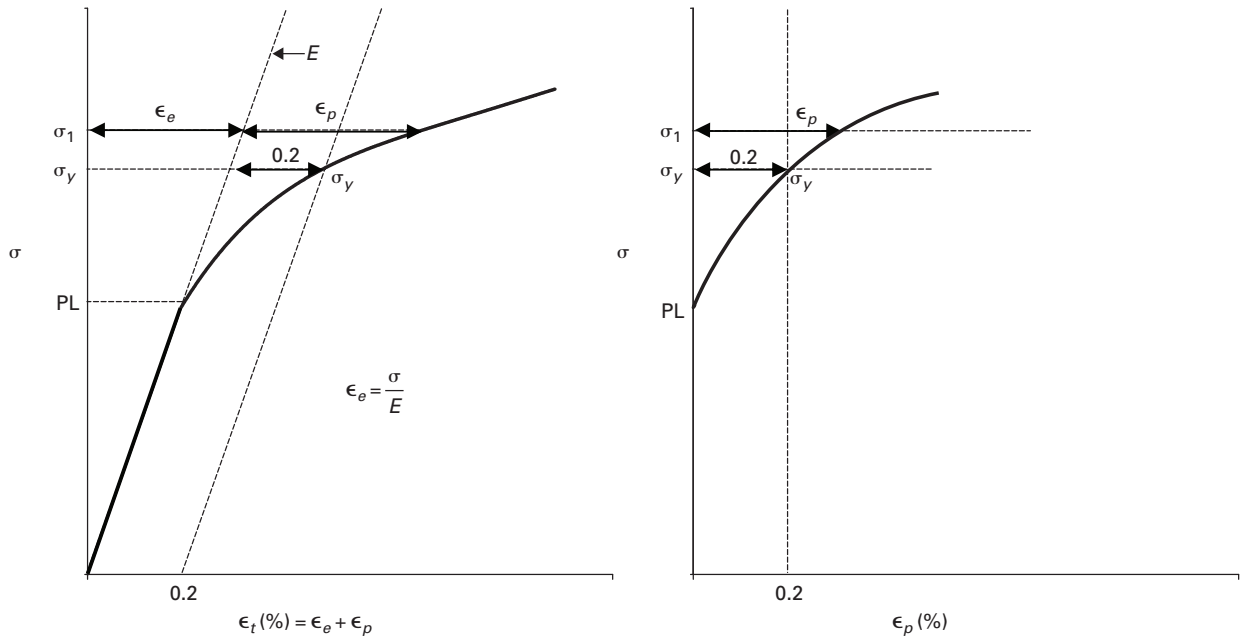
Step 1. Select a representative $\sigma-\varepsilon$ curve. For a new material, $\sigma-\varepsilon$ curves are provided in accordance with the requirements of Mandatory Appendix 5. For multiple $\sigma-\varepsilon$ curves from multiple heats all at a specific temperature, select the curve that shows the largest plastic deformation at lower stresses, usually the one with the lowest ratio of proportional limit to yield stress. The shape of the curve is more important than the absolute value of stress, because the curve is going to be normalized to $\sigma_{y\ \min}$. A $\sigma-\varepsilon$ curve is required for each temperature for which an external pressure chart is desired, not to exceed the requirements of Mandatory Appendix 5.

Step 2. Normalize the $\sigma-\varepsilon$ curve for each temperature to the specified E and $\sigma_{y\ \min}$ at that temperature. First, determine the yield stress, σ_y, on the representative $\sigma-\varepsilon$ curve in the usual manner, i.e., the stress at 0.2% plastic strain [see Figure 3-700.1, illustration (a)]. If the $\sigma-\varepsilon$ curve has no clearly defined elastic portion, then it is necessary to obtain E by constructing a line tangent to the $\sigma-\varepsilon$ curve at its origin. The total strain at a point is composed of an elastic component and a plastic component. The elastic strain is defined by E, i.e., elastic strain = σ/E. The rest of the strain at the point is plastic. The elastic strain measured by a tensile test is unreliable, so it is necessary to subtract it out from the total strain [see Figure 3-700.1, illustration (b)]. The $\sigma-\varepsilon$ curve is then normalized to $\sigma_{y\ \min}$ by multiplying the stress at each value of plastic strain by the ratio $\sigma_{y\ \min}/\sigma_y$ [see Figure 3-700.1, illustration (c)]. The normalized $\sigma-\varepsilon$ curve is then constructed by plotting the normalized stress against total strain, where the elastic strain is obtained using the Code approved value of E, i.e., elastic strain = (normalized stress)/E_{code}, for each temperature [see Figure 3-700.1, illustration (d)].

Step 3. Obtain the tangent modulus of the normalized $\sigma-\varepsilon$ plot as a function of stress. This can be done graphically by calculating the tangent (i.e., the slope of a straight

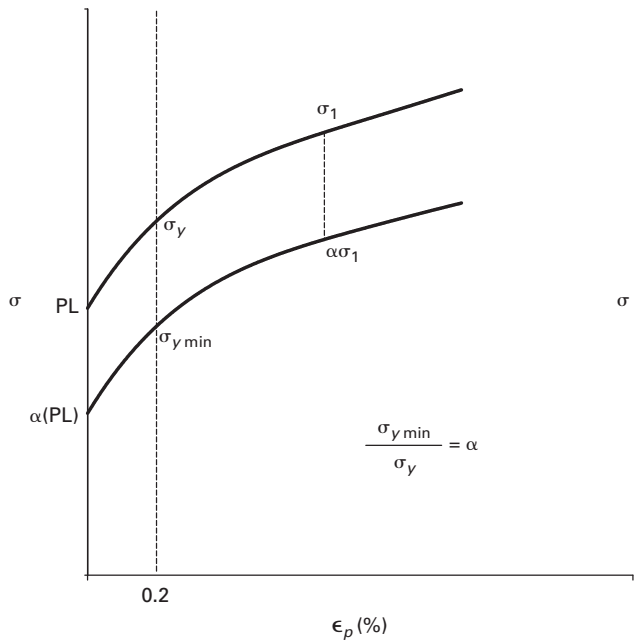
(13)

Figure 3-700.1
Normalization of Test σ–ε to $\sigma_{y\ min}$ and E_{code}

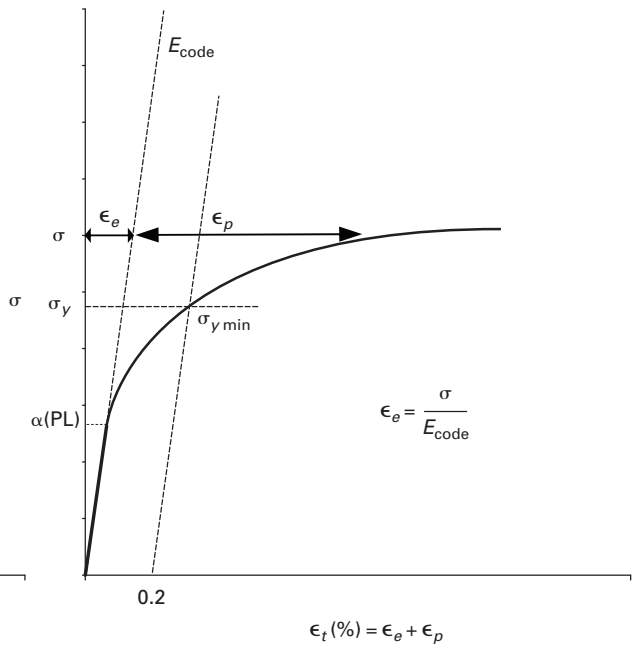


(a) From Test

(b) Subtract Out Elastic



(c) Normalize to $\sigma_{y\ min}$



(d) Add in Code E

line tangent to the curve) at a number of points along the $\sigma-\varepsilon$ curve and plotting the tangent against the stress at the associated points. Alternatively, if the $\sigma-\varepsilon$ curve is approximated in algebraic terms and represented in equation form, the tangent modulus is the first derivative of the equation, $d\sigma/d\varepsilon$, and can be represented in equation form.

Step 4. The values of A and B used to construct the external pressure charts can now be calculated from the following:

$$A = \text{stress} / \text{tangent modulus}$$

$$B = \text{stress}/2$$

where a different curve is plotted for each temperature.

(2) Chart Construction. The external pressure charts are plotted in log–log coordinates, with A as the abscissa and B as the ordinate. Section II, Part D, Subpart 3 limits B to one-half of $\sigma_{y\ \min}$. Thus, the curves can generally be plotted in two or three segments, which may be more convenient for curve fitting. The first segment is linear, representing the linear portion of the $\sigma-\varepsilon$ curve up to the proportional limit, if there is a proportional limit. It may be argued that there is no true proportional limit, and there may not be for a few metals, but definition of a proportional limit is required in Mandatory Appendix 5 and a practical limit can generally be constructed. The second segment is nonlinear and represents the $\sigma-\varepsilon$ curve beyond the proportional limit. It is not necessary that the tangent to the curve be continuous between the first and second segments. The allowable stress, B, increases with increasing A until it reaches $\frac{1}{2}\ \sigma_{y\ \min}$ or the maximum value of A on the chart. If B is restricted by the limit, then there is a third segment of the curve that is linear and parallel to the abscissa at B = $\frac{1}{2}\ \sigma_{y\ \min}$. In summary,

(a) Segment 1: B = $\frac{1}{2}$ AE up to the proportional limit (PL)

(b) Segment 2: B = $\frac{1}{2}$ AE_t from PL to $\frac{1}{2}\ \sigma_{y\ \min}$, where $E_t = d\sigma/d\varepsilon$

(c) Segment 3: B = $\frac{1}{2}\ \sigma_{y\ \min}$

Chart construction and the development of tabular values are the responsibility of the Subgroup on External Pressure of the BPV-II Committee on Materials.

3-800 ALTERNATE PROCEDURE FOR DETERMINING ALLOWABLE COMPRESSIVE STRESSES (13)

Alternative rules for the design of shells under external pressure and allowable compressive stresses are given in Section VIII, Division 2, Part 4, para. 4.4. These rules are based on linear structural stability theory, modified by reduction factors to account for the effects of imperfections, boundary conditions, nonlinearity of material properties, and residual stresses. A step-by-step procedure is given to calculate the allowable compressive stress for components made of carbon and low alloy steel plate material at temperatures limited depending on the specific material. For materials other than carbon and low alloy steel, the procedure is modified by calculating the allowable compressive stress based on carbon and low alloy plate material, and then applying an adjustment that essentially replaces the elastic modulus with the tangent modulus of the material. The tangent modulus is determined based on a stress equal to the elastic compressive membrane failure stress of the component. This alternative procedure is applicable to a broader range of geometry and loading conditions than covered in the external pressure charts of Section II, Part D. Where comparisons have been made between the two methods, agreement is generally good.

3-900 REFERENCES (13)

[1] Timoshenko, S. and Goodier, J. N., *Theory of Elasticity*, McGraw-Hill Book Co., New York, 1951

[2] Timoshenko, S. and Woinowsky-Krieger, S., *Theory of Plates and Shells*, McGraw-Hill Book Co., New York, 1959

[3] Timoshenko, S. and Gere, J. M., *Theory of Elastic Stability*, McGraw-Hill Book Co., New York, 1961

[4] *Pressure Vessel and Piping Design — Collected Papers 1927–1959*, ASME, New York, 1960

[5] Sturm, R. G., *A Study of the Collapsing Pressure of Thin Walled Cylinders*, University of Illinois Bulletin 329, 1941

[6] Sturm, R. G. and O'Brien, H. L., Computing Strength of Vessels Subjected to External Pressure, *Transactions of the ASME*, May 1947

[7] Griffin, D. S., *External Pressure: Effect of Initial Imperfections and Temperature Limits*, WRC Bulletin 443

(13)

MANDATORY APPENDIX 4

DELETED

(13)

MANDATORY APPENDIX 5
GUIDELINES ON THE APPROVAL OF NEW MATERIALS UNDER THE ASME BOILER AND PRESSURE VESSEL CODE

5-100 CODE POLICY

It is expected that requests for Code approval will normally be for materials for which there is a recognized national or international specification. It is the policy of the ASME Boiler and Pressure Vessel (BPV) Committee on Materials to approve, for inclusion in the Code Sections, only materials covered by specifications that have been issued by standards-developing organizations such as, but not limited to, American Petroleum Institute (API), American Society for Testing and Materials (ASTM), American Welding Society (AWS), Canadian Standards Association (CSA), European Committee for Standardization (CEN), Japan Industrial Standards (JIS), Standards Association of Australia (SAA), and China Standardization Committee (CSC).

Material specifications of other than national or international organizations, such as those of material producers/suppliers or equipment manufacturers, will not be considered for approval. The Committee will consider only official requests for specifications authorized by the originating standardization body and available in the English language and in U.S. Customary and/or SI/Metric units.

For materials made to a recognized national or international specification other than that of ASTM or AWS, the inquirer shall give notice to the standards-developing organization that a request has been made to ASME for approval of the specification under the ASME Code and should request that the issuing organization grant ASME permission to at least reproduce copies of the specification for Code Committee internal use and, if possible, reprint the specification. For other materials, a request shall be made to ASTM, AWS, or a recognized national or international standardization body to include the material in a specification that can be presented to the BPV Committee on Materials.

It is the policy of the ASME BPV Committee on Materials to consider requests to approve new materials only from boiler, pressure vessel, transport tank, nuclear facility component manufacturers, architect–engineers, or end users. Such requests should be for materials for which there is a reasonable expectation of use in a boiler, pressure vessel, transport tank, or nuclear facility component constructed to the rules of one of the Sections of this Code. When a grade does exist in a defined wrought product form, a material producer/supplier may request the inclusion of additional wrought product forms. When a grade does exist in a defined cast product form, a material producer/supplier may request the inclusion of additional cast product forms.

Any qualified organization requesting that an ASME BPV Committee approve a “new” material for use in their Code book should be aware that only the BPV Committee on Materials provides the appropriate design values for the Construction Codes (Sections I, III, IV, VIII, and XII of the BPV Code and B31 Codes).

The design values are calculated in accordance with the appropriate mandatory Code rules. If the inquirer considers the material to be essentially identical to one that has been approved by the BPV Committee on Materials, the inquirer shall so state in its request, and the BPV Committee on Materials shall evaluate that judgment. If the material is not essentially identical to one that has been approved by the BPV Committee on Materials, the inquirer shall provide all of the data cited in this Mandatory Appendix. Based on those data, the BPV Committee on Materials will provide the appropriate design values.

Before approval of a new material for inclusion in one of the Sections of the Code, use of this material may be permitted in the form of a Code Case. This Case shall fix at least the conditions of use and the necessary requirements linked to these conditions. It is the policy of the ASME BPV Committee to admit, in this way, material for which full experience on all working parameters has not yet been acquired.

5-200 APPLICATION

The inquirer shall identify to the BPV Committee the following:

(a) the Section or Sections and Divisions of the Code in which the new material is to be approved

(b) the temperature range of intended application

(c) whether cyclic service is to be considered

(d) whether external pressure is to be considered

The inquirer shall identify all product forms, size ranges, and specifications or specification requirements for the material for which approval is desired. When available, the inquirer shall furnish information describing service experience in the temperature range requested.

5-300 CHEMICAL COMPOSITION

The inquirer shall recommend to the BPV Committee on Materials whether the chemical composition specified in the reference specification applies or whether restrictions to this composition shall be imposed for the intended application. When coverage by a recognized national or international standardization body has been requested but not yet obtained, the inquirer shall indicate the detailed chemical composition in the inquiry. The inquirer shall explain the reasons for the chemistry and chemistry limits, and their relationship to the metallurgical structure (e.g., influence on precipitates and their morphology, grain size, and phases), heat treatment effect (e.g., strengthening mechanisms and their stability), and mechanical properties. Elements that significantly influence strength, ductility, toughness, weldability, and behavior under service conditions should be identified.

After review of the submitted data, the Committee reserves the right to modify the permitted compositional ranges for key elements so that they more accurately reflect the range of the elements of the submitted test heats.

5-400 METALLURGICAL STRUCTURE AND HEAT TREATMENT

When applicable for the proposed material, the inquirer shall indicate the intended metallurgical structure(s) to be achieved in order to comply with the mechanical properties requirements and, where applicable, fully describe the heat treatment (including cooling rates) to be applied to achieve this (or these) structure(s), the mechanical properties, and the expected behavior under service conditions.

An explanation for the proposed heat treatment temperature ranges shall be furnished. When such concepts apply, metallurgical transformation curves and information on the transformation points and conditions for appearance of the major phases in the microstructure (e.g., continuous cooling transformation diagram or time–temperature precipitation plots) would be beneficial for the Committee's consideration.

5-500 MECHANICAL PROPERTIES

Test methods employed for the properties tested shall be those referenced in or by the material specifications, or shall be the appropriate ASTM test methods, recommended practices, or test methods described in accepted international standards. The test methods used shall be indicated in the data package.

It is desired that the data be obtained using material representative of the range of effects of the key variables of composition, thickness, mechanical working, and heat treatment. It is desirable that, when applicable, test data also be provided for the range of heat treatment exposures that may influence properties such as tensile strength, toughness, and stress rupture behavior. After consideration of the submitted data, the Committee reserves the right to modify the specification requirements.

5-600 DEFINITIONS FOR DATA COLLECTION PURPOSES

casting lot: single production pour from a master heat.

heat: quantity of metal with one chemical composition, produced by a recognized production process from a single primary melt of the metal. Remelted ingot material is not recognized as a separate heat unless it is produced from a melt having a different chemical composition than the other heats.

wrought lot: quantity of metal made by melting followed by working or by working and heat treatment as a unique batch. Different lots may come from the same heat and may be made into different product forms. Lot definitions are expected to be found in the applicable material specifications.

5-700 REQUIRED SAMPLING

For all mechanical properties, data shall be provided over the required range of test temperatures from at least three heats of material meeting all of the requirements of the applicable specifications. Data submitted on three heats of one wrought product form for which coverage is requested may be considered to be applicable for all other wrought product forms having the same chemistry.

For wrought materials and especially for those materials whose mechanical properties are enhanced by heat treatment, forming practices, or a combination thereof, and for other materials for which the mechanical properties may be reasonably expected to be thickness dependent, data from one additional lot from material of at least 75% of the maximum thickness for which coverage is requested shall be submitted. If no maximum thickness is given, information shall be provided to support the suitability of the thickness used for the tested samples.

When adoption of cast product forms is requested, data from at least three heats for one of the cast product forms shall be submitted. The cast material shall be considered as a separate material even if its nominal composition is the same or very similar to that of an approved wrought material.

Additional data for other heats tested to a lesser degree than described herein would be beneficial to the Committee's consideration.

5-800 TIME-INDEPENDENT PROPERTIES

For time-independent properties at and above room temperature, the required data include values of ultimate tensile strength, 0.2% offset yield strength (or yield as

otherwise defined in the material specification), reduction of area (when specified in the material specification), and elongation, at 50°C intervals, from room temperature to 50°C above the maximum intended use temperature, unless the maximum intended use temperature does not exceed 40°C. In addition, when specified in the material specification, hardness values shall be provided at room temperature and shall be determined as specified in the material specification.

5-900 TIME-DEPENDENT PROPERTIES

If approval is desired for temperatures where time-dependent properties may be expected to control design, time-dependent data, as itemized below, shall be provided, starting at temperatures approximately 25°C below the temperature where time-dependent properties may govern and extending at least 50°C above the maximum intended use temperature. Exceptions to this rule are permitted, provided the inquirer provides suitable justification for the deviation.

For time-dependent tests, the interval between successive temperatures shall be chosen such that it permits, in all cases, an accurate estimation of the slope of the stress rupture curves. For normally stable materials (e.g., solid solution strengthened materials), test temperatures shall be at 50°C intervals or less. Where there is a possibility of degradation of strength related to metallurgical instability (e.g., for precipitation strengthened materials), test temperatures shall be at intervals of 25°C or less.

In addition, for certain types of steels or alloys, it may be necessary to choose different temperature intervals in order to adequately reflect the evolution of the properties. In such cases, the interval between successive test temperatures shall be chosen such that rupture lives do not differ by more than a factor of 10 at any given stress for two adjacent temperatures. Data to be reported include stress, temperature, time to rupture, and, when available, either or both elongation and reduction of area. Additional comments regarding post-test specimen appearance (e.g., oxidation, necking, intergranular fracture, etc.), as well as photographs and photomicrographs, may be beneficial for the analysis.

Except as provided further below, the longest rupture time at each test temperature shall be in excess of 10,000 h for each required heat. At least three additional tests shall be conducted for each required heat at each test temperature, at stresses selected to provide shorter rupture times but at least 500 h (e.g., 500 h, 1,400 h, and 4,000 h).

Tests of shorter duration than about 500 h are not desired for long-term stress rupture prediction. Obviously, longer times and additional test data are beneficial. At successive temperatures, two or more test stresses should be selected to be preferably identical or in a close range.

Alternative test plans that deviate from the prior description but achieve the overall objective may be considered. This may, in particular, apply to solid solution alloys for which the stability of strength-controlling microstructures is certain.

For new materials for which the expectation of reasonable stability of strength-controlling microstructures is uncertain or suspect, and for extension of allowable stresses of more familiar classes of alloys into much higher temperature applications where such stability might come into question, either creep rupture data with duration of more than 30,000 h or equivalent experience in service is required. A Code Case may be approved based on shorter duration test data, but inclusion of the material into one of the Sections of the BPV Code may be deferred until longer-term creep rupture data are available or until sufficient service experience is obtained to provide confidence that extrapolations from the existing database reasonably describe the long-term behavior of the material.

For at least two heats, strain–time plots or minimum creep rate (MCR) data shall be provided for at least two test stresses at each test temperature, including at least one stress for each material resulting in MCR values below 3×10^{-4} %/h. If it can be conclusively demonstrated that creep rate does not control the design stresses, the creep rate data may be sparse in relation to the above requirement. Creep rate data may be obtained in the course of stress–rupture testing or may be obtained on additional specimens.

5-1000 LOW-TEMPERATURE PROPERTIES

If use of the material below room temperature is contemplated, data should be provided at appropriate temperatures down to the lowest contemplated use temperature.

5-1100 TOUGHNESS DATA

Toughness data shall be provided for materials for which Construction Code toughness rules would be expected to apply. The test requirements shall be as required by the requested Construction Code(s). The data shall include test results for the intended lowest service metal temperature and for the range of material thicknesses desired.

5-1200 STRESS–STRAIN CURVES

If the material is to be used in components that operate under compressive loads (e.g., external pressure), stress–strain plots (tension or compression) shall be furnished for each of the three heats of material at 50°C intervals from room temperature up to 50°C above the maximum temperature desired.[4] Engineering stress–strain data

(stress versus strain) shall be provided in the form of stress–strain plots and digitized data, from which the plots were derived, in tabular form up to 1.2% strain. Digitized data shall be provided at intervals no greater than 0.01% strain. In addition, the minimum yield strength,[5] modulus of elasticity,[6] and proportional limit, for materials where a proportional limit can be identified, shall be reported for each temperature. The stress–strain plots (not load versus extension) shall be determined using a Class B-2 or better-accuracy extensometer as defined in ASTM E83. The plots shall include gridlines with the units marked on the gridlines: for strain, minor gridlines at intervals of 0.01% and major gridlines at 0.1%, up to 1.2% strain; and for stress, minor gridlines at 2 MPa and major gridlines at 20 MPa.

5-1300 FATIGUE DATA

If the material is to be used in cyclic service and the Construction Code in which adoption is desired requires explicit consideration of cyclic behavior, fatigue data for characterized samples shall also be furnished over the range of design temperatures desired, from 10^3 to at least 10^6 cycles.

5-1400 PHYSICAL PROPERTIES

For at least one of the three required heats, the inquirer shall furnish to the BPV Committee on Materials adequate data necessary to establish values for coefficient of thermal expansion, thermal conductivity and diffusivity, modulus of elasticity, Poisson's ratio, and density. Data shall be determined using ASTM E1875, *Standard Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio by Sonic Resonance*, or an equivalent national or international method. Data shall be provided over the range of temperatures for which the material is to be used. It is recommended that data be collected at temperature intervals not greater than 50°C. If the material is intended to be used below room temperature, data should be provided for temperatures down to the minimum use temperature.

5-1500 WELDABILITY

The inquirer shall furnish substantial data on the weldability, weld metal, and weldment properties of material intended for welding, including data on procedure qualification tests made in accordance with the requirements of Section IX. Tensile, ductility, and, where applicable, stress rupture tests shall be made over the full range of thickness in which the material is to be used. Tensile tests shall be consistent with those for the base metal as specified in 5-800. Stress rupture tests shall be consistent with those for the base metal as specified in 5-900. Pertinent information, such as welding processes to be used, applicable welding consumables, postweld heat treatment required, susceptibility to air hardening, heat-affected zone, weld metal notch toughness if applicable, and the amount of experience in welding the material, shall be given.

5-1600 LONG-TERM PROPERTIES STABILITY

For new materials, and particularly for those whose creep rupture properties are affected by heat treatment or deformation processes or a combination of these, it is important to know the structural stability characteristics and the degree of retention of properties with long-term exposure at temperature. Where particular temperature ranges of service exposure or fabrication heat treatment, cooling rates, and combination of mechanical working and thermal treatments cause significant changes in the microstructure on which the creep rupture properties depend, these shall be brought to the attention of the BPV Committee.

5-1700 REQUESTS FOR ADDITIONAL DATA

The Committee may request additional data, including data on properties or material behavior not explicitly treated in the Construction Code for which approval is desired.

5-1800 NEW MATERIALS CHECKLIST

To assist inquirers desiring Code coverage for new materials, or extending coverage of existing materials, the Committee has developed the following checklist of items that ought to be addressed in each inquiry. While taking into account the intended application of the product, the Committee may require specific information from the inquirer, as shown above for certain material characteristics.

(a) Has a qualified inquirer request been provided?

(b) Has a request either for revision to existing Code requirements or for a Code Case been defined?

(c) Has a letter to ASTM or AWS been submitted requesting coverage of the new material in a specification? Alternatively, is this material already covered by a specification issued by a recognized national or international organization and has an English language version been provided?

(d) Has the Construction Code and, if applicable, a Division, Subsection, or Part been identified?

(e) Have product forms, size range, and the applicable specification(s) been defined?

(f) Has the range (maximum/minimum) of temperature application been defined?

(g) Has the chemistry been submitted and the related requirements been addressed?

(h) Have the metallurgical structure and heat treatment requirements been submitted?

(i) Have mechanical property data been submitted (ultimate tensile strength, yield strength, reduction of area, and elongation at 50°C intervals, from room temperature to 50°C above the maximum intended use temperature, for three heats of appropriate product forms and sizes?

(j) If requested temperatures of coverage are above those at which time-dependent properties begin to govern design values, have appropriate time-dependent property data for base metal and weldments been submitted?

(k) If higher allowable stresses for material to be used below room temperature are requested, have appropriate mechanical property data below room temperature been submitted?

(l) Have toughness considerations required by the Construction Code been defined and have appropriate data been submitted?

(m) Have stress–strain curves been submitted for the establishment of External Pressure Charts?

(n) If cyclic service considerations are required by the requested Construction Code application, have appropriate fatigue data been submitted?

(o) Have physical properties data (coefficient of thermal expansion, thermal conductivity and diffusivity, modulus of elasticity, Poisson's ratio, and density) been submitted?

(p) Have welding requirements been defined, and weld metal and weldment data been submitted?

(q) Has the influence of fabrication practices on material properties been defined?

5-1900 REQUIREMENTS FOR RECOGNIZED NATIONAL OR INTERNATIONAL SPECIFICATIONS

Acceptable material specifications will be identified by date or edition. The latest approved edition(s) will be stated in the subtitle of the ASME specification. Eventually, acceptable previous editions will be listed in Section II, Parts A and B. Minimum requirements that shall be contained in a material specification for which acceptance is being requested include such items as the name of the national or international organization, scope, reference documents, process, manufacture, conditions for delivery, heat treatment, chemical and tensile requirements, forming properties, testing specifications and requirements, workmanship, finish, marking, inspection, and rejection.

5-2000 PUBLICATION OF RECOGNIZED NATIONAL OR INTERNATIONAL SPECIFICATIONS

Specifications for which ASME has been given publishing permission by the originating organization will be published in Section II, Parts A and B. Specifications for which ASME has not been given publishing permission by the originating organization will be referenced on a cover sheet in Section II, Parts A and B. Information on obtaining a copy of those referenced documents will be maintained in those Parts. Additions and exceptions to the material specification will be noted in the subtitle of the specification and in Table II-200-1 or II-200-2 in Section II, Parts A and B.

5-2100 CEN SPECIFICATIONS

European Standards are adopted by CEN in three official languages (English, French, and German) as an EN standard. After the CEN adoption, to become applicable in a member country of CEN, an EN standard shall be given the status of a national standard. During this process

- the text of the EN standard shall remain unaltered and shall be included as adopted by CEN
- national forewords and/or annexes may be added to cover specific national practices, but shall not be in contradiction with the EN standard
- a prefix XX (e.g., XX = BS for the United Kingdom, NF for France, and DIN for Germany) is added to the designation of the EN standard (e.g., BS EN 10028-1 or NF EN 10028-1)
- the date of adoption as a national standard will differ from the date of adoption as an EN standard, and may differ from one country to another

Written or electronic copies can only be obtained from European National Standardization Bodies as XX EN (CEN does not sell standards). Consequently, in order to maintain coherence and homogeneity in the reference system, the mentions in the subtitle of the corresponding ASME specification will only refer to the EN standard number without any prefix and to the year of approval by CEN. It will also be mentioned in the cover sheet that the national parts do not apply for the ASME specification.

MANDATORY APPENDIX 7
GUIDELINES ON MULTIPLE MARKING OF MATERIALS

7-100 BACKGROUND

A common inquiry topic is the permissibility of using material that is identified with two or more specifications (or grades, classes, or types), even if they have different strengths, or even if one of them is not permitted for use in the construction code of application. The Committee has addressed variants of these questions in several interpretations: I-89-11, IIA-92-08, VIII-1-89-269, and VIII-1-89-197.

7-200 GUIDELINES

The construction codes individually define what materials may be used in boilers, vessels, and components constructed in compliance to their rules. If a material meets all of the requirements for a specification for which it is marked, including documentation, if any, and if it meets all requirements for use imposed by the construction code, it may be used. The construction codes, in general, do not address the case of materials marked with more than one specification, grade, class, or type, so these guidelines are offered for clarification.

7-210 ACCEPTABILITY OF MULTIPLE MARKING

Dual or multiple marking is acceptable, as long as the material so marked meets all of the requirements of all the specifications, grades, classes, and types with which it is marked.

All of the measured and controlled attributes of the multiply marked grades or specifications must overlap (e.g., chemistry, mechanical properties, dimensions, and tolerances) and the material so marked must exhibit values that fall within the overlaps. Further, the controlled but unmeasured attributes of the specifications or grades must overlap (e.g., melting practices, heat treatments, and inspection).

Many specifications or grades have significant overlap of chemistry ranges or properties. It is common for material manufacturers to produce materials that satisfy more than one specification, grade, class, or type. Examples are SA-53 and SA-106 (some grades and classes), SA-213 TP304L and TP304, SA-213 TP304 and TP304H, and SA-106 B and C.

7-220 PROHIBITION ON MULTIPLE MARKING

Dual or multiple marking is not acceptable if two or more specifications to which the material is marked have mutually exclusive requirements.

This prohibition includes more than just chemistry and property requirements. One example is SA-515 and SA-516; the former requires melting to coarse grain practice while the latter requires melting to fine grain practice. Another example is SA-213 TP304L and TP304H; the carbon content ranges of these grades have no overlap.

7-230 GRADE SUBSTITUTION

Grade substitution is not permitted. Grade substitution occurs when:

(a) the material contains an element (other than nitrogen) that is unspecified for one of the grades marked; and

(b) the amount of that element present in the material meets the minimum and maximum composition limits for that element in another grade of a specification contained in Section II, Part A or Part B, whether or not it is also so marked.

For example, a material meets all of the composition limits for SA-240 304, contains 0.06C and 0.02N, but also contains 0.45% Ti. This material cannot be marked or provided as meeting SA-240 304 because the Ti content meets the requirements of SA-240 321 [which is Ti greater than 5 × (C + N) but less than 0.70].

Another material, with identical composition, except 0.35% Ti, may be marked SA-240 304 because the Ti content does not meet the minimum requirement for 321. The Ti content is just a residual.

7-240 MARKING SELECTION

If a material is marked with specifications, grades, classes, or types, it may be used with the allowable stresses, design stress intensities, or ratings appropriate for any of the markings on the material, as long as the material specification, grade, class, and type is permitted by the code of construction governing the boiler, vessel, or component in which the material is to be used. However, once the designer has selected which marking applies (specification, grade, class, type, etc.), the designer must use all the design values appropriate for that selection and may not mix and match values from any other specifications, grades, classes, types, etc., with which the material may be marked.

7-250 OTHER MARKINGS

Any other markings, such as marking of non-ASME or non-ASTM material specifications, have no relevance, even if those markings are for materials explicitly prohibited by the construction code being used. That is, as long as the *one* marking, and the documentation required by the material and by the construction code, shows that it meets all the requirements for use of that material in that construction code, any additional markings are irrelevant.

MANDATORY APPENDIX 9
STANDARD UNITS FOR USE IN EQUATIONS

Table 9-100
Standard Units for Use in Equations

Quantity	U.S. Customary Units	SI Units
Linear dimensions (e.g., length, height, thickness, radius, diameter)	inches (in.)	millimeters (mm)
Area	square inches ($in.^2$)	square millimeters (mm^2)
Volume	cubic inches ($in.^3$)	cubic millimeters (mm^3)
Section modulus	cubic inches ($in.^3$)	cubic millimeters (mm^3)
Moment of inertia of section	$inches^4$ ($in.^4$)	$millimeters^4$ (mm^4)
Mass (weight)	pounds mass (lbm)	kilograms (kg)
Force (load)	pounds force (lbf)	newtons (N)
Bending moment	inch-pounds (in.-lb)	newton-millimeters (N·mm)
Pressure, stress, stress intensity, and modulus of elasticity	pounds per square inch (psi)	megapascals (MPa)
Energy (e.g., Charpy impact values)	foot-pounds (ft-lb)	joules (J)
Temperature	degrees Fahrenheit (°F)	degrees Celsius (°C)
Absolute temperature	Rankine (R)	kelvin (K)
Fracture toughness	ksi square root inches $\left(\text{ksi}\sqrt{\text{in.}}\right)$	MPa square root meters $\left(\text{MPa}\sqrt{\text{m}}\right)$
Angle	degrees or radians	degrees or radians
Boiler capacity	Btu/hr	watts (W)

MANDATORY APPENDIX 10
BASIS FOR ESTABLISHING MAXIMUM ALLOWABLE STRESS VALUES FOR TABLES 5A AND 5B

10-100 DERIVATION OF ALLOWABLE STRESS VALUES

The values in Tables 5A and 5B are established by the Committee only. In the determination of allowable stress values, the Committee is guided by successful experience in service, insofar as evidence of satisfactory performance is available. Such evidence is considered equivalent to test data where operating conditions are known with reasonable certainty. In the evaluation of new materials, it is sometimes necessary to be guided by the comparison of test information with available data on successful applications of similar materials.

The factors employed to determine the maximum allowable stress values are provided in Table 10-100. Nomenclature for this Table is as follows:

F_{avg} = multiplier applied to average stress for rupture in 100 000 h. At 815°C and below, F_{avg} = 0.67. Above 815°C, it is determined from the slope of the log time-to-rupture versus log stress plot at 100 000 h such that log [F_{avg}] = 1/n, but F_{avg} may not exceed 0.67.

NA = not applicable

n = a negative number equal to Δ log time-to-rupture divided by Δ log stress at 100 000 h

R_y = ratio of the average temperature dependent trend curve value of yield strength to the room temperature yield strength

S_{Cavg} = average stress to produce a creep rate of 0.01%/1 000 h

S_{Ravg} = average stress to cause rupture at the end of 100 000 h

S_{Rmin} = minimum stress to cause rupture at the end of 100 000 h

S_T = specified minimum tensile strength at room temperature

S_y = specified minimum yield strength at room temperature

(13) 10-110 CRITERIA FOR MATERIALS OTHER THAN BOLTING

The maximum allowable stress values at any temperature shall be the lowest value obtained from the criteria in Table 10-100. The mechanical properties considered and the factors applied to establish the maximum allowable stresses are as given below.

(a) At temperatures below the range where creep and stress rupture strength govern the selection of stresses, the maximum allowable stress value is the lowest of the following:

(1) the specified minimum tensile strength at room temperature divided by 2.4

(2) the specified minimum yield strength divided by 1.5

(3) the yield strength at temperature divided by 1.5, except for austenitic stainless steels, high-nickel steels, nickel, and nickel alloys

(4) for austenitic stainless steels, high-nickel steels, nickel, and nickel alloys, due to their relatively low yield strength, higher stress values are established at temperatures where the short-time tensile properties govern, to permit use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed 66$^2/_3$%, but do not exceed 90%, of the yield strength at temperature, but never exceed two-thirds of the specified room-temperature minimum yield strength. These higher stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y-2 lists multiplying factors that, when applied to the yield strength values shown in Table Y-1, will give allowable stresses that will result in lower levels of permanent strain.

In the application of these criteria, the Committee considers the yield strength at temperature to be R_yS_y.

(b) At temperatures in the range where creep and stress rupture govern the selection of stresses, the maximum allowable stress value for all materials is established by the Committee not to exceed the lowest of the following:

(1) 100% of the average stress to produce a creep rate of 0.01%/1 000 h

(2) 100F_{avg}% of the average stress to cause rupture at the end of 100 000 h

(3) 80% of the minimum stress to cause rupture at the end of 100 000 h

Stress values for high temperature are based, whenever possible, on representative uniaxial properties of the materials obtained under standard testing conditions. The stress values are based on basic properties of the material and no consideration is given for corrosive environment, for abnormal temperature and stress conditions, or for other design considerations.

(13)

Table 10-100
Criteria for Establishing Allowable Stress Values for Tables 5A and 5B

Product/Material	Below Room Temperature		Room Temperature and Above			
	Tensile Strength	Yield Strength	Tensile Strength	Yield Strength	Stress Rupture	Creep Rate
All wrought or cast ferrous and nonferrous product forms except bolting, and except for austenitic stainless steel, high-nickel alloy steel, nickel, and nickel alloy product forms	$\frac{S_T}{2.4}$	$\frac{S_y}{1.5}$	$\frac{S_T}{2.4}$	$\frac{R_y S_y}{1.5}$	$\text{Min.}\left(F_{\text{avg}} S_{R\,\text{avg}},\ 0.8\,S_{R\,\text{min}}\right)$	$1.0\,S_{C\text{avg}}$
All wrought or cast austenitic stainless steel, high-nickel alloy steel, nickel, and nickel alloy product forms except bolting [Note (1)]	$\frac{S_T}{2.4}$	$\frac{S_y}{1.5}$	$\frac{S_T}{2.4}$	$\text{Min.}\left(\frac{S_y}{1.5}, \frac{0.9\,S_y R_y}{1.0}\right)$	$\text{Min.}\left(F_{\text{avg}} S_{R\,\text{avg}},\ 0.8\,S_{R\,\text{min}}\right)$	$1.0\,S_{C\text{avg}}$

GENERAL NOTE: When using this stress basis criterion to determine the allowable stresses for a specific material as a function of temperature, the derived allowable stress at a higher temperature can never be greater than the derived allowable stress at a lower temperature.

NOTE:

(1) Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short-time tensile properties govern, to permit the use of these materials where slightly greater deformation is acceptable. The stress values in this range exceed $66\frac{2}{3}$% but do not exceed 90% of the yield strength at temperature. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y-2 lists multiplying factors that, when applied to the yield strength values shown in Table Y-1, will give allowable stresses that will result in lower values of permanent strain.

10-120 CRITERIA FOR BOLTING MATERIALS

The criteria for bolting materials listed in Tables 3 and 4 are to be found in Mandatory Appendix 2.

(13)

NONMANDATORY APPENDIX A
ISSUES ASSOCIATED WITH MATERIALS USED IN ASME CODE CONSTRUCTION

A-100 GENERAL

The performance over time of the various ferrous and nonferrous alloys permitted for use in Code construction may be influenced by many factors, ranging from the processes involved in their fabrication into components and their installation to changes in the material structure or direct damage to the material related to operation in the intended service. If Code-constructed equipment is to provide the reasonably long period of safe operation expected by the users of that equipment, then the equipment designers must be aware of any potential change in the material's properties related to fabrication, installation, or service as they go about selecting materials for Code usage. Although the Code does not mandate that all of the various metallurgical phenomena and environmental effects that can influence material performance be considered in the design of a Code component, such consideration is a part of the good engineering judgment that is expected to be exercised in all Code-related matters and, as such, this Nonmandatory Appendix is provided to designers and other Code users to assist in the material selection process.

Historically, some of the information contained in this Nonmandatory Appendix has been available in other Sections of the Boiler and Pressure Vessel Code, as well as in the Piping Code. In addition to information provided previously in Nonmandatory Appendix A, Metallurgical Phenomena, in Section II, Part D, there was information available in Section VIII and more recently in Section III Appendices, Nonmandatory Appendix W, Environmental Effects. A review of these various information sources revealed that there were many important issues not covered, and that there were other issues that required revision to incorporate new information. Thus, what follows is an expanded coverage of metallurgical phenomena and environmental effects. It is emphasized, however, that this is not a comprehensive coverage of all possible mechanisms, nor is it an exhaustive treatment of the individual topics. Rather, this revised Appendix is intended to serve as a more convenient resource for designers and users of Code equipment as they consider the many issues that could adversely affect materials in Code service.

A-110 ISSUES COVERED

Issues covered in this Nonmandatory Appendix include those listed below (it is recognized, of course, that some of these issues could be placed in more than one of the general categories). In the first section, on metallurgical changes (A-200), an attempt is made to identify the materials most commonly affected by the changes in question. In the remaining sections (A-300 through A-800), the various types of damage to which materials may be subject are described, with a strong emphasis on the environmental effects that, in the absence of appropriate preventive measures, can render the materials inoperable. Items covered in each section and paragraph are as follows:

Section/ Paragraph Number	Section/Paragraph Description
A-200	Metallurgical changes
A-201	Graphitization (occurs almost exclusively in carbon and C–Mo steels)
A-202	Softening (occurs in most ferritic alloys used for elevated temperature service)
A-203	Temper embrittlement (occurs in low alloy steels)
A-204	Strain aging (occurs in carbon and low alloy steels)
A-205	Cold working (effects occur in most steels, but are particularly important for the 300 series stainless steels)
A-206	Relaxation cracking
A-207	475°C embrittlement (occurs mostly in high chromium stainless steels and in the ferritic phase of duplex stainless steels)
A-208	Sigma phase embrittlement (occurs in 300 series stainless steels and in some 400 series stainless steels with Cr >17%)
A-209	Laves phase precipitation (occurs in some 300 series stainless steels, Fe–Ni base alloys, Co-base superalloys, and in the tungsten-bearing CSEF steels)
A-210	Sensitization (carbide formation) (occurs in both the 300 series stainless steels as well as in 400 series stainless grades)
A-211	Thermal aging embrittlement (occurs to varying degrees in most ferrous alloys)
A-212	Radiation embrittlement (affects all materials, both ferrous and nonferrous)
A-213	Solidification cracking in nickel alloys
A-300	Uniform corrosion
A-301	General corrosion and wastage
A-302	Atmospheric corrosion
A-303	Galvanic corrosion
A-304	Stray current corrosion

Table continued

Section/ Paragraph Number	Section/Paragraph Description
A-305	High-temperature corrosion
A-306	Soil corrosion
A-307	Caustic corrosion
A-308	Carbon dioxide corrosion
A-309	Concentration cell corrosion
A-310	Differential-temperature cell corrosion
A-311	Molten salt corrosion
A-312	Liquid metal corrosion
A-400	Localized corrosion
A-401	Pitting corrosion
A-402	Filiform corrosion
A-403	Crevice corrosion
A-404	Microbiologically induced corrosion
A-500	Metallurgically influenced corrosion
A-501	Intergranular corrosion
A-502	Dealloying corrosion (dezincification and graphite corrosion) (occurs mainly in brasses and gray cast iron)
A-503	Grooving (occurs mostly in ERW carbon steel pipe)
A-600	Mechanically assisted corrosion
A-601	Velocity-affected corrosion
A-602	Erosion-corrosion
A-603	Impingement corrosion
A-604	Cavitation erosion
A-605	Corrosion fatigue
A-700	Environmentally induced embrittlement and cracking
A-701	Stress corrosion cracking – Transgranular stress corrosion cracking – Intergranular stress corrosion cracking – Irradiation-assisted stress corrosion cracking
A-702	Hydrogen damage – Hydrogen embrittlement – Hydrogen stress cracking – Hydrogen attack (high-temperature damage)
A-703	Liquid metal embrittlement
A-704	Caustic embrittlement
A-705	Flow-assisted corrosion
A-706	Sulfur embrittlement
A-800	Mechanical damage mechanisms
A-801	Fretting and wear
A-802	Thermal fatigue
A-803	Dynamic loading
A-804	Anisotropy

Discussion of the above various issues in this Nonmandatory Appendix is limited to a definition of the phenomenon or environmental effect in question, which includes a brief description of the conditions under which the metallurgical change or the damage may occur. This is followed by a references section that is provided to guide the Code user to more-comprehensive sources of information. Some "authoritative sources" used in covering materials issues are listed below. These are not all of the possible references, but they are considered to be adequate for providing a general characterization of the various phenomena and environmental effects discussed.

A-120 GENERAL REFERENCES

ASM Handbooks

Volume 1, *Properties and Selection: Iron, Steels, and High-Performance Alloys*, 1993

Volume 2, *Properties and Selection: Nonferrous Alloys and Special-Purpose Materials*, 1993

Volume 9, *Metallography and Microstructures*, 2004

Volume 11, *Failure Analysis and Prevention*, 2002

Volume 13A, *Corrosion: Fundamentals, Testing, and Protection*, 2003

Volume 13B, *Corrosion: Materials*, 2005

Volume 13C, *Corrosion: Environments and Industries*, 2006

Garverick, L., *Corrosion in the Petrochemical Industry*, ASM, 1994

Collins, J. A., *Failure of Materials in Mechanical Design*, John Wiley and Sons, New York, 1981

Wulpi, D. J., *Understanding How Components Fail*, ASM, 1985

Smith, G. V., *Properties of Metals at Elevated Temperatures*, McGraw-Hill Book Co., New York, 1950

Revie, R. W. and Uhlig, H. H., *Corrosion and Corrosion Control*, John Wiley and Sons, New York, 2008

Dobis, J. D. and Bennett, D. C., *Damage Mechanisms Affecting Fixed Equipment in the Pulp and Paper Industry*, WRC Bulletin 488, January 2004

Dobis, J. D. et al., *Damage Mechanisms Affecting Fixed Equipment in the Refining Industry*, WRC Bulletin 489, February 2004

Dobis, J. D. and French, D. N., *Damage Mechanisms Affecting Fixed Equipment in the Fossil Electric Power Industry*, WRC Bulletin 490, April 2004

McGuire, M. F., *Stainless Steels for Design Engineers*, ASM International, 2008

References cited in

- Section II, Part D (2007 Edition), Materials Properties, Appendix A, Metallurgical Phenomena
- Section III, Division 1 (2007 Edition), Nuclear Construction, Appendix W, Environmental Effects
- ASME B31.1-2007, Power Piping
- ASME B31.3-2008, Process Piping

A-200 METALLURGICAL CHANGES THAT CAN OCCUR IN SERVICE

Materials purchased to ASTM or ASME specifications are, by intent, well-defined substances, each having a well-characterized database from which allowable stresses can be developed. However, there are certain manufacturing and installation processes, as well as many service conditions, that can affect the macrostructure and microstructure of these materials and, in so doing, modify the

behavior of these materials in service. These are the "bulk" effects where large parts of an entire structure have been altered – and these effects are sometimes called metallurgical phenomena. The various phenomena of potential interest to Code users are discussed below, in no particular order of importance.

A-201 GRAPHITIZATION

A-201.1 Definition. Graphitization is a process in which some portion of the carbon, present in the iron carbide that forms in the microstructure of carbon or carbon–0.5Mo steels during virtually all standard heat treatments for these steels, dissociates from the carbides and forms separate particles of free carbon, or graphite. This change will occur only over a relatively long period of time when the steel is operating in the temperature range of 425°C to 595°C and, depending on the nature of the distribution of the graphite particles in the microstructure, can result in a substantial loss of the material's strength and ductility. The graphite particles may be randomly distributed throughout the structure, in which case the effects on material performance will be minimal (although a modest loss of creep strength may be observed), or they may be aligned along certain preferred planes in the structure (e.g., at the edge of weld heat-affected zones or along cold-worked bands of material), in which case the loss of ductility can be severe, leading to unexpected failure of the component. Graphitization competes with another metallurgical phenomenon known as spheroidization (discussed in A-202), with graphitization more likely to occur at temperatures below approximately 550°C.

The relative susceptibility to graphitization of the carbon or carbon–moly steels can vary substantially, depending on the specific heat chemistry, and there is not at this time a good quantitative understanding of the influence of individual elements on susceptibility. For example, it has long been suspected that aluminum enhances the graphitization process, so that aluminum-killed steels are more susceptible to graphitization than are steels killed with silicon or titanium, but some investigators have disputed this, suggesting that the aluminum may hasten the process of the initial particle formation but does not influence the overall extent of the graphitization over time. Nor is there at this time a complete understanding of why in some cases the aligned-type particle formation is favored over the random-type formation. As noted above, graphitization will occur over a range of temperatures, with the rate of particle formation varying with temperature. Experience has shown that for the carbon–moly steels the temperatures of greatest susceptibility are approximately 30°C higher than for the plain carbon steels. The addition of approximately 0.5 weight % chromium to the steel will stabilize the carbides in the microstructure and prevent the occurrence of graphitization, which is an inducement to use other grades of steel containing chromium for service at elevated temperatures.

A-201.2 References. In addition to the general references cited in A-120, see also the following references for additional details:

[1] *Embrittlement of Components in Fossil Fueled Power Plants*, EPRI 1004515, 2003.
[2] *Boiler Tubes: Theory and Practice, Volume 3: Steam Touched Tubes*, EPRI TR-105261 – V3.
[3] French, D. N., "Microstructural Degradation," The National Board of Boiler and Pressure Vessel Inspectors, June 2001.
[4] Foulds, J. R. and R. Viswanathan, "Graphitization of Steels in Elevated Temperature Service," *Proceedings of the First International Symposium on Microstructures and Mechanical Properties of Aging Materials*, The Minerals, Metals and Materials Society, November 1992.
[5] Port, R. D., "Non-Weld-Related Graphitization Failures," *Corrosion/89*, Paper No. 248, NACE.
[6] Wilson, J. G., *Graphitization of Steel in Petroleum Refining Equipment and the Effect of Graphitization of Steel on Stress Rupture Properties*, WRC Bulletin 32, January 1957.
[7] Thielsch, H., *Defects and Failures in Pressure Vessels and Piping*, Reinhold Publishing Corp., 1965.
[8] Hemingway, W. L., "The Study of Graphitization," The Edwards Valve Co., 1952.

A-202 SPHEROIDIZATION (SOFTENING)

A-202.1 Definition. As noted in A-201.1, graphitization and spheroidization are competing processes in which the carbide phases of certain steels are altered as the result of prolonged exposure to temperatures in the range of 425°C to 760°C. In the case of spheroidization, the carbide does not break down to release the carbon, but it changes from an approximately planar shape developed during the original heat treatment (e.g., the platelike lamellae of pearlite in normalized carbon steel) to a lower-energy spheroidal shape, resulting in some loss of both room temperature and elevated temperature strength (by as much as 30%), but an increase in ductility.

Spheroidization may occur in any carbon or alloy steel, including the 9% Cr and 12% Cr creep strength-enhanced ferritic steels. Experience over the years has shown the following:

(a) Annealed steels are more resistant to spheroidization than normalized steels, since they are intentionally heat treated to exist in a more stable condition.

(b) Coarse-grained steels are more resistant to spheroidization than fine-grained steels.

(c) Fine-grained silicon-killed steels are more resistant than aluminum-killed steels.

For components operating in the time-dependent regime, spheroidization often is an inevitable part of the aging process, and qualitative correlations between the degree of spheroidization and the amount of remaining life have been used with a moderate degree of success.

A-202.2 References. In addition to the general references cited in A-120, see the references cited in A-201.2, particularly references [3] and [5].

A-203 TEMPER EMBRITTLEMENT

A-203.1 Definition. Temper embrittlement is a metallurgical phenomenon that can occur in several different classes of steel, including plain carbon steels, low alloy steels, and martensitic steels, in which the toughness of the material drops significantly when subjected to prolonged exposure to temperatures within what would be considered a normal range for either heat treatment or service. When testing for embrittlement is carried out by use of the Charpy V-notch test, the embrittlement manifests itself as an upward shift in the ductile-to-brittle transition temperature. The mechanisms of embrittlement vary somewhat with the type of steel involved, but in the application of materials for Code construction, the more significant embrittlement is that which occurs in some low alloy steels during long-time exposure in the temperature range of 345°C to 595°C. Temper embrittlement can occur either during fabrication or during prolonged exposure in the embrittling temperature range during service.

For the low alloy steels, the embrittling mechanism has been shown to involve the preferential segregation of certain residual and surface-active elements to the grain boundaries. Elements that are believed to be particularly harmful include phosphorous, arsenic, antimony, and tin, with other elements, such as manganese, silicon, chromium, nickel, and vanadium, playing a lesser role in the embrittlement process by facilitating the action of the more-harmful elements. The embrittled material is most vulnerable during equipment startups and shutdowns, during which times it is most likely to fracture in a brittle manner when rapidly loaded at temperatures within or below the transition temperature range.

One of the most commonly used low alloy steels, $2\frac{1}{4}$Cr–1Mo, is also one of the most susceptible steels, with 3Cr–1Mo being slightly less susceptible. High-strength low alloy (HSLA) chromium–molybdenum–vanadium steels are also susceptible to temper embrittlement. Steels of an older vintage (prior to approximately 1972) and those steels produced without the advantage of modern clean steel technologies also tend to be more susceptible to the embrittlement, due to the higher levels of impurities.

Various methods have been devised for controlling the susceptibility to temper embrittlement through control of chemical composition, with the use of the J and X factors having achieved a fairly broad range of acceptance. Through use of these factors, the amounts of the most deleterious elements are limited to levels known to confer a high degree of resistance to temper embrittlement. These factors are defined as follows:

$$\text{J factor (base metal)} = (\text{Si} + \text{Mn}) \times (\text{P} + \text{Sn}) \times 10{,}000 \le 150 \text{ (elements calculated in wt. \%)}$$

$$\text{X factor (weld metal)} = (10\text{P} + 5\text{Sb} + 4\text{Sn} + \text{As})/100 \le 15 \text{ (elements calculated in ppm)}$$

In addition to material composition, postweld heat treatment procedures should be carefully selected and/or qualified to avoid temper embrittlement before exposing the material to service conditions.

The effects of temper embrittlement can be reversed by heating the affected material to a minimum temperature of 620°C and holding for 2 h per 25.4 mm of thickness, followed by rapid cooling to room temperature. However, the material will quickly re-embrittle if it is reexposed to the conditions that caused the embrittlement in the first place.

A-203.2 References. In addition to the general references cited in A-120, see the following references for additional details:

[1] API RP 934, *Materials and Fabrication Requirements for $2\frac{1}{4}$Cr-1Mo and 3Cr-1Mo Steel Heavy Wall Pressure Vessels for High Temperature, High Pressure Hydrogen Service*, American Petroleum Institute.

[2] White, R. A. and E. F. Ehmke, *Materials Selection for Refineries and Associated Facilities*. NACE, 1991, pp. 53-54.

[3] Viswanathan, R., *Damage Mechanisms and Life Assessment of High Temperature Components*, ASM International, 1989.

[4] Swift, R. A., "Temper Embrittlement in Low Alloy Ferritic Steels," *Corrosion/76*, Paper No. 125, NACE.

A-204 STRAIN AGING

A-204.1 Definition. An early (1948 edition/1960 reprinting) edition of the ASM Metals Handbook defines strain aging as "aging induced by cold working." With improved understanding of the strain aging mechanism, strain aging now can be defined as an age-hardening phenomena in which the tensile strength and hardness of a cold-worked material are increased and the ductility reduced when that material is exposed to moderately elevated temperatures, normally as a result of service, although it can also occur during fabrication. The most common mechanism for the aging is the precipitation of nitrides at dislocations and other crystalline defects created during the cold working of the material, and it is for this reason that strain age damage is far more prevalent in older versions (pre-1980) of carbon and carbon–0.5 molybdenum steels, where control of the nitrogen content was less effective. Newer steels made in basic oxygen furnaces and fully killed with aluminum have not shown as great a susceptibility to strain age damage. The effects of strain aging can be minimized or eliminated

by a stress-relieving heat treatment following the cold working, where the temperature of the stress relief is sufficiently high to substantially reduce the number of available initiation sites for the nitride precipitation.

A-204.2 References. Most of what is needed to understand and deal with strain aging can be found in the general references cited in A-120.

A-205 COLD WORKING (COLD STRAIN)

A-205.1 Definition. Cold working is any process of plastic deformation of a metal that occurs at temperatures below the material's transformation or recrystallization temperature and in which the material is hardened by the strain. As the hardness of a cold-worked material is increased, the ductility of the material decreases. The amount of hardening that occurs with a given amount of cold work varies with the alloy system, and cold work effects are particularly pronounced in alloys like the austenitic (3XX series) stainless steels. When austenitic stainless steels that have been moderately to heavily cold worked are operated in the creep range (generally above about 540°C), recrystallization may occur and the grain size can be substantially reduced, particularly if the temperature is limited to a level only slightly above the recrystallization temperature. This can result in an increase in the creep rate, with a corresponding decrease in creep rupture strength. As discussed earlier (see A-201 and A-204), cold work contributes to certain types of microstructural instability. In addition, the residual stresses induced by cold work can substantially increase the risk of cracking in austenitic stainless steels and other austenitic alloys when these materials are exposed to certain types of aggressive environment (see A-701 on stress corrosion cracking).

Cold work can accelerate other forms of embrittlement; see reference [1]. Concern over the effects of cold work has led to the implementation of various requirements in the construction codes for heat treatment of certain cold-worked materials once a critical level of strain is exceeded. It is understood that because of the complexity of the relationship between cold work and material degradation, implementation of the heat treatment rules is not a guarantee that premature failures will be avoided in all situations. Likewise, violation of the limits defined in the rules will not inevitably result in premature failures. Factors such as melting practice, consolidation (forming) and heat treatment practices of the material producer, and the initial grain size all can play a role in determining whether a cold-worked material operates reliably in service. However, the rules represent a consensus of what can be considered good practice by parties representing disparate interests and, in general, serve to benefit the end user.

A-205.2 References. The general references cited in A-120 contain extensive information on the effects of cold work in materials used for Code construction. See the following reference for additional detail:

[1] Groebner, P. J. and R. F. Steigerwald, "Effect of Cold Work on the 885°F (475°C) Embrittlement of 18Cr-2Mo Ferritic Stainless Steels," Journal of Metals, July 1977, pp. 17–23.

A-206 RELAXATION CRACKING (STRAIN-INDUCED PRECIPITATION HARDENING)

A-206.1 Definition. Relaxation cracking is a condition that may develop in cold-worked or warm-worked austenitic materials when temper-resistant particles precipitate at excess defect sites generated by the cold or warm working operations; these precipitates act to "pin" the defects, which results in a substantial increase in the material's creep strength and hardness. The bulk of the strengthening occurs within the individual grains, while the grain boundaries remain comparatively weak, so that when the material is heated to intermediate temperatures in the range of 510°C to 760°C any strains that develop either in response to heat treatments or service temperatures concentrate in the grain boundaries. This can lead to rapid creep crack growth and ultimately failure of the component in a nonductile fashion. In the austenitic stainless steel alloys, the precipitates commonly are carbides and carbonitrides involving columbium or titanium, while in the nickel-base alloys titanium and aluminum contribute to the formation of gamma prime or gamma double-prime precipitates. There is substantial heat-to-heat variability in the relative susceptibility of an alloy to relaxation cracking, but in susceptible heats the rate of crack growth can be quite rapid if the amount of working and the temperature of exposure are unfavorable. In fact, pressure parts fabricated from susceptible heats of 347H material and 310HCbN have cracked through-wall during heat-up for solution annealing. The rules contained in PG-19 (BPVC Section I) and UHA-44 (Section VIII, Division 1) were developed, in part, to minimize the risk of relaxation cracking.

A-206.2 References.

[1] Truman, R. J. and H. W. Kirkby, "Some Ductility Aspects of 18-12-1Nb Steel," *Journal of the Iron and Steel Institute*, October 1960.

[2] Moore, N. E. and J. A. Griffiths, "Microstructural Causes of Heat-Affected Zone Cracking in Heavy Section 18-12-Nb Austenitic Stainless Steel Welded Joints," *Journal of the Iron and Steel Institute*, January 1961.

[3] Shingledecker, J. P. "Creep-Rupture Behavior and Recrystallization in Cold-Bent Boiler Tubing for USC Applications," *Proceedings of the 5th International Conference on Advances in Materials Technology for Fossil Power Plants*, Marco Island, Florida, 2007.

[4] Van Wortel, H. "Control of Relaxation Cracking in Austenitic High Temperature Components," *Corrosion/2007*, Paper No. 07423, NACE.

A-207 475°C EMBRITTLEMENT

A-207.1 Definition. Upon exposure to elevated temperatures, high chromium stainless steels and the ferrite phase of austenitic and austenitic–ferritic (duplex) stainless steels are subject to a type of embrittlement in which the material hardness increases and the tensile ductility and toughness decrease at and below the service temperature. This metallurgical phenomenon is observed at chromium levels in excess of 10% to 12% and the embrittlement may be due to carbide, nitride, or silicide precipitation, especially at the lower chromium levels, rather than precipitation of alpha prime chromium-rich particles. The severity of embrittlement increases with increasing chromium content, and the effect is enhanced by certain alloying elements, notably aluminum, molybdenum, and tungsten, which tend to increase and stabilize the ferrite content. While the maximum rate of embrittlement occurs at 475°C, a typical "C" curve time–temperature behavior is observed and some alloys with as little as 15% to 18% chromium have shown significant embrittlement with just a few thousand hours exposure at temperatures as low as 260°C. At very high chromium levels, alpha prime embrittlement proceeds via spinodal decomposition, rather than by nucleation and growth of discrete alpha prime particles. This may be the primary cause of embrittlement for alloys S44735 and S44660.

The 475°C embrittlement generally becomes apparent first as a reduction in Charpy impact ductile–brittle transition temperature (DBTT), and only in its last stages are changes in strength, hardness, and ductility observed. The embrittlement normally is not a problem at elevated temperatures, but it can become a problem when components are cooled to ambient temperatures.

A-207.2 References. In addition to the general references cited in A-120, see also the following references for additional information:

[1] Miller, G. E. "Experiences with 885°F Embrittlement in Ferritic Stainless Steels," *Materials Protection*, NACE International, May 1966.
[2] Groebner, P. J., "The 885°F (475°C) Embrittlement of Ferritic Steels," *Metallurgical Transactions*, Volume 4, January 1973, pp. 251–260.
[3] Nichol, T. J., A. Datta, and G. Aggen, "Embrittlement of Ferritic Stainless Steels," *Metallurgical Transactions*, Volume 11A, April 1980, pp. 573–585.

A-208 SIGMA PHASE EMBRITTLEMENT

A-208.1 Definition. Sigma phase embrittlement is a metallurgical phenomenon in which an iron–chromium intermetallic compound that is hard and brittle forms in certain high alloy steels after prolonged exposure at temperatures ranging from 565°C to 925°C. The embrittling effect is observed most immediately at lower temperatures, where there is a reduction in tensile ductility and a loss in toughness. The presence of sigma phase normally is less injurious at the higher temperatures where it forms. However, under certain conditions the presence of large amounts of the sigma phase has been linked to significant reductions in creep ductility, with a corresponding reduction in the creep life of a component.

Materials typically susceptible to sigma phase formation include the following:

(a) 300 series stainless steels, including both wrought and cast forms, as well as weld metal

(b) 400 series stainless steels, both ferritic and martensitic types, generally with chromium levels of 17% and more

(c) duplex stainless steels

Factors that influence the rate of sigma phase formation include the amount of delta ferrite present, time within the temperature range of formation, prior cold working, variations in composition due to progressive solidification, increased chromium content, and the presence of ferrite-stabilizing elements, particularly molybdenum, niobium, and titanium, which act to increase the chromium equivalent, while austenite-stabilizing elements, particularly carbon, nitrogen, nickel, and manganese, reduce the rate of sigma phase formation.

Sigma phase can nucleate preferentially at carbides and especially at ferrite–austenite interfaces in predominantly austenitic alloys, or in duplex alloys it can result from the transformation of the delta ferrite phase at temperatures following exposure to temperatures above approximately 650°C. It is possible to "de-sigmatize" affected materials by re-solution annealing at a minimum of 1065°C for about 4 h, followed by a water quench, but the rate of reformation when reexposed to temperatures within the susceptible range is rapid.

A-208.2 References. In addition to the general references cited in A-120, see also the following references for additional details:

[1] Viswanathan, R., "Damage Mechanisms and Life Assessment of High Temperature Components," ASM International, 1989.
[2] API Publication 581, "Risk-Based Resource Document," American Petroleum Institute.
[3] Kiesheyer, H. and H. Brandis, "Precipitation and Embrittlement Behavior of Nickel-Containing Superferrites," Zeit. Werkst. 8, March 1977, pp. 69–77.

A-209 LAVES AND LAVES PHASE PRECIPITATION

A-209.1 Definition. Most austenitic (300 series) stainless steels are metastable materials, which means that during elevated temperature service a range of complex carbides and other noncarbide phases may form, depending on the time and temperature of exposure, the specific alloy composition, and prior cold working or other fabrication process variables. One of those phases is the

Laves phase, the formation of which may occur during alloy production or during service, and is another of the metallurgical phenomena that may occur during exposure of austenitic stainless steels containing molybdenum, titanium, and niobium, in the temperature range from just above 595°C to approximately 870°C. Laves phase may also develop in other iron-base, iron–nickel-base, or cobalt-base superalloys, including the tungsten-enriched grades of the creep strength-enhanced ferritic steels (e.g., Grades 92 and 122). Silicon and niobium promote formation of Laves phase in Alloy 718 (N07718). Laves phase precipitates within the grains (intragranularly) or intergranularly, forming into globular particles or into platelets.

Laves phase forms during solidification of high niobium alloys, most notably N07718, and its presence can result in the embrittlement of welded materials unless a very high temperature solution-annealing operation is performed as the postweld heat treatment. There is also an Ni_2Mg Laves phase that can form as a result of excessive desulfurization of N07718 and similar alloys.

A-209.2 References. In addition to the general references cited in A-120, see also the following references for additional details:

[1] Kriege, O. H., "Phase Separation as a Technique for the Characterization of Superalloys," STP 557, ASTM, 1974.
[2] Kuy, E., "On the Methodology of Phase Extraction in Nickel-Base Superalloys," *Practical Metallography*, Volume 13, November 1976.

A-210 SENSITIZATION (CARBIDE FORMATION)

A-210.1 Definition. Sensitization involves the precipitation of chromium carbides along the grain boundaries of austenitic (300 series) and ferritic/martensitic (400 series) stainless steels when they are exposed for significant periods of time in the temperature range of about 540°C to 845°C. Most high-temperature alloys are sensitized either as-produced or as the result of service. The grain boundary precipitation of the chromium carbides typically results in a strengthening of the alloy; however, because the formation of the carbides depletes the material immediately adjacent to the precipitates of chromium, the material can be highly susceptible to intergranular corrosion when exposed to corrosive aqueous environments at lower temperatures. The rate at which sensitization occurs and the degree of sensitization will depend on the specific material composition and the time and temperature of exposure. For example, the ferritic stainless grades will sensitize much more rapidly than the austenitic grades, due to the difference in diffusion rates in the two different crystal structures. Portions of a weld heat-affected zone in a susceptible material inevitably will be subjected to sensitizing temperatures and this should be considered if the welded component is to be subjected to a corrosive environment. For high-temperature applications, the material will desensitize over time as the chromium from the surrounding material diffuses back into the depleted region, but this process occurs much more slowly than the sensitization itself. Modifications have been made to the composition of some austenitic and ferritic grades to minimize the risk of sensitization, including the reduction of carbon (i.e., the so-called L grades) and the introduction of elements such as titanium and niobium that form carbides in preference to the chromium carbide (e.g., Type 321 and Type 347). It should be noted, however, that in high-temperature applications, the presence of "stabilizing" elements such as titanium or niobium will typically retard, but not prevent, the occurrence of sensitization, although the presence of these elements will alter the rate of its development.

It should be understood that the sensitized condition does not relate directly to the presence of the carbides in the grain boundaries; rather, the condition occurs because at a certain stage in the evolution of the carbides, chromium-depleted zones are created that render the material subject to intergranular attack. Different tests for sensitization (e.g., ASTM A262 Practices A, B, C, E, and F) will detect different levels of chromium depletion and may yield different results. Since the extent of chromium depletion can vary, the degree of sensitization (DOS) varies too. Standard electrochemical techniques (see ASTM G108) exist for quantifying the DOS and allow determination of whether the DOS is compatible with the intended service. Note that some of the intergranular corrosion tests (most commonly the ASTM A262, Practice C Nitric Acid Test) may detect susceptibility to intergranular corrosion caused by mechanisms other than carbide precipitation. Thus, test method selection and the proper interpretation of results are important.

A-210.2 References. In addition to the general references cited in A-120, see also the following reference for additional details:

[1] J. J. Demo and A. P. Bond, "Intergranular Corrosion and Embrittlement of Ferritic Stainless Steels," *Corrosion*, Volume 31, January 1975, pp. 21-22.

A-211 THERMAL AGING EMBRITTLEMENT

A-211.1 Definition. Several forms of thermally induced embrittlement have previously been covered in A-201 (graphitization), A-203 (temper embrittlement), A-204 (strain-aging embrittlement), A-207 (475°C embrittlement), and A-208 (sigma phase embrittlement). Issues not yet covered within the general subject of thermal aging embrittlement include blue brittleness, quench age embrittlement, stress-relief embrittlement, and tempered-martensite embrittlement. These last four issues all arise during fabrication-related heating activities.

Blue brittleness is an embrittling phenomenon that occurs when plain carbon steels and some alloy steels are heated into the temperature range of 230°C to 370°C. Blue

brittleness is an accelerated form of strain-age embrittlement and is characterized by an increase in strength and a marked decrease in ductility and toughness.

Quench-age embrittlement occurs in low carbon steels when the material undergoes hardening in response to the precipitation of carbides at existing dislocations due to differences in the solid solubility of carbon in ferrite at different temperatures. The hardening reaction is made possible by rapid cooling from temperatures slightly below the lower critical transformation temperature, at which temperature the solubility of carbon is substantially greater than at room temperature. As the hardness of the steel increases with increased aging at room temperature, the ductility decreases proportionally. An aging period of several weeks at room temperature is required for maximum embrittlement.

Stress-relief embrittlement is also known as *postweld heat treat cracking* or *reheat cracking*; where this mechanism is active, it will lead to intergranular cracking within the higher-strength portions of the weld zone (e.g., the coarse-grained heat-affected zone and the weld deposit itself) during stress relieving or during subsequent elevated temperature service. The metallurgical phenomenon occurs only in low alloy structural and pressure vessel steels, ferritic creep-resisting steels, austenitic stainless steels, and some nickel-base alloys. In all of these alloys, the rapid precipitation of temper-resistant phases during the early stages of heat treatment or service leads to a significant strengthening of the interior of grains within the material. The creep strain that is the mechanism of stress relief then concentrates within the grain boundary regions, which often are depleted of precipitates, leading to rapid intergranular cracking.

Tempered-martensite embrittlement is a metallurgical phenomenon affecting quenched and tempered high-strength low alloy steels over the temperature range of 205°C to 370°C. Tempered-martensite embrittlement is generally thought to be caused by ferrite networks that develop due to the precipitation of cementite platelets along prior-austenite grain boundaries. Steels containing significant percentages of chromium or manganese have the highest potential for this form of embrittlement.

A-211.2 References. Everything covered in this paragraph was derived from the general references cited in A-120, with particular emphasis on ASM Handbook Volumes 1 and 11.

A-212 RADIATION EMBRITTLEMENT

A-212.1 Definition. Radiation embrittlement is a metallurgical phenomenon affecting most structural materials exposed to high levels of high-energy neutrons, usually within or near the cores of nuclear reactors. The embrittlement is evident as a substantial loss in toughness and ductility, with accompanying gains in strength (hardening). For pressure-boundary materials, the most significant concern is the increase in the ductile-to-brittle transition temperature and a decrease in the upper-shelf energy observed during impact tests.

Extensive research over the years has revealed the following:

(a) High-strength steels that have lower initial nil-ductility transition temperatures than low-strength steels are generally less susceptible to radiation embrittlement.

(b) Steels with low initial nil-ductility transition temperatures, fine-grain microstructures, and structures with high dislocation densities generally show greater resistance to radiation embrittlement.

(c) Steels with tempered-martensite in the microstructures are less susceptible than those with tempered upper bainite or ferritic microstructures.

(d) Vacuum degassing and control of alloying elements such as copper, phosphorus, and possibly nickel help to reduce the susceptibility to radiation embrittlement.

A-212.2 References. In addition to the general references cited in A-120, additional useful information can be derived from the following references:

[1] Billington, D. S. and J. H. Crawford, *Radiation Damage in Solids*, Princeton University Press, 1961.

[2] Bement, A. L., STP 484, *Irradiation Effects on Structural Alloys for Nuclear Reactor Applications*, ASTM, 1970.

[3] Wechsler, M. S. and W. H. Smith, CONF-730801, *Symposium on Materials Performance in Operating Nuclear Systems*, National Technical Information Center, August 1973.

A-213 SOLIDIFICATION CRACKING

Solidification cracking is a form of hot cracking that can occur in weldments of nickel-base alloys. Solidification cracking occurs when alloying elements or impurities are present that segregate during solidification and form low-melting-point liquid films on grain boundaries. Tensile stresses, which build up during solidification and cooling of the weld metal, can cause cracking along the liquid films. Elements that can promote solidification cracking in nickel-base alloys include sulfur, phosphorus, silicon, boron, and zirconium. The problem may appear as macroscopic solidification cracks, typically along the weld centerline, or as microfissures within the weld metal. Solidification cracks may or may not be open to the surface. For a given material, the occurrence of solidification cracking is influenced by weld joint design and weld bead geometry. Solidification cracking is promoted by high heat input, a concave weld bead profile, and a teardrop-shaped weld pool. Heavy restraint, due to thick material or a rigid joint design, will also promote solidification cracking.

A-300 UNIFORM CORROSION

This is the simplest form of environmental damage – one that generally results in a uniform amount of wall loss over a defined period of time. It can usually be expressed

as some amount of wall thickness lost per unit of time (e.g., mils per year). Most Sections of the Code have requirements for corrosion allowance, and uniform corrosion is usually what is addressed. The following are several possible uniform corrosion mechanisms, which are presented in no particular order of importance.

A-301 GENERAL CORROSION AND WASTAGE

A-301.1 Definition. General corrosion and wastage are terms frequently used to describe the phenomenon of uniform corrosion in a material. General corrosion refers to corrosion dominated by uniform wall thinning that typically proceeds without any obvious signs of localized attack. Weathering steels and copper alloys are classic examples of materials that undergo general attack or corrosion in the process of developing a semiprotective oxide layer that then resists subsequent attack. The term *wastage* is defined in Webster's Dictionary as that which is lost by "deterioration, wear, destruction, or the like." In general corrosion and wastage, electrochemical reactions develop between adjacent closely spaced micro-anode and micro-cathode areas, resulting in what appears to be (on a macro scale) a uniform loss of material. Consequently, general corrosion and wastage can be considered to be a specialized form of pitting attack, in which the number of individual electrochemical cells active on the material surface is so great that to the unaided eye it appears that the material is being removed uniformly over the entire surface of the component affected.

A-301.2 References. Most of what is needed to understand and effectively deal with general corrosion and wastage can be found in the general references cited in A-120.

A-302 ATMOSPHERIC CORROSION

A-302.1 Definition. Atmospheric corrosion is the process in which material cross-section is reduced as the result of the corrosive nature of the atmosphere. The relative corrosivity of the atmosphere depends heavily on the location of the metal parts under consideration. For example, metal parts exposed to dry desert air typically will suffer very little, if any, corrosion due to the absence of moisture – an essential component in any electrochemical reaction. On the other hand, metals exposed to warm and moist tropical conditions, particularly near a seacoast, may undergo rapid wall loss. A variety of factors can influence the rate of atmospheric corrosion, including temperature, humidity, the strength of prevailing winds, and the presence of pollutants in the air. If airborne particulate matter happens to deposit on the metal, then that substance, along with any moisture present, might lead to nonuniform attack (which is discussed in A-400, Localized Corrosion).

A-302.2 References. Most of what is needed to understand and effectively deal with atmospheric corrosion can be found in the general references cited in A-120.

A-303 GALVANIC CORROSION

A-303.1 Definition. A useful definition of galvanic corrosion comes from ASM Handbook Volume 11, which reads as follows: When dissimilar metals are in electrical contact in an electrolyte, the less noble metal (anode) is attacked to a greater degree than if it were exposed alone, and the more noble metal (cathode) is attacked to a lesser degree than if it were exposed alone. This behavior, which is known as galvanic corrosion, can often be recognized by the fact that the corrosion is more severe near the junction of the two metals than elsewhere on the metal surfaces. Galvanic corrosion is usually the result of poor design and selection of materials, or the plating out of a more noble metal from solution on a less noble metal. The greater the difference in potential between the two metals, the more rapid will be the galvanic attack. The textbook electromotive-force series ranks the metals according to their chemical reactivity, but applies only to the laboratory conditions under which the reactivity was determined. In practice, the solution potential of metals is affected by such factors as the presence of passive or other protective films on some metals, polarization effects, the degree of aeration, complexing agents, and temperature.

A-303.2 References. Information that can be of use in dealing with galvanic corrosion can be found in the general references cited in A-120.

A-304 STRAY CURRENT CORROSION

A-304.1 Definition. Stray current corrosion is damage to materials that occurs due to the influence of electric currents from a source (or sources) external to the component affected (typically extraneous current in the earth). This type of attack is most frequently seen in buried cast iron, carbon steel, and low alloy steel components – mostly because high alloy steels and most nonferrous materials are not typically buried. Sources of stray currents may include cathodic protection systems, electric welding machines, and grounded direct-current electric sources. However, temporary use of welding equipment during fabrication or repair on-site is unlikely to cause a long-term problem. Nearby aluminum pot line facilities, electroplating, electrolytic refining, or electrowinning facilities are more likely sources of stray currents. Other environmental factors, e.g., oxygen concentration, pH, and soil makeup, may play a role in the overall corrosion process.

At points where the current enters the metal, the site will become cathodic – and the site where the current leaves will become anodic. These coupled cells may be located hundreds of yards apart, or they may be located in close proximity to each other, e.g., on either side of a gasketed pipe joint. Bolted flange connections do not provide reliable electrical continuity in pipe systems unless electrical bonds are used that are carefully installed and maintained.

A-304.2 References. What is described above with regard to stray current corrosion was generally derived from the general references cited in A-120. Additional references that may prove useful include the following:

[1] Parker, M. E. and E. G. Peattie, *Pipeline Corrosion and Cathodic Protection*, Third Edition, Gulf Publishing, 1984.

[2] NACE Paper No. 98559, "Stray Currents Generation, Interference Effects and Control."

A-305 HIGH-TEMPERATURE CORROSION

A-305.1 Definition. High-temperature corrosion is the attack of a metal surface that occurs when the material is exposed to an oxidizing gas at elevated temperature. Corrosion or metal loss occurs by direct reaction with the gas, without the presence of a liquid electrolyte. This type of corrosion may also be called high-temperature oxidation, tarnishing, or scaling. As should be expected, the rate of attack typically increases with increasing temperature, although in some material/environment combinations the rate of attack may diminish with increasing temperature.

When exposed to a high-temperature environment, most engineering materials will spontaneously form an oxide film on their surface, and depending on the character of the film, it may substantially impede the corrosion process or have very little effect on the rate of attack. Initial film formation occurs rapidly, but subsequent increases in film thickness depend upon transport of reactive species through the film. Although these films are generally considered to be oxides, the films may also be sulfides, carbides, or mixtures of these species – or other species depending on the balance of oxidation and reduction, and the dissociation pressure.

A-305.2 References. The general references cited in A-120 provide information that is useful in understanding and dealing with this type of corrosion.

A-306 SOIL CORROSION

A-306.1 Definition. Soil corrosion is the deterioration of metals and alloys that occurs when they are exposed to soils. Since "soils" can consist of an endless variety of naturally occurring substances, as well as an equally large number of man-made contaminants, predicting under what conditions soil corrosion will occur and how rapidly it will proceed can be an extraordinarily difficult task. The materials that most often are found to have experienced soil corrosion are those materials, such as cast irons, carbon steels, and low alloy steels, from which buried piping is produced.

Naturally occurring factors that will influence susceptibility to soil corrosion include moisture content, oxygen availability, soil homogeneity, soil drainage, the presence of seashells (in coastal areas), and the overall soil chemistry. Chloride and sulfate content, together with soil pH, also strongly affect the susceptibility of a material to soil corrosion. Other factors that may affect soil corrosion include, but are not limited to, dissimilar soils, galvanic corrosion, stray currents, differential aeration cells, and microbiologically induced corrosion. These issues are all discussed in more detail elsewhere in this Nonmandatory Appendix.

Soil corrosion is characterized by external wall thinning (general corrosion), accompanied by areas of localized attack due to pitting. Corrosion rates tend to increase with higher metal temperatures.

A-306.2 References. In addition to the general references cited in A-120, the following references should be of use:

[1] Jones, D. A., *Principles and Prevention of Corrosion*, Macmillan Publishing Co., New York, 1992.

[2] NACE RP-0169, *Standard Recommended Practice: Control of External Corrosion on Underground or Submerged Metallic Piping Systems*, NACE International.

A-307 CAUSTIC CORROSION

A-307.1 Definition. Caustic corrosion is a form of localized attack of metals and alloys that occurs when caustic (or alkaline) salts, primarily NaOH and KOH, concentrate on a surface. However, more general corrosion can also occur, depending on the level of concentration. Caustic corrosion is an all-too-common problem in steam- or water-side boilers, where the caustic salts can concentrate under deposits formed on the internal surface of evaporative tubing. The caustics in these units often are intentionally added to control pH and to protect tube surfaces in the event of the introduction of acidic species, such as chlorides. Materials mostly affected by this type of corrosion include the carbon steels, low alloy steels, and some aluminum alloys.

A-307.2 References. Information useful in understanding the basics of caustic corrosion, including means of prevention, can be found in the general references cited in A-120.

A-308 CARBON DIOXIDE CORROSION

A-308.1 Definition. Carbon dioxide corrosion is a form of metal attack that occurs when carbon dioxide dissolves in water and forms carbonic acid, which is the actual corrodent. As with any acid, the pH of the solution is lowered and, with sufficient quantities, general corrosion and/or pitting will occur.

Materials most commonly affected by carbon dioxide corrosion are the carbon steels and, to a lesser extent, the low alloy steels Alloy steels containing at least 12% chromium tend to be immune to carbon dioxide corrosion.

A-308.2 References. The information needed to understand the basics of carbon dioxide corrosion can be found in the general references cited in A-120.

A-309 CONCENTRATION CELL CORROSION

A-309.1 Definition. Concentration cell corrosion is damage to a metal or alloy that occurs when an electrolytic cell develops, the electromotive driving force of which is caused by a local difference in the concentration of some component of the electrolyte. This concentration difference leads to the formation of discrete anodic and cathodic regions. If the difference in electromotive force or potential is great enough, the more anodic area corrodes preferentially.

There are many situations in which concentration cells may form, e.g.:

(a) The rate of diffusion of air produces differential aeration in the layers of water or aqueous solutions just below the liquid level and causes concentration cell corrosion in this region on partly immersed metal parts.

(b) In a metal part that is partly immersed in a liquid electrolyte, a concentration cell can develop if the gaseous phase above the electrolyte consists of a gas (or gases) other than air.

(c) Concentration cell corrosion can initiate on buried metals as a result of their being in contact with soils that have different chemical compositions, water contents, or degrees of aeration (oxygen supply).

See the paragraphs below for pitting, crevice, and microbiologically influenced corrosion, which are all special forms of concentration cell corrosion.

A-309.2 References. Information useful for understanding the basic causes of concentration cell corrosion can be found in the general references cited in A-120.

A-310 DIFFERENTIAL-TEMPERATURE CELL CORROSION

A-310.1 Definition. Differential-temperature cell corrosion is one of the more obscure corrosion processes that cause metal loss when different parts of the same metal or alloy are immersed in an electrolyte that varies in temperature from one location to another. If the anode and cathode are areas located on a single piece of metal (or on two electrically connected pieces of the same metal) immersed in the same electrolyte, corrosion will proceed as in any short-circuit galvanic cell.

For steels immersed in dilute aerated chloride solutions, the warmer area is anodic to the cooler area. But, as the reaction progresses, the polarity may reverse, depending on aeration, the solution velocity where it contacts the metal surface, and other factors.

For copper in aqueous salt solutions, the area of the metal at the higher temperature is the cathode and the area at the lower temperature is the anode. So, there is preferential attack at the anodic area, with copper dissolving from the cold area and depositing on the warmer cathodic area.

A-310.2 References. Information useful for understanding the basics of differential-temperature cell corrosion can be found in the general references cited in A-120.

A-311 MOLTEN SALT CORROSION

A-311.1 Definition. Molten salt corrosion is the attack that metals experience when a molten salt in contact with the surface completely or partially dissolves the protective oxide film that in more benign environments limits the rate of attack. In the absence of the protective oxide film, the reaction of the metal with dissolved or combined oxygen in the salt can occur very rapidly to form molten flux in the salt or nodular oxide on the metal surface, which then promotes galvanic corrosion. The molten salts may be fluorides, chlorides, nitrates, or sulfates, or they may be molten hydroxides or carbonates. Uniform metal loss is the most common form of molten salt corrosion. However, selective leaching of one or more elements from the metal may occur at the higher temperatures, whereas pitting and/or crevice corrosion may take place at the lower temperatures. All forms of corrosion observed in aqueous systems, such as stress-assisted corrosion, galvanic corrosion, erosion-corrosion, and fretting, have been experienced in molten salts. Molten salt exposure will exist where molten salts are used for heat transfer or storage, but may also occur in waste incineration, fossil-fuel combustion, and other high-temperature environments. In the latter environments, this phenomenon is often called hot corrosion.

A-311.2 References. Much of the information needed to understand the basics of molten salt corrosion can be found in the general references cited in A-120. Reputable material suppliers should also be contacted to determine if one or more of their materials has shown good performance under conditions similar to those where the problem exists.

A-312 LIQUID METAL CORROSION

A-312.1 Definition. Liquid metal corrosion is the attack experienced by susceptible materials in plants and/or systems that use liquid metals as coolants. These systems are generally associated with nuclear reactors, other than the conventional water-cooled or gas-cooled types. System coolants may be molten forms of sodium, sodium–potassium (NaK) eutectic, lead, lithium, mercury, cesium, lead–bismuth alloys, and lead–lithium alloys. An experience base exists showing which structural/pressure boundary materials are suitable at given time/temperature combinations for service with particular liquid metals.

Liquid metal corrosion may involve dissolution from a surface by direct dissolution; surface reaction, involving solid-metal atoms, the liquid metal, and an impurity element present in the liquid metal: or intergranular attack. It may also involve impurity and interstitial reactions, alloying (or dealloying), and compound reduction.

In evaluating instances of liquid metal corrosion, there are three important factors:

- surface attrition (loss in thickness)
- depth of depleted zone (altered base metal)

– presence of intergranular attack

A factor often overlooked is the probability that any material lost in a given region of a liquid metal system may turn up elsewhere in the system as a deposit, most likely in a cooler portion of the system.

A-312.2 References. Liquid metal corrosion is a fairly rare occurrence, since there are limited applications for the use of liquid metals. A general understanding of the corrosion mechanism can be derived from the general references cited in A-120. One additional source of information is

[1] Draley, J. E. and J. R. Weeks, *Corrosion by Liquid Metals*, Plenum Press, 1970.

A-400 LOCALIZED CORROSION

As the name implies, localized corrosion is a broad term describing any one of a number of corrosion processes in which damage takes place at small and well-defined locations on the surface of a material rather than uniformly over the entire surface. A concern with this type of corrosion is that often it is difficult to determine how serious is the degree of attack until leakage at one or more sites on the surface actually occurs. This type of corrosion usually does not lead to the catastrophic ruptures typically associated with gross wall loss over a period of time. The following are several mechanisms considered to be forms of localized corrosion, in no particular order of significance.

A-401 PITTING CORROSION

A-401.1 Definition. Pitting corrosion is defined as localized attack of a metal surface, with the attack confined to a point or small area in which the ratio of the depth of the attack to the amount of surface area affected is large. Pitting is one of the most difficult types of corrosion to manage, because of the lack of predictability regarding where the attack will occur and the speed with which the attack may proceed.

The mechanism driving pitting corrosion is thought to begin with a local breakdown of the passive film on the metal surface. The breakdown is followed by the formation of an electrolytic cell. The anode of this cell is the small area of active attack and the cathode is the remaining large area of passivated metal. Once pits begin, they tend to continue to grow in depth by a self-sustaining or autocatalytic process. Propagation of pits is thought to involve the dissolution of metal and the maintenance of a high degree of acidity at the bottom of the pit by hydrolysis of the dissolved metal ions.

A-401.2 References. Information that may be useful in effectively dealing with pitting corrosion can be found in the general references cited in A-120.

A-402 FILIFORM CORROSION

A-402.1 Definition. Filiform corrosion is that material deterioration that occurs under some coatings which assumes the form of randomly distributed threadlike filaments. Filiform corrosion usually occurs on metal surfaces that are coated with a thin layer (approximately 4 mils) of an organic coating. The corrosion usually initiates at a defect of some sort (i.e., a hole, a scratch, etc.) in the coating.

Filiform corrosion generally occurs when the coated material is exposed to temperatures in the range of 20°C to 35°C at relative humidity levels between 60% and 95%. The surrounding atmosphere must contain air or oxygen.

Filiform corrosion is characterized by its unique appearance, in which fine filaments emanate from one or more sources in somewhat random directions across the surface of the material. The filaments are fine tunnels composed of corrosion products underneath the bulged or cracked coating.

A-402.2 References. Most of what is needed to understand and deal with filiform corrosion can be found in the general references cited in A-120.

A-403 CREVICE CORROSION (AND DENTING)

A-403.1 Definition. Crevice corrosion is the localized attack of a metal surface that occurs when the surface is located immediately adjacent to an area that is shielded from full exposure to the environment by the surface of another material (not necessarily a metal). The environment, itself, may be relatively benign with respect to the metal experiencing the crevice corrosion. The term denting has a more specialized meaning, originating primarily from special crevice corrosion problems experienced in pressurized water nuclear reactor steam generators. Denting involves corrosion of the tube support plates, with the resulting denting of the tubes due to the impingement of the increased volume of the corrosion products on the surface of the tubing.

Crevices frequently occur as narrow openings or spaces (gaps) between metal-to-metal or nonmetal-to-metal components. These may occur as a normal part of any construction (e.g., the area around a washer on a bolted assembly). Unintentional crevices also occur as cracks, laps, seams, and other similar discontinuities. Underdeposit corrosion is another form of crevice corrosion. Note also that the presence of weld spatter and unremoved heat tint has been identified as a potential source of pitting of welds in stainless steels.

In crevice corrosion, regardless of the materials involved, a common factor is the development of localized environments that differ from the bulk coolant environment. This condition is referred to as an oxygen differential cell and it develops as oxygen within the crevice is consumed while the bulk coolant remains constant in

oxygen content. The bulk surfaces then become the larger cathode, while the crevice area becomes the anode, resulting in potentially rapid attack of the anodic area.

A-403.2 References. The information needed to understand and deal with crevice corrosion can be found in the general references cited in A-120.

A-404 MICROBIOLOGICALLY INFLUENCED CORROSION

A-404.1 Definition. Microbiologically influenced corrosion (MIC) is the deterioration that can occur in a broad range of alloys as the result of the metabolic activity of microorganisms. Attack from MIC typically is characterized by localized pitting under deposits or tubercles that are utilized by the organisms to sustain their metabolic activity. In cast irons and carbon steels, subsurface damage usually appears to be cup-shaped, while in stainless steels, subsurface cavities or "wormholes" tend to develop. MIC usually occurs in situations where water is present (either continuously or intermittently), particularly when stagnant or low-flow conditions exist, which fosters the growth of microorganisms. There are a large variety of microorganisms that potentially can be involved in the degradation of materials and they thrive on a variety of nutrients including inorganic substances (sulfur, ammonia, hydrogen sulfide, etc.) and organics, such as hydrocarbons and organic acids. All of these organisms require carbon, nitrogen, and phosphorus for their growth.

In most cases the conditions favoring the development of MIC will not exist over the entire surface of the component under attack, whether it is a pipe, a pump, or a boiler tube, but rather will be associated with the local formation of dispersed deposits or slime coatings. Welds often are preferentially affected by MIC. This corrosion mechanism has been encountered in numerous industries, including the chemical processing industry, the fossil and nuclear power industries, the petrochemical industry (both offshore and oil field), and generally in any application in which buried pipelines are involved.

A-404.2 References. In addition to the general references cited in A-120, the following sources of information may be helpful in dealing with MIC:

[1] Kobrin, G., ed., *A Practical Manual on Microbiologically Influenced Corrosion*, NACE International, 1993.

[2] Lucina, G. J., *Sourcebook for Microbiologically Influenced Corrosion in Nuclear Power Plants*, EPRI NP-5580, Electric Power Research Institute, 1988.

A-500 METALLURGICALLY INFLUENCED CORROSION

This group of corrosion mechanisms involves those cases where the structure of a material has been altered either during fabrication into a component or during relatively longtime exposure to service conditions. Examples of these mechanisms follow.

A-501 INTERGRANULAR CORROSION

A-501.1 Definition. Intergranular corrosion is the attack of a material that occurs preferentially at its grain boundaries, usually with slight or negligible attack on the adjacent grain surfaces. This is also known as intercrystalline corrosion, or intergranular attack (IGA).

One prerequisite for intergranular corrosion is the development of a condition in which the grain boundary or the material immediately adjacent to the grain boundary is rendered substantially less resistant to certain contaminants, due to a local concentration or loss of particular elements. This may involve the diffusion of certain types of impurities to the grain boundaries, or it may involve the depletion of critical alloying constituents from the material immediately adjacent to the grain boundary due to the precipitation of carbide or carbonitride phases in the grain boundaries. A second obvious prerequisite for intergranular corrosion is exposure of the susceptible material to an electrolyte, which may be either the system coolant or an external contaminant activated by the presence of moisture in some form.

The classic example of intergranular corrosion is the standard carbon grade of Type 304 stainless steel that has been joined by welding to another piece of metal (Type 304 SS or otherwise). With typical welding heat input and a slower rate of cooling from the temperatures of welding, and in the absence of a postweld solution-annealing heat treatment, chromium-rich carbides form in the grain boundaries located in the heat-affected zone. The formation of these carbides robs chromium from the adjoining material, setting up a significant difference in corrosion potential between the chromium-depleted material at the grain boundaries and the chromium-enriched material within the grains. In this condition, rapid dissolution of the chromium-depleted material can occur if the material is exposed to a contaminant, because the anodic area (i.e., the chromium-depleted material at the grain boundaries) is small compared to the cathodic area (i.e., the much larger intragranular area where the chromium is at "normal" levels). See also A-210, dealing with sensitization (carbide formation).

Several common aluminum alloys also suffer from intergranular corrosion (often called exfoliation corrosion) due to segregation of alloying elements such as copper and magnesium.

A-501.2 References. Information useful in understanding the basics of intergranular corrosion can be found in the general references cited in A-120.

A-502 DEALLOYING CORROSION (DEZINCIFICATION AND GRAPHITE CORROSION)

A-502.1 Definition. Dealloying involves the selective attack of one or more components of a metal solid solution. Also known as parting or selective leaching, it is the mechanism involved in such phenomena as

decarburization, decobaltification, denickelification, dezincification, and graphite corrosion. One highly detrimental result of this type of selective attack is that with the loss of one or more of the alloy constituents, the density of the material may be reduced and the structure may become porous. In turn, this can lead to an undermining of the material's mechanical integrity, so that the material becomes subject to sudden unanticipated overload failure. The process by which dealloying occurs is not fully understood and, as a consequence, the variables controlling the process are difficult to quantify; however, it is known that damage may occur progressively over many years under conditions of operation that are otherwise regarded as innocuous.

Dezincification, which is one of the most common forms of dealloying corrosion, occurs in some brasses and involves the selective removal of zinc from the alloy. Inhibited alpha phase brasses containing certain minor alloying additions are less prone to dezincification, while the duplex alpha–beta phase brasses are more prone to this degradation mechanism. Graphitic corrosion is another very common form of dealloying that affects primarily gray cast iron. Ductile and malleable cast irons tend to be immune to dealloying corrosion.

A-502.2 References. Information needed to understand and effectively deal with dealloying corrosion can be found in the general references cited in A-120.

A-503 GROOVING

A-503.1 Definition. Grooving is a form of localized corrosion that is most typically encountered in electric resistance welded (ERW) carbon steel pipe exposed to aggressive aqueous coolants. The preferential corrosion, or grooving, is related to the redistribution of manganese sulfides along the weld line during the welding process. The higher temperatures that develop in the weld area during welding tend to break down the manganese sulfides, leading to local enrichment of the matrix in sulfur. The resulting heterogeneous structure can behave like a dissimilar metal couple, leading to selective attack of the sulfur-enriched anodic zone (the groove) in the presence of an electrolyte.

A-503.2 References. Information useful in effectively dealing with grooving can be found in the general references cited in A-120.

A-600 MECHANICALLY ASSISTED CORROSION

These are corrosion-related damage mechanisms in which the process of metal loss is substantially enhanced by the impinging action of a solid, liquid, or gas present in the operating environment on the surface of the component containing that environment. The impinging substance may be any impurity, corrosion product, or entrained gas contained within the operating system. The damage caused by any one of these mechanisms tends to be localized, reflecting the influence of variations in the flow pattern of the water or other process fluids. Examples of these mechanisms follow.

A-601 VELOCITY-AFFECTED CORROSION

A-601.1 Definition. Velocity-affected corrosion is a general term used to define the attack that occurs on metals immersed in flowing water. The extent of attack varies as a function of the water velocity and is most pronounced in metals that show passivity behavior or form protective films in water.

Velocity-affected corrosion is generally subdivided into the following categories:

- Effects of slow-moving and stagnant waters
- Swift-moving water
- Erosion-corrosion
- Impingement corrosion
- Cavitation corrosion

The latter three types of velocity-affected corrosion are handled in separate discussions; see A-602, A-603, and A-604.

In slow-moving and stagnant waters, loosely adherent solid corrosion products can deposit on component surfaces and aggravate corrosion. In closed systems, corrosion inhibitors can lose their effectiveness under very low flow conditions or within stagnant legs of the system.

Swift-moving water may carry away dissolved metal ions from a corroding area before protective films can reform, resulting in a continuous high rate of attack of the component surface. [Flow-accelerated corrosion (FAC) is a special form of velocity-affected corrosion in which the protective oxide film on a component surface is dissolved in the feedwater or boiler water under specific conditions of pH and electrochemical potential; see A-705.] Suspended solids in water can scour metal surfaces and continually expose fresh metal to corrosive attack. In fresh water, as velocities increase, the corrosion rate in a particular area of a component may first increase, then decrease, and then increase again as the passivity of the metal breaks down under the effects of the erosive action.

Metals that perform well in swift-moving water may still be prone to pitting in stagnant waters or areas of low flow.

A-601.2 References. Information useful to an understanding of velocity-affected corrosion can be found in the general references cited in A-120.

A-602 EROSION-CORROSION

A-602.1 Definition. Erosion-corrosion is the damage to metals that occurs when particles transported in a liquid impinge on a component surface and remove the protective surface film. This exposes fresh metal surfaces that are anodic to neighboring protected surfaces, which results in rapid localized corrosion of the exposed areas. The areas attacked will often exhibit grooves, channels,

or other asymmetric surface penetrations that reflect a directional pattern. Nearly all flowing or turbulent corrosive fluids can cause erosion-corrosion.

Metal loss rates vary greatly with coolant velocity, corrosion resistance of the materials, hardness of the materials, and corrosivity of the flowing media.

A-602.2 References. Useful information that will assist in understanding the issues surrounding erosion-corrosion can be found in the general references cited in A-120.

A-603 IMPINGEMENT CORROSION

A-603.1 Definition. Impingement corrosion is the attack of a metal surface caused by the impingement on that surface of turbulent flowing liquids. Attack may be accelerated by solids or gas bubbles entrained in the impinging liquid. This corrosion mechanism can be considered a severe form of erosion-corrosion.

Impingement corrosion most frequently occurs where there is a sharp change in fluid direction, at impellers (or turbine blades), or even in straight runs of tubing where there is a partial blockage disrupting the flow.

A-603.2 References. Most of what is needed to understand the issues surrounding impingement corrosion can be found in the general references cited in A-120.

A-604 CAVITATION EROSION

A-604.1 Definition. Cavitation erosion is the most severe form of erosion-corrosion, and occurs through the formation and collapse of gas bubbles under conditions of changing pressure in the liquid in direct contact with the affected surface. The gas bubbles form when the pressure in the liquid drops in response to some change in the operating environment and they collapse when the pressure increases. If the shock waves generated by the collapse of the gas bubbles impinge on a metal surface, the local pressures at the surface can be of sufficient magnitude to cause local plastic deformation of the metal and breakdown of the protective film at the metal surface. This permits a brief cycle of accelerated corrosion to occur until the protective film re-forms, and the cycle is repeated when another gas bubble collapses in the same area.

Damage is characterized by the appearance of sharp-edged pits, but it may also appear as gouges in rotating components. The damage tends to be limited to localized low-pressure zones.

A-604.2 References. Most of what is needed to understand issues associated with cavitation erosion can be found in the general references cited in A-120.

A-605 CORROSION FATIGUE

A-605.1 Definition. Corrosion fatigue is a form of damage that occurs through the interaction of repeated or fluctuating stresses and a corrosive environment, with the damage occurring at lower stress levels or fewer cycles than would be required in the absence of the corrosive environment. For a given operating environment in which corrosion-fatigue cracking occurs, the relative contribution of stress and corrosion can vary substantially, and the complexity of the interaction between the loading condition, the metallurgical variables, and the environmental parameters can complicate the identification of the root cause of the damage.

Corrosion-fatigue cracks invariably begin at the material surface; even in cases where there are near-surface defects that act as stress concentration sites and facilitate subsurface crack initiation, the damage cannot be defined as corrosion fatigue until the environmental influence is activated. Surface features that can be observed at the origin of a corrosion-fatigue crack can vary from alloy to alloy and will be strongly influenced by the environmental parameters. If a component suffering from corrosion fatigue eventually fails, corrosion products will generally be found on most of the fracture surfaces.

A-605.2 References. Most of what is needed to understand issues associated with corrosion fatigue can be found in the general references cited in A-120.

A-700 ENVIRONMMENTALLY INDUCED EMBRITTLEMENT AND CRACKING

This general category of damage could be included in the discussion of some of the other types of damage in which metallurgical changes and corrosion interact. However, because some of the specific types of damage have special significance in Code construction, they warrant individual coverage to draw attention to their importance.

A-701 STRESS CORROSION CRACKING

A-701.1 Definition. Stress corrosion cracking (SCC) is a type of damage that requires the simultaneous action of a corrodent at a critical concentration and a sustained tensile stress of sufficient magnitude on a susceptible material in order for the cracking to occur. The elimination of any one of these three factors, or a change in the concentration of the corrodent or a reduction in the level of stress, can completely remove or significantly reduce the susceptibility to SCC.

Stress corrosion cracking frequently occurs in seemingly mild chemical environments, at tensile stresses well below the yield strength of the metal. Failures, when they occur, often take the form of fine cracks that penetrate deeply into the metal, with little or no evidence of corrosion on the adjoining surface. A casual visual inspection, or in some cases even a detailed inspection using one of the volumetric NDE methods, may fail to detect any signs of the cracking.

Stresses that contribute to SCC can arise during manufacturing/fabrication or in service. During manufacturing/fabrication/construction, residual tensile stresses can develop during thermal processing, surface finishing,

various forming processes (particularly cold bending), and assembly operations such as fit-up and welding. The influence of these stresses can be substantially increased wherever stress risers may exist. During service, sources of stress include temperature differences that may occur during plant startup or during shutdowns. Stress raisers also can develop in the form of pitting corrosion. The design pressure loads in pressure vessels and piping systems also can be sufficiently high to cause SCC in certain environments.

Metal susceptibility to SCC has been the subject of extensive research. One of the better summaries of "specific ions and substances that have been known to cause SCC in various alloys when present at low concentrations and as impurities" is found in ASM Handbook Volume 11.

Chloride SCC is common, especially in the austenitic stainless steels. The 18–8 type alloys, such as TP304 and TP316, are the most susceptible to chloride SCC. They can suffer SCC whenever temperatures exceed 60°C when in contact with high chloride concentrations. Alloy substitution can reduce susceptibility; higher nickel austenitic alloys, ferritic stainless steels, and duplex (austenitic–ferritic) stainless steels are less susceptible. Nickel-free ferritic stainless steels, austenitic alloys with greater than 50% nickel content, and carbon steels are effectively immune to chloride SCC.

There are three basic forms of SCC, which are distinguished as follows:

- Transgranular stress corrosion cracking (TGSCC)
- Intergranular stress corrosion cracking (IGSCC)
- Irradiation-assisted stress corrosion cracking (IASCC)

Transgranular stress corrosion cracking is generally thought to be associated with higher stress levels, with cracks (cross-sections) beginning at the surface of a component in a single location — possibly a pit — and growing into the component in a continually branching mode.

Intergranular stress corrosion cracking typically occurs near welds, in heat-affected zones, or in base metal where the material has been subjected to a level of heating that has altered the material structure near the grain boundaries in such a way that the grain boundary region is less corrosion resistant than the material away from the grain boundaries. In response to residual stresses from welding or to applied service loads, cracking will develop in the material if the fluids in contact with the surface are corrosive. Cracking proceeds inward along the grain boundaries in a direction that is approximately normal to the dominant source of stress.

It is important to note, however, that under some conditions, stress corrosion cracking in certain steels may propagate by a mixed transgranular/intergranular mode of fracture.

Irradiation-assisted stress corrosion cracking is a special form of SCC in which the source or the driving force for the cracking is the high level of neutron bombardment to which the materials are subjected; the austenitic stainless steels used in the core region of nuclear reactors have shown particular susceptibility to this type of damage. It is believed that the passage of the neutrons through the material creates (through transmutation) both impurity species that concentrate in the grain boundaries and "residual" stresses. In the presence of a corrosive media, the grain boundaries are anodic to the grains themselves and if the level of tensile stress is sufficiently high, SCC will occur.

A-701.2 References. Stress corrosion cracking is covered in nearly every one of the sources identified in A-120. The extent of coverage above and in cited references should be enough to provide the necessary guidance for avoiding this form of environmental damage.

A-702 HYDROGEN DAMAGE

A-702.1 Definition. Hydrogen damage is a general term used to cover several types of possible material degradation for which hydrogen is the principal degrading agent, including the following:

- Hydrogen embrittlement
- Hydrogen-induced blistering
- Cracking from precipitation of internal hydrogen
- Hydrogen attack
- Cracking from hydride formation

Many metals and alloys are susceptible to hydrogen damage, but it occurs most frequently in carbon and low alloy steels. Hydrogen is one of the more abundant gases in the earth's atmosphere and it often is present during various phases of alloy production, during certain phases of the processing of the alloy, and once the alloy is placed in service. Corrosion reactions frequently are the source of damaging amounts of hydrogen. Thus, hydrogen damage can develop in a wide variety of environments and under a broad range of circumstances. The following are brief discussions of each of the five most-common hydrogen-dominated damage mechanisms.

A-702.1.1 Hydrogen Embrittlement. This is a condition of induced low ductility or hydrogen-induced cracking in metals resulting from the absorption of hydrogen. A related term, *hydrogen-induced delayed cracking*, is sometimes used to identify a form of hydrogen embrittlement in which the metal or alloy appears to fracture spontaneously under a steady stress *less* than the yield stress. There is usually a delay between the application of stress (or exposure of the stressed metal to hydrogen) and the onset of cracking. This damage is sometimes referred to as static fatigue.

Steels can be embrittled by a very small amount of hydrogen (i.e., a few parts per million) from a wide variety of sources. Failure by hydrogen embrittlement occurs with very little plastic deformation, with the fracture surface characterized by brittle cleavage or quasi-cleavage.

The susceptibility of carbon and low alloy steels to hydrogen embrittlement tends to increase with increased strength of the steels. For a given hydrogen content, embrittlement tendency increases with decreased strain rate.

Embrittlement is most prevalent at room temperature, with cracking tendency decreasing as temperatures rise. Above 200°C, susceptibility to hydrogen embrittlement disappears entirely in steels, due to the rapid diffusion of the small hydrogen atom through the crystal lattice at those temperatures.

A-702.1.2 Hydrogen-Induced Blistering. This is a condition that involves the formation of blisters on or below a metal surface due to excessive internal hydrogen pressure. The hydrogen may be generated during cleaning, pickling, plating, corrosion, etc. Hydrogen-induced blistering is most prevalent in low strength alloys that are exposed to hydrogen-charging conditions. When hydrogen is absorbed into the metal and diffuses inward, it can precipitate as molecular hydrogen at internal voids, laminations, or at inclusion/matrix interfaces. As the larger hydrogen molecules concentrate within a particular location in the material, pressure can increase to levels where internal cracks form. If these cracks are just below the surface, the gas pressure in the cracked area can cause the metal at the surface to become raised and bulge out, creating a blister-like protuberance on the surface. Although this type of damage is encountered in a variety of situations, it is worth noting that hydrogen blistering in line pipe steels is always associated with certain metallurgical features, such as inclusions, large precipitate particles, or martensite bands.

A-702.1.3 Cracking From the Precipitation of Internal Hydrogen. This can appear as flakes, fish eyes, or underbead cracking (also known as hydrogen-delayed cracking). Flakes frequently are encountered on the surfaces of heavy steel forgings, where they appear as small elliptically shaped cracks. These are formed during cooling after the first forging or rolling operation. The flakes are caused by localized hydrogen embrittlement resulting from the concentration of internal hydrogen. The source for the hydrogen frequently is the steelmaking process itself, with the hydrogen coming from moisture in the atmosphere or from moisture entrained in additives used in the steelmaking process. When the metal is cooled, any hydrogen present can precipitate as molecular hydrogen at inclusions, where flakes are subsequently formed due to the increased pressure of the gaseous hydrogen.

Fish eyes (small rounded shiny areas of fracture) also are associated with absorbed hydrogen, but they more typically appear on the fracture surface of tensile specimens from steel forgings or plates having high hydrogen contents. When fish eyes are found on the fracture surfaces of tensile specimens, there will be an associated loss in ductility. Baking or prolonged room-temperature aging allows a portion of the hydrogen to diffuse out of the material, and typically eliminates fish eyes and restores tensile ductility.

When this type of hydrogen damage occurs in welding, it is called underbead cracking. The cracking typically develops in the coarse-grained region of the heat-affected zone, running generally parallel to the fusion line. Since this cracking may not occur until several hours after welding, it is commonly referred to as hydrogen-delayed cracking. As the weld metal cools, it becomes supersaturated with hydrogen, and further cooling, coupled with residual stresses in the weld area, eventually leads to cracking.

A-702.1.4 Hydrogen Attack. This is damage that occurs when a material is exposed at high temperatures and high pressures to a hydrogen-rich environment, whereby the material appears to be unaffected for many days or months, and then suddenly loses its strength and ductility. The effects of high-temperature attack are irreversible. Failure by hydrogen attack is characterized by decarburization and fissuring at grain boundaries, or by bubbles in the metal matrix. Damage of this type is most commonly encountered in the petroleum industry where equipment experiences hydrogen and hydrogen–hydrocarbon substances at pressures as high as 20 kPa and temperatures up to 540°C. However, hydrogen attack also is a common mode of damage in the furnace wall tubing of high-pressure steam generators, where acid-forming constituents that concentrate at internal deposits instigate corrosion that liberates hydrogen. This hydrogen then diffuses through the metal lattice, where it combines with carbon from carbides to form methane. The methane diffuses to grain boundaries, where it causes fissuring, and ultimately the tube fails due to loss of effective thickness.

A-702.1.5 Cracking From Hydride Formation. This is the fifth in the list of hydrogen damage mechanisms unique to a variety of transition, rare-earth, and alkaline-earth metals. For ASME Code applications, the only hydride-forming metals whose use is permitted are the alloys of titanium and zirconium. The presence of hydrides in these metals can cause significant increases in strength, accompanied by substantial losses in toughness and ductility. Hydrogen in these materials is picked up during melting or welding, with hydride formation taking place during the cooling process. Applied stresses can cause preferential alignment of hydrides, which typically are much less ductile than the matrix.

Hydride pickup from corrosion reactions in service also occurs and has been shown to cause fracture. Typically, elevated temperature exposure is required, as the mobility of hydrogen in these alloys at room temperature is insufficient to affect the bulk material.

A-702.2 References. Most of what is needed to understand and deal with hydrogen damage can be found in the general references cited in A-120. An additional useful specific reference is:

[1] *Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Practices*, API 941, American Petroleum Institute, Dallas, TX 1970.

A-703 LIQUID METAL EMBRITTLEMENT

A-703.1 Definition. Liquid metal embrittlement (LME) is the decrease in ductility of a metal caused by contact with a liquid metal, sometimes leading to catastrophic brittle fracture of a normally ductile metal. Liquid metals can include those purposely being contained by the system – or their source can be low-melting-point substances that inadvertently have come in contact with the pressure boundary material.

The following are considered critical factors in the development of LME:

(a) LME can occur in very specific combinations of structural/pressure boundary materials and low-melting-point metals, such as zinc, mercury, cadmium, lead, bismuth, copper, and tin.

(b) Very small quantities of the low-melting-point metals are sufficient to cause LME problems.

(c) High tensile stress promotes cracking, but cracking can occur simply through contact with the molten metal. Cracking under load can be very rapid.

(d) Cracking due to LME can also take a very long time to occur with some metal/liquid metal combinations.

(e) A susceptible metal in contact with a low-melting-point metal may not crack until the temperature of the materials rises above the melting point of the contaminating low-melting-point metal.

Copper checking is an example of LME that has been encountered with some frequency in the manufacture of thick-walled pressure parts with relatively high levels of residual copper. During high-temperature forming operations, the iron at the surface of the part will oxidize, leading to an enrichment of the surface in elemental copper. With further high-temperature processing, the material at the surface can develop shallow cracks due to the penetration of the copper into the grain boundaries of the host material.

A-703.2 References. Most of what is needed to understand the basics of liquid metal embrittlement can be found in the general references cited in A-120.

A-704 CAUSTIC EMBRITTLEMENT

A-704.1 Definition. Caustic embrittlement or caustic cracking is an obsolete historical term denoting a form of stress corrosion cracking (SCC) most frequently encountered in carbon steels or iron–chromium–nickel alloys that are exposed to concentrated hydroxide solutions at temperatures of 205°C to 250°C. In austenitic stainless steels (300 series), caustic cracking has been observed at temperatures as low as 90°C, is mostly transgranular, and is not easily distinguished from chloride stress-corrosion cracking. Alloys such as N06600 and N08800 generally exhibit intergranular SCC in high-temperature caustic environments.

A-704.2 References. Information related to the basics of caustic embrittlement and caustic stress corrosion cracking can be found in the general references cited in A-120.

A-705 FLOW-ACCELERATED CORROSION

A-705.1 Definition. Flow-accelerated corrosion (FAC) has emerged as a serious problem in both nuclear and fossil-fired power plants, where its occurrence has resulted in fatalities at several plants. It is a term used to describe a form of attack on metals that occurs as the result of the local dissolution of the protective oxide film and the simultaneous sweeping away of metal ions from the exposed surfaces by the flowing liquid. This type of attack is sometimes erroneously considered to be a form of erosion-corrosion, involving mechanical removal of the protective oxide film by the fluid and whatever suspended solids it might be carrying, whereas in FAC the damage to the oxide film that instigates the attack is chemical in nature. Also, as was the case in liquid metal corrosion (discussed in A-312), if material is being dissolved away at one location, then it must be assumed that whatever was dissolved will eventually be deposited elsewhere in the system; if these deposits accumulate on heat transfer surfaces, they may lead to problems related to the under-deposit corrosion mechanisms, such as hydrogen attack, caustic gouging, or acid phosphate corrosion.

Flow-accelerated corrosion can occur under either single- or two-phase conditions and is influenced by a complex interaction between a number of variables, including base material composition, water/steam temperature and steam quality (dry versus wet), pH, oxygen content, fluid velocity, and geometry. Because FAC takes place as a gradual thinning in localized areas, piping has a tendency to rupture when it becomes sufficiently thinned. Relatively small amounts of chromium in the base metal — some studies have suggested as little as 0.10% (by weight) — can render the material immune to FAC.

A-705.2 References. In addition to the general references cited in A-120, the following additional references may be helpful in dealing with FAC:

[1] Wu, P. C., "Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants," Final Report, U.S. NRC NUREG-1344, April 1989.

[2] Partlo, J. G., "Erosion/Corrosion-Induced Pipe Wall Thinning," U.S. NRC Generic Letter 89-08, May 2, 1989.

[3] Jonas, O., "Erosion-Corrosion of PWR Feedwater Piping Survey of Experience, Design, Water Chemistry, and Materials," Final Report, U.S. NRC NUREG/CR-5149, March 1988.

A-706 SULFUR EMBRITTLEMENT

Nickel combines with sulfur at elevated temperatures to form a brittle sulfide. This phenomenon takes place preferentially at the grain boundaries, and results in embrittlement that exhibits itself as a network of cracks when

the material is stressed or bent. Nickel is affected most, nickel–copper somewhat less, and nickel–chromium–iron still less. The more sulfur present or the higher the temperature, the more rapid and deep will be the attack.

Material that has been sulfur embrittled cannot be salvaged. It must be scrapped.

Prior to any operation that involves heating to a higher temperature, such as welding, brazing, annealing, hot forming, and forging, it is imperative to remove all sulfur-containing substances, such as oil, grease, marking pencil marks, paint, and drawing or threading lubricants. In addition, the atmosphere of the furnace in which heating is done should be essentially sulfur-free. A city gas or natural gas containing less than 25 grains of sulfur per 2.8 m^3 or a fuel oil containing less than 0.5% sulfur will be satisfactory for heating. Coal and coke are not satisfactory.

A-800 MECHANICAL DAMAGE MECHANISMS

Mechanical damage mechanisms are those mechanisms in which the damage is not controlled by direct electrochemical reactions between the pressure-containing material and the substance contained. Instead, damage occurs to system materials as a result of simple mechanical contact with other materials — or from sudden changes in coolant temperature and/or velocity. The more important damage mechanisms are described as follows.

A-801 FRETTING AND WEAR

A-801.1 Definition. Fretting is defined as wear that occurs between tight-fitting surfaces subjected to oscillation at very small amplitudes. This type of wear can be a combination of oxidative wear and abrasive wear. If corrosion is a factor in the damage, then the deterioration at the interface is termed fretting corrosion. Wear is defined as the damage to a solid surface, generally involving progressive loss of material due to relative motion between one surface and a contacting surface or substance.

The term fretting covers numerous forms of deterioration, including fretting corrosion, false brinelling, friction oxidation, chafing fatigue, molecular attrition, and wear oxidation.

Wear may range in severity from mild polishing over a long period of time, to the rapid and aggressive removal of material with accompanying surface roughening. There are numerous wear modes and they may change in service as a component deteriorates.

Adhesive wear occurs generally under nonlubricated conditions when both contacting surfaces are metallic. It is also known as scoring, galling, seizing, or scuffing. Microscopic projections from the mating surfaces bond at the sliding interface under very high local pressure. As the bonds are broken, material may be torn from one surface and adhere to the other surface, or loose particles may be formed that then contribute to abrasive wear.

Abrasive wear occurs when hard particles of some origin slide or roll under pressure across a surface, cutting grooves in the surface. Both of the mating sliding surfaces may wear, or the particles may become embedded in one of the surfaces, causing abrasive wear to the mating surface. Abrasive wear may be grinding abrasion or low-stress scratching abrasion.

Corrosive wear is a form of abrasive wear in which chemical or electrochemical reactions accelerate the metal loss between mating surfaces where sliding occurs. In this mode of wear, it may be unclear whether the damage due to mechanical wear precedes the chemical reactions, or vice versa.

Surface fatigue is another mode of wear, in which particles of metal are detached from a surface under high cyclic contact stresses, causing pitting and spalling.

A-801.2 References. Most of what is needed to understand the various aspects of fretting and wear can be found in the general references cited in A-120. References specific to coating options include the following:

[1] Davis, J. R., *Handbook of Thermal Spray Technology*, ASM International, 2004.

[2] Davis, J. R., *Surface Engineering for Corrosion and Wear Resistance*, ASM International, 2001.

A-802 THERMAL FATIGUE

A-802.1 Definition. Thermal fatigue damage is defined as fracture resulting from the presence of temperature gradients that vary with time to produce cyclic stresses in a structure. Two conditions essential for thermal fatigue are some form of mechanical restraint and a temperature change. Thermal stresses are caused by the thermal expansions and contractions against restrained endpoints. In thick sections, temperature gradients may develop through the thickness, as well as longitudinally, causing triaxial stresses. Most thermal fatigue fractures are of the low-cycle, high-strain type. The resulting fracture surfaces are rough and faceted at or near the initiation sites, and are more fibrous with shear lips at the final fracture area.

A-802.2 References. Information that may be of assistance in understanding and dealing with thermal fatigue can be found in the general references cited in A-120.

A-803 DYNAMIC LOADING

A-803.1 Definition. Dynamic loading involves the application of moving, sometimes high-velocity stresses, that can produce high strain rates in the affected component. This type of loading is contrasted with static loadings of the type imposed by deadweights or the slow application (or variation) of pressure stresses within a system.

Dynamic loads may range from the mild application of cyclic loads during normal plant operations to severe impact loads experienced during abnormal plant excursions (transients) or during some type of component/plant failure. Impacts with tools, suspended loads, or mobile

equipment are other sources of dynamic loading. Mobile equipment (i.e., BPVC Section XII) may demand additional considerations of dynamic loadings.

Toughness — the ability to absorb energy without fracturing — is one of the most important material properties for structures/components subjected to dynamic loads. A relatively simple gauge of a material's toughness can be made using the Charpy V-notch test, in which a notched material specimen at a controlled temperature is struck with a heavy pendulum, and the amount of energy absorbed in breaking the specimen is considered to be a relative measure of the material's toughness. As temperatures are reduced, materials will generally break at lower values of absorbed energy, with fractures displaying progressively more brittle rather than ductile characteristics.

A-803.2 References. Most of what is needed to understand and deal with a wide variety of dynamic loading events can be found in the general references cited in A-120.

A-804 ANISOTROPY

All materials possess some degree of directional dependence of properties, or *anisotropy.* For polycrystalline cubic metals, this anisotropy is not significant. For wrought hexagonal metals, such as titanium and zirconium, the anisotropy can be significant. Anisotropy is usually described with reference to the principal direction of mechanical working; for bar this is the axial direction and for plate it is the longitudinal direction. For titanium and zirconium, the axial/longitudinal direction has lower elastic modulus and lower yield strength than the circumferential long-transverse direction, which has lower elastic modulus and lower yield strength than the radial/short-transverse direction. Through-thickness modulus can be up to 45% greater than the axial/longitudinal modulus. Thermal expansion is also anisotropic, with expansion in the through-thickness direction being up to 15% greater than in the working direction.

(13)

NONMANDATORY APPENDIX B
DEVELOPING NOMINAL COMPOSITION DESIGNATIONS FOR ASME CODE MATERIALS

B-100 BACKGROUND

Nominal composition designations play an essential role in the ordering of materials in stress tables for ferrous materials in Section II, Part D of the ASME Boiler and Pressure Vessel Code and in other Sections of the Code containing such tables. In Code stress tables for nonferrous materials, alloys are ordered by increasing Unified Numbering System (UNS) numbers, except that nonferrous alloys without UNS numbers (alloys not listed in an ASTM specification) are listed following similar nonferrous alloys that do have UNS numbers. Nonferrous alloys include aluminum, copper, nickel, and the reactive and refractory alloys (cobalt, titanium, and zirconium). For nonferrous materials, Code stress tables provide nominal composition designations for information only, but only for nickel-base and the reactive and refractory alloys. A voted action within the Subcommittee on Materials (now BPV II on Materials) several years ago precluded the listing of nominal compositions for both aluminum and copper-base alloys. However, nominal compositions for all aluminum and copper alloys, along with all ferrous alloys and nickel-base alloys, can be found in other sources.[7, 8]

Nominal composition designations have existed in the Code stress tables for many years, but it was the publication of Section II, Part D that placed new significance on nominal composition designations, as they were used in the ordering of ferrous materials in the stress tables. At the same time, the Section II-D tables of thermophysical properties were also updated, with values for ferrous materials tied to their nominal compositions. It became necessary to resolve some conflicts where nominal compositions differed within a given alloy. No guidelines had ever been developed by those who established the earlier designations. This guideline now serves that need.

In the interest of helping those who have to define nominal composition designations for new alloys introduced to the Code through Construction Code Code Cases and incorporation into Section II, and to resolve discrepancies within established nominal composition descriptions, this guideline describes how these nominal compositions are developed for each class of Code materials – first for ferrous alloys, and then for the various nonferrous alloys.

B-200 GENERAL GUIDELINE FOR ALL MATERIALS

Any nominal composition designation is nothing more than a naming device, helping to describe the primary or most significant elements in a given alloy. The nominal composition is *not* meant to be construed as a specified composition, particularly since amounts of each element are shown as single values, rather than as maximums, minimums, or ranges.

To simplify the process of designating nominal compositions, a list consisting of between two and five elements should be used to distinguish one alloy from another. However, additional elements may be used, if necessary, to adequately describe the alloy or alloys.

It has been customary to list the elements comprising the nominal composition designations in order of decreasing amounts present. However, some existing nominal composition designations violate this guideline and there is no intent to revise those designations.

When small amounts of selected elements are added to the alloys to impart particular characteristics, they may be shown without a specified amount (percentage). Otherwise, the values shown for each element are considered weight percentages (corresponding to specified amounts in ASME, ASTM, or other approved materials specifications). Weight percentages are generally shown as whole percentage numbers, although sometimes it is necessary to show such percentages to one decimal place. Further, some designations have been in common usage for so long that they are still used, even though the designations may not reflect the midpoint of a composition range and even though the specified composition ranges may have been changed. Examples of such situations are austenitic stainless steel designations, such as 18Cr–8Ni and 18Cr–10Ni–Cb. Finally, some classes of such alloys that differ by small variations (examples are grades 347, 348, 347H, 347LN, etc.) may all be grouped into one nominal compositional designation (e.g., 18Cr–10Ni–Cb), differentiated by grade, and listed in the tables in order of increasing UNS number.

B-300 GUIDELINES FOR DEVELOPING NOMINAL COMPOSITION DESIGNATIONS FOR FERROUS MATERIALS

The first source for determining the nominal composition designations for a given ferrous material is the title of its specification. Those specification titles often identify the category to which the material belongs — carbon steel, alloy steel (low and intermediate), or high alloy steel (chromium, chromium–nickel, heat-resisting austenitics, etc.). If the title of the specification does not identify the class of materials covered, the scope paragraph of the specification may do so.

For all categories of ferrous materials, iron is always presumed to be present and is *never* shown in the nominal composition designation. Further, most steels contain customary amounts of sulfur, phosphorus, silicon, and manganese, and these elements, too, are *not* listed in the nominal compositions, unless they are intentionally added in higher amounts to impart special characteristics.

Primary alloying constituents, found in the specified chemical requirements as a minimum amount, are usually listed in the nominal composition at that numerical percentage value. If the specified chemical requirements show a range, then a value at the midpoint of the range is selected. Carbon steels, carbon–manganese steels, carbon–silicon steels, and carbon–manganese–silicon steels are simply listed as "Carbon steel." When a specification for an alloy otherwise similar to an alloy in the C steel group identifies or covers the alloy as "microalloyed" material, the principal alloying ingredients are listed without numerical values (since amounts are generally small fractions of 1%).

For all other classes of ferrous materials, simply two to five of the principal alloying constituents, in order of decreasing percentage amounts, are shown.

B-400 GUIDELINES FOR DEVELOPING NOMINAL COMPOSITION DESIGNATIONS FOR NONFERROUS MATERIALS

B-410 NICKEL ALLOYS

Many of the specifications for nickel alloys have complex titles that provide information about the primary elements comprising each alloy covered by a given specification, e.g., SB-574, SB-688, and SB-710. Most specifications for nickel alloys will generally list the nickel content as "balance" or "remainder." Since nominal composition designations for nickel alloys always begin with the percentage amount of nickel, it is necessary to add up the nominal or average percentage amounts of all other specified elements and then subtract their total from 100 to develop a value for the nickel content (i.e., determine by difference). After the amount of nickel is listed, then other alloying elements are listed in decreasing order of alloy content. For some complex alloys, it might seem necessary to list more than five elements to adequately differentiate one alloy from another, but since these alloys are sufficiently defined and ordered in the table by their UNS numbers, it is not necessary to be overly precise in developing such lists of alloying elements and the listing of more than five alloying elements is to be discouraged.

There are some alloys that were considered to be nickel alloys by the former definition of a nonferrous material (an alloy containing 50% or less of iron), but that are now considered to be ferrous materials (alloys whose principal element is iron). Those alloys have nominal compositions beginning with the amount of iron, unlike the other ferrous alloys described previously. However, an action plan was initiated in 2010 to move those alloys out of the nonferrous material tables and specifications.

B-420 ALUMINUM ALLOYS

Nominal composition designations for aluminum alloys always begin with "Al", with no designation of the amount of aluminum in the alloy. Other alloying elements should be listed in order of decreasing nominal content in the alloy as listed in the composition requirements of the specification.

B-430 COPPER ALLOYS

Nominal composition designations for copper alloys are developed in a manner similar to the process used for nickel alloys. First listed is the amount of copper present and again this is usually determined by difference. Then, using the nominal or average amounts of alloying elements, their amounts are selected and listed in decreasing order of concentration.

B-440 TITANIUM ALLOYS

Similarly to the guidelines for aluminum alloys, nominal composition designations for titanium alloys simply begin with "Ti," with no numerical designation of the amount of titanium. Then, using the specified chemical requirements, nominal or midrange values of principal alloy ingredients are identified and listed in order of decreasing amounts.

B-450 ZIRCONIUM ALLOYS

As with the guidelines for nickel and copper alloys, nominal composition designations for zirconium alloys always show the amount of zirconium. Also, the amount of zirconium is generally obtained by difference. After listing the amount of zirconium, then the percentage amounts of the other alloying ingredients are listed in order of decreasing content. However, for zirconium alloys used in Code construction, the *actual amounts* of alloying additions are *not* shown for the single alloying element.

B-460 COBALT ALLOYS

Cobalt alloys are identified as R3XXXX alloys in the Unified Numbering System designations. The cobalt alloys have their own unique nominal composition designation system. New cobalt alloys should follow the precedent used for those now listed.

B-500 SUMMARY

This guideline follows the existing historical conventions to the extent possible. Thus, it is based in large part on precedent and does not create a new convention that could be applied to all alloys. If it did not, a very large part of the Code would have to be revised and that would not be a fruitful use of resources.

In developing *new* nominal composition designations, refer first to these new guidelines, but remember to also do the following:

(a) Try to conform new nominal compositions to existing designations found in specifications or other sources.

(b) Follow precedent to the extent possible.

(c) Add up the percentage amounts of all elements shown in the nominal composition designation and ensure that the total does not exceed 100. Totals less than 100 are acceptable, particularly for those alloy systems (e.g., ferrous, aluminum, and titanium alloys) that do not list the amounts of the principal alloying elements in the nominal composition.

(d) Avoid, to the extent possible, the listing of more than five alloying elements.

Since most of the use of nominal composition designations is in the stress and property tables of Section II, Part D, the BPV II Committee on Materials retains the final approval authority over any revisions to, or development of, any new nominal composition designations.

NONMANDATORY APPENDIX C
GUIDANCE FOR THE USE OF U.S. CUSTOMARY AND SI UNITS IN THE ASME BOILER AND PRESSURE VESSEL CODE

C-100 USE OF UNITS IN EQUATIONS

The equations in this Nonmandatory Appendix are suitable for use with either the U.S. Customary or the SI units provided in Mandatory Appendix 9, or with the units provided in the nomenclature associated with that equation. It is the responsibility of the individual and organization performing the calculations to ensure that appropriate units are used. Either U.S. Customary or SI units may be used as a consistent set. When necessary to convert from one system of units to another, the units shall be converted to at least three significant figures for use in calculations and other aspects of construction.

C-200 GUIDELINES USED TO DEVELOP SI EQUIVALENTS

The following guidelines were used to develop SI equivalents:

(a) SI units are placed in parentheses after the U.S. Customary units in the text.

(b) In general, separate SI tables are provided if interpolation is expected. The table designation (e.g., table number) is the same for both the U.S. Customary and SI tables, with the addition of suffix "M" to the designator for the SI table, if a separate table is provided. In the text, references to a table use only the primary table number (i.e., without the "M"). For some small tables, where interpolation is not required, SI units are placed in parentheses after the U.S. Customary unit.

(c) Separate SI versions of graphical information (charts) are provided, except that if both axes are dimensionless, a single figure (chart) is used.

(d) In most cases, conversions of units in the text were done using hard SI conversion practices, with some soft conversions on a case-by-case basis, as appropriate. This was implemented by rounding the SI values to the number of significant figures of implied precision in the existing U.S. Customary units. For example, 3,000 psi has an implied precision of one significant figure. Therefore, the conversion to SI units would typically be to 20 000 kPa. This is a difference of about 3% from the "exact" or soft conversion of 20 684.27 kPa. However, the precision of the conversion was determined by the Committee on a case-by-case basis. More significant digits were included in the SI equivalent if there was any question. The values of allowable stress in Section II, Part D generally include three significant figures.

(e) Minimum thickness and radius values that are expressed in fractions of an inch were generally converted according to the following table:

Fraction, in.	Proposed SI Conversion, mm	Difference, %
1/32	0.8	−0.8
3/64	1.2	−0.8
1/16	1.5	5.5
3/32	2.5	−5.0
1/8	3	5.5
5/32	4	−0.8
3/16	5	−5.0
7/32	5.5	1.0
1/4	6	5.5
5/16	8	−0.8
3/8	10	−5.0
7/16	11	1.0
1/2	13	−2.4
9/16	14	2.0
5/8	16	−0.8
11/16	17	2.6
3/4	19	0.3
7/8	22	1.0
1	25	1.6

(f) For nominal sizes that are in even increments of inches, even multiples of 25 mm were generally used. Intermediate values were interpolated rather than converting and rounding to the nearest mm. See examples in the following table. [Note that this table does not apply to nominal pipe sizes (NPS), which are covered below.]

Size, in.	Size, mm
1	25
1 1/8	29
1 1/4	32
1 1/2	38
2	50
2 1/4	57
2 1/2	64
3	75
3 1/2	89
4	100
4 1/2	114
5	125
6	150

Table continued

Size, in.	Size, mm
8	200
12	300
18	450
20	500
24	600
36	900
40	1 000
54	1 350
60	1 500
72	1 800

Size or Length, ft	Size or Length, m
3	1
5	1.5
200	60

(g) For nominal pipe sizes, the following relationships were used:

U.S. Customary Practice	SI Practice	U.S. Customary Practice	SI Practice
NPS 1/8	DN 6	NPS 20	DN 500
NPS 1/4	DN 8	NPS 22	DN 550
NPS 3/8	DN 10	NPS 24	DN 600
NPS 1/2	DN 15	NPS 26	DN 650
NPS 3/4	DN 20	NPS 28	DN 700
NPS 1	DN 25	NPS 30	DN 750
NPS 1 1/4	DN 32	NPS 32	DN 800
NPS 1 1/2	DN 40	NPS 34	DN 850
NPS 2	DN 50	NPS 36	DN 900
NPS 2 1/2	DN 65	NPS 38	DN 950
NPS 3	DN 80	NPS 40	DN 1000
NPS 3 1/2	DN 90	NPS 42	DN 1050
NPS 4	DN 100	NPS 44	DN 1100
NPS 5	DN 125	NPS 46	DN 1150
NPS 6	DN 150	NPS 48	DN 1200
NPS 8	DN 200	NPS 50	DN 1250
NPS 10	DN 250	NPS 52	DN 1300
NPS 12	DN 300	NPS 54	DN 1350
NPS 14	DN 350	NPS 56	DN 1400
NPS 16	DN 400	NPS 58	DN 1450
NPS 18	DN 450	NPS 60	DN 1500

(h) Areas in square inches ($in.^2$) were converted to square mm (mm^2) and areas in square feet (ft^2) were converted to square meters (m^2). See examples in the following table:

Area (U.S. Customary)	Area (SI)
1 $in.^2$	650 mm^2
6 $in.^2$	4 000 mm^2
10 $in.^2$	6 500 mm^2
5 ft^2	0.5 m^2

(i) Volumes in cubic inches ($in.^3$) were converted to cubic mm (mm^3) and volumes in cubic feet (ft^3) were converted to cubic meters (m^3). See examples in the following table:

Volume (U.S. Customary)	Volume (SI)
1 $in.^3$	16 000 mm^3
6 $in.^3$	100 000 mm^3
10 $in.^3$	160 000 mm^3
5 ft^3	0.14 m^3

(j) Although the pressure should always be in MPa for calculations, there are cases where other units are used in the text. For example, kPa is used for small pressures. Also, rounding was to one significant figure (two at the most) in most cases. See examples in the following table. (Note that 14.7 psi converts to 101 kPa, while 15 psi converts to 100 kPa. While this may seem at first glance to be an anomaly, it is consistent with the rounding philosophy.)

Pressure (U.S. Customary)	Pressure (SI)
0.5 psi	3 kPa
2 psi	15 kPa
3 psi	20 kPa
10 psi	70 kPa
14.7 psi	101 kPa
15 psi	100 kPa
30 psi	100 kPa
50 psi	350 kPa
100 psi	700 kPa
150 psi	1 MPa
200 psi	1.5 MPa
250 psi	1.7 MPa
300 psi	2 MPa
350 psi	2.5 MPa
400 psi	3 MPa
500 psi	3.5 MPa
600 psi	4 MPa
1,200 psi	8 MPa
1,500 psi	10 MPa

(k) Material properties that are expressed in psi or ksi (e.g., allowable stress, yield and tensile strength, elastic modulus) were generally converted to MPa to three significant figures. See example in the following table:

Strength (U.S. Customary)	Strength (SI)
95,000 psi	655 MPa

(l) In most cases, temperatures (e.g., for PWHT) were rounded to the nearest 5°C. Depending on the implied precision of the temperature, some were rounded to the nearest 1°C or 10°C or even 25°C. Temperatures colder than 0°F (negative values) were generally rounded to the nearest 1°C. The examples in the table below were created by rounding to the nearest 5°C, with one exception:

Temperature, °F	Temperature, °C
70	20
100	38
120	50
150	65
200	95
250	120
300	150
350	175
400	205
450	230
500	260
550	290
600	315
650	345
700	370
750	400
800	425
850	455
900	480
925	495
950	510
1,000	540
1,050	565
1,100	595
1,150	620
1,200	650
1,250	675
1,800	980
1,900	1 040
2,000	1 095
2,050	1 120

C-300 SOFT CONVERSION FACTORS

The following table of "soft" conversion factors is provided for convenience. Multiply the U.S. Customary value by the factor given to obtain the SI value. Similarly, divide the SI value by the factor given to obtain the U.S. Customary value. In most cases it is appropriate to round the answer to three significant figures.

U.S. Customary	SI	Factor	Notes
in.	mm	25.4	...
ft	m	0.3048	...
$in.^2$	mm^2	645.16	...
ft^2	m^2	0.09290304	...
$in.^3$	mm^3	16,387.064	...
ft^3	m^3	0.02831685	...
U.S. gal	m^3	0.003785412	...
U.S. gal	liters	3.785412	...
psi	MPa (N/mm^2)	0.0068948	Used exclusively in equations
psi	kPa	6.894757	Used only in text and for nameplate
psi	bar	0.06894757	...
ft-lb	J	1.355818	...
°F	°C	$\frac{5}{9} \times (°F - 32)$	Not for temperature difference
°F	°C	$\frac{5}{9}$	For temperature differences only
R	K	$\frac{5}{9}$	Absolute temperature
lbm	kg	0.4535924	...
lbf	N	4.448222	...
in.-lb	N·mm	112.98484	Use exclusively in equations
ft-lb	N·m	1.3558181	Use only in text
$ksi\sqrt{in.}$	$MPa\sqrt{m}$	1.0988434	...
Btu/hr	W	0.2930711	Use for boiler rating and heat transfer
lb/ft^3	kg/m^3	16.018463	...

(13)

NONMANDATORY APPENDIX D
GUIDELINES FOR ROUNDING MINIMUM SPECIFIED TENSILE AND YIELD STRENGTH VALUES AND FOR ESTABLISHING ANCHOR POINTS FOR TENSILE AND YIELD STRENGTH TREND CURVES IN TABLES 1A, 1B, 2A, 2B, 3, 4, 5A, 5B, U, U-2, AND Y-1

D-100 MINIMUM TENSILE STRENGTH AND MINIMUM YIELD STRENGTH COLUMNS

D-110 DUAL UNIT SPECIFICATIONS

For specifications that contain both U.S. Customary and Metric minimum specified tensile and yield strength values, do the following:

(a) List the U.S. Customary values from the material specification in the columns for Minimum Tensile Strength, ksi and Minimum Yield Strength, ksi in the U.S. Customary edition tables of Section II, Part D.

(b) List the Metric values from the material specification in the columns for Minimum Tensile Strength, MPa and Minimum Yield Strength, MPa in the Metric edition tables of Section II, Part D.

D-120 TWO SEPARATE SPECIFICATIONS FOR THE SAME PRODUCT FORM

When two separate specifications exist for the same product form, one in U.S. Customary units and one in Metric units (a common situation for some fastener specifications), do the following:

(a) List the values from the U.S. Customary edition of the material specification in the columns for Minimum Tensile Strength, ksi and Minimum Yield Strength, ksi in the U.S. Customary edition tables of Section II, Part D.

(b) List the values from the Metric edition of the material specification in the columns for Minimum Tensile Strength, MPa and Minimum Yield Strength, MPa in the Metric edition tables of Section II, Part D.

D-130 SPECIFICATION EXISTS IN ONLY ONE SET OF UNITS

When a specification exists for only one set of units (common for EN and other non-U.S. specifications for which only Metric editions exist), do the following:

(a) Specification Exists Only in U.S. Customary Units

(1) List the U.S. Customary values in the columns for Minimum Tensile Strength, ksi and Minimum Yield Strength, ksi in the U.S. Customary edition tables of Section II, Part D.

(2) Multiply the U.S. Customary specification values by 6.894757, round to the nearest MPa (i.e., do a soft conversion), and list these rounded values in the columns for Minimum Tensile Strength, MPa and Minimum Yield Strength, MPa in the Metric edition tables of Section II, Part D.

(b) Specification Exists Only in Metric Units

(1) List the Metric values in the columns for Minimum Tensile Strength, MPa and Minimum Yield Strength, MPa in the Metric edition tables of Section II, Part D.

(2) Divide the Metric specification values by 6.894757, round to the nearest 0.5 ksi (i.e., do a soft conversion), and list these rounded values in the columns for Minimum Tensile Strength, ksi and Minimum Yield Strength, ksi in the U.S. Customary edition tables of Section II, Part D.

D-200 SELECTING ANCHOR POINT FOR TENSILE AND YIELD STRENGTH TREND CURVES FOR ALL SITUATIONS IN WHICH THE MINIMUM RT SPECIFIED VALUES IN ONE UNIT SYSTEM ARE NOT PRECISE CONVERSIONS OF THE UNITS IN THE OTHER SYSTEM

D-210 ONE MATERIAL HAS ONE TREND CURVE RULE

This rule requires that the trend curves in either system of units are precisely congruent with one another. That is, if the Metric and U.S. Customary curves are placed on top of one another, they appear to be only one curve. Thus, a material does not have two trend curves of the same shape, but has one curve shifted up or down because of slight differences between the U.S. Customary and Metric RT specified values.

It should be recognized that following the "one material: one trend curve" rule will result in certain inconsistencies with the criteria established by Mandatory Appendices 1, 2, and 10 of Section II, Part D. The rule was first established when the Section II-D tables were metricated. An example of the inconsistency with Appendix 1 can be seen

in the Metric values for Type 347H stainless steel, on pp. 102–105 of the 2010 Edition, 2011 Addenda of Section II, Part D Metric. Inspection of Line No. 1 on these pages, for SA-312 seamless pipe, shows that the values in the Min. Tensile Strength and Min. Yield Strength columns on p. 103 are, respectively, 515 MPa and 205 MPa, as they appear in the SA-312 specification in Section II, Part A. However, the value in the −30 to 40°C and the 65°C columns, 138 MPa, is not equal to either 515/3.5 = 147.14 = 147 MPa or (205 × 2)/3 = 136.67 = 137 MPa. Instead, 138 MPa is obtained from (30 ksi × 6.894757 × 2)/3 = 137.89514 = 138 MPa. In this example, the "one material: one trend curve" rule results in a value at two temperatures that is slightly higher than would have been obtained from applying the Appendix 1 criteria to the Metric minimum specified yield strength. For other materials, slightly lower values might result. However, in either example, the values will be identical (within rounding variances) to those of the U.S. Customary values at the same temperatures.

D-220 ANCHORING THE TREND CURVE

When anchoring the yield and tensile strength trend curve, the U.S. Customary tensile and yield strengths are used when the specification is either a dual unit specification or exists only in U.S. Customary units. The Metric trend curve is then anchored to the conversion of the U.S. Customary values — the U.S. Customary values multiplied by 6.894757. Rounding is delayed until the last step (see D-300). However, when the specification exists only in a Metric version, the U.S. Customary trend curves are anchored to the soft conversion from the Metric-specified minimum tensile and yield strengths, in all cases, i.e., the U.S. Customary trend curves are anchored to the Metric-specified minimum tensile and yield strengths divided by 6.894757. Again, rounding is delayed until the last step.

D-230 EQUIVALENT MATERIALS

When a non-ASTM specification that, in the judgment of the Committee, has chemistry and heat treatment requirements so similar to an ASTM specification and grade that is already listed in Section II, Part D, that it is indistinguishable from the ASTM material, the Committee may choose to use the same trend curves for the non-ASTM specification as were used to develop the values for the ASTM material, regardless of any differences between the U.S. Customary minimum specified values and the Metric minimum specified values.

D-300 SIGNIFICANT FIGURES IN THE ALLOWABLE STRESS TABLES

D-310 U.S. CUSTOMARY TABLES

When listing allowable stress values in ksi, the last step in the analysis is to round the calculated values to three significant figures for values of 10.0 ksi and greater, and to two significant figures for values less than 10.0 ksi.

D-320 METRIC TABLES

When listing allowable stress values in MPa, the last step in the analysis is to round the calculated values to three significant figures, except that, for values greater than 999 MPa, round the value of the fourth figure to 0 or 5. For example, 1022 rounds to 1020, while 1023 rounds to 1025 MPa.

ENDNOTES

1 ASME uses the current ASTM definition of *ferrous alloy*: an alloy whose major constituent is iron, even if the iron content is less than 50% of the total composition. However, this is a recently adopted definition and the change to specifications is occuring over time. Therefore, some alloys that were formerly defined as nonferrous are still listed in the nonferrous tables or both.

2 This chart is used only for this condition and is only applicable to uniform external pressure.

3 This applies to unstiffened cylinders.

4 Since most materials are, in many applications, used in components that operate under compressive loads, the Committee recommends that stress–strain plots as described above should always be included in the data package submitted in support of the application for any new material.

5 The term *minimum yield strength*, as used here, means the yield strength values that are derived from the analysis of the tensile data required elsewhere in this Mandatory Appendix.

6 Modulus of elasticity values shall be determined by dynamic methods such as ASTM Test Method E1876 (latest edition) or other international equivalent.

7 *CASTI Guidebook to ASME Section II, B31.1 & B31.3 – Materials Index*, latest edition.

8 *Metals & Alloys in the Unified Numbering System*, SAE HS-1086 and ASTM DS-56, latest edition.

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ASME BOILER AND PRESSURE VESSEL CODE
SECTION II, PART D (METRIC)

INTERPRETATIONS
Volume 62

Interpretations of the Code will be posted in January and July of 2014 and January of 2015 at http://cstools.asme.org/interpretations.cfm. Interpretations of Section III, Divisions 1 and 2, are part of the update service to Section III, Subsection NCA.

Interpretations Volumes 60 and 61 were included with the update service to the 2010 Edition of the Code; Volume 62 is the first Interpretations volume to be included with the update service to the 2013 Edition.

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INTERPRETATIONS VOLUME 62 — SECTION II, PART D (METRIC)

Replies to Technical Inquiries January 1, 2011 through December 31, 2012

FOREWORD

GENERAL INFORMATION

This publication includes all written interpretations issued between the indicated dates by the ASME Staff on behalf of the ASME Boiler and Pressure Vessel Committee in response to inquiries concerning interpretations of the ASME Boiler and Pressure Vessel Code. A contents is also included that lists subjects specific to the interpretations covered in the individual volume.

These interpretations are taken verbatim from the original letters, except for a few typographical and editorial corrections made for the purpose of improved clarity. In some instances, a review of the interpretation revealed a need for corrections of a technical nature. In these cases, a revised interpretation is presented bearing the original interpretation number with the suffix R and the original file number with an asterisk. Following these revised interpretations, new interpretations and revisions to them issued during the indicated dates are assigned interpretation numbers in chronological order. Interpretations applying to more than one Code Section appear with the interpretations for each affected Section.

ASME procedures provide for reconsideration of these interpretations when or if additional information is available that the inquirer believes might affect the interpretation. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee or subcommittee. As stated in the Statement of Policy in the Code documents, ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

An interpretation applies either to the Edition and Addenda in effect on the date of issuance of the interpretation or the Edition and Addenda stated in the interpretation. Subsequent revisions to the Code may supersede the interpretation.

For detailed instructions, see "Submittal of Technical Inquiries to the ASME Boiler and Pressure Vessel Standards Committees" in the front matter.

SUBJECT AND NUMERICAL INDEXES

Subject and numerical indexes (if applicable) have been prepared to assist the user in locating interpretations by subject matter or by location in the Code. They cover interpretations issued from Volume 12 up to and including the present volume, and will be updated with each volume.

Subject	Interpretation	File No.
Note G3 Reference on the Design Stress Intensity Line for SA-540 Type B24 Class 3 in Table 4 (2010 Edition)	II-D-M-13-01	12-2163

Interpretation: II-D-M-13-01

Subject: Note G3 Reference on the Design Stress Intensity Line for SA-540 Type B24 Class 3 in Table 4 (2010 Edition)
Date Issued: December 28, 2012
File: 12-2163

Question: Is it the intent that the design stress intensity line for SA-540 Type B24 Class 3 ≤238 mm diameter in Table 4 of Section II, Part D carry the note G3?

Reply: Yes.

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2013 ASME Boiler and Pressure Vessel Code

AN INTERNATIONAL CODE

The ASME Boiler and Pressure Vessel Code (BPVC) is "An International Historic Mechanical Engineering Landmark," widely recognized as a model for codes and standards worldwide. Its development process remains open and transparent throughout, yielding "living documents" that have improved public safety and facilitated trade across global markets and jurisdictions for nearly a century.

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