

ASME BPVC.II.D.M-2025

SECTION II
MATERIALS

2025

ASME Boiler and
Pressure Vessel Code
An International Code

Part D
Properties (Metric)

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME,” ASME logos, or the ASME Single Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code or Standard. Use of the ASME Single Certification Mark requires formal ASME certification; if no certification program is available, such ASME markings may not be used. (For Certification and Accreditation Programs, see <https://www.asme.org/certification-accreditation>.)

Items produced by parties not formally possessing an ASME Certificate may not be described, either explicitly or implicitly, as ASME certified or approved in any code forms or other document.

AN INTERNATIONAL CODE

2025 ASME Boiler & Pressure Vessel Code

2025 Edition

July 1, 2025

II MATERIALS

Part D

Properties (Metric)

ASME Boiler and Pressure Vessel Committee
on Materials



The American Society of
Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2025

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

ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity. ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor does ASME assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representatives or persons affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

The endnotes and preamble in this document (if any) are part of this American National Standard.



ASME Collective Membership Mark



ASME Single Certification Mark

All rights reserved. “ASME” and the above ASME symbols are registered trademarks of The American Society of Mechanical Engineers. No part of this document may be copied, modified, distributed, published, displayed, or otherwise reproduced in any form or by any means, electronic, digital, or mechanical, now known or hereafter invented, without the express written permission of ASME. No works derived from this document or any content therein may be created without the express written permission of ASME. Using this document or any content therein to train, create, or improve any artificial intelligence and/or machine learning platform, system, application, model, or algorithm is strictly prohibited.

Library of Congress Catalog Card Number: 56-3934

Adopted by the Council of The American Society of Mechanical Engineers, 1914; latest edition 2025.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

Copyright © 2025 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

TABLE OF CONTENTS

List of Sections		xiii
Foreword		xiv
Statement of Policy on the Use of the ASME Single Certification Mark and Code Authorization in Advertising		xvi
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items		xvi
Personnel		xvii
Correspondence With the Committee		xl
Summary of Changes		xlvi
Cross-Referencing in the ASME BPVC		xlvi
Subpart 1	Stress Tables	1
	Statement of Policy on Information Provided in the Stress Tables	1
	Guideline on Locating Materials in Stress Tables, and in Tables of Mechanical and Physical Properties	3
Subpart 2	Physical Properties Tables	1155
	Introduction	1155
Subpart 3	Charts and Tables for Determining Shell Thickness of Components Under External Pressure	1196
Mandatory Appendix 1	Basis for Establishing Stress Values in Tables 1A and 1B	1326
1-100	Derivation of Allowable Stress Values	1326
Mandatory Appendix 2	Basis for Establishing Design Stress Intensity Values for Tables 2A, 2B, and 4, and Allowable Stress Values for Table 3	1328
2-100	Derivation of Stress Intensity Values	1328
Mandatory Appendix 3	Basis for Establishing External Pressure Charts	1331
3-100	General	1331
3-200	Basis of Charts in Subpart 3	1331
3-300	Use of Charts in Subpart 3	1331
3-400	Background and Development of Theory	1331
3-500	Design Basis	1331
3-600	Criteria for Allowable Stresses	1332
3-700	Procedure and Responsibility for Chart Development	1334
3-800	Alternate Procedure for Determining Allowable Compressive Stresses	1337
3-900	References	1337
Mandatory Appendix 5	Guidelines on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code	1338
5-100	Code Policy	1338
5-200	Application	1338
5-300	Chemical Composition	1340
5-400	Metallurgical Structure and Heat Treatment	1340
5-500	Mechanical Properties	1340
5-600	Definitions for Data Collection Purposes	1340
5-700	Required Sampling	1341
5-800	Time-Independent Properties	1341
5-900	Time-Dependent Properties	1341
5-1000	Low-Temperature Properties	1343
5-1100	Toughness Data	1343
5-1200	Stress-Strain Curves	1343

5-1300	Fatigue Data	1343
5-1400	Physical Properties	1344
5-1500	Data Requirements for Welds, Weldments, and Weldability	1344
5-1600	Long-Term Properties Stability	1346
5-1700	Requests for Additional Data	1346
5-1800	New Materials Checklist	1346
5-1900	Requirements for Recognized National or International Specifications	1346
5-2000	Publication of Recognized National or International Specifications	1347
5-2100	CEN Specifications	1347
Mandatory Appendix 6	Basis for Establishing Stress Values in Tables 6A, 6B, 6C, and 6D	1348
6-100	Derivation of Allowable Stress Values	1348
Mandatory Appendix 7	Guidelines on Multiple Marking of Materials	1350
7-100	Background	1350
7-200	Guidelines	1350
Mandatory Appendix 9	Standard Units for Use in Equations	1352
Mandatory Appendix 10	Basis for Establishing Maximum Allowable Stress Values for Tables 5A and 5B	1353
10-100	Derivation of Allowable Stress Values	1353
Nonmandatory Appendix A	Issues Associated With Materials Used in ASME Code Construction ...	1355
A-100	General	1355
A-200	Metallurgical Changes That Can Occur in Service	1356
A-300	Uniform Corrosion	1363
A-400	Localized Corrosion	1366
A-500	Metallurgically Influenced Corrosion	1367
A-600	Mechanically Assisted Corrosion	1368
A-700	Environmentally Induced Embrittlement and Cracking	1369
A-800	Mechanical Damage Mechanisms	1373
Nonmandatory Appendix B	Developing Nominal Composition Designations for ASME Code Materials	1375
B-100	Background	1375
B-200	General Guideline for All Materials	1375
B-300	Guidelines for Developing Nominal Composition Designations for Ferrous Materials	1376
B-400	Guidelines for Developing Nominal Composition Designations for Nonferrous Materials	1376
B-500	Summary	1377
Nonmandatory Appendix C	Guidance for the Use of U.S. Customary and SI Units in the ASME Boiler and Pressure Vessel Code	1378
C-100	Use of Units in Equations	1378
C-200	Guidelines Used to Develop SI Equivalents	1378
C-300	Soft Conversion Factors	1380
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, and Y-1	1381
D-100	Minimum Tensile Strength and Minimum Yield Strength Columns	1381
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	1381
D-300	Significant Figures in the Allowable Stress, Tensile Strength, and Yield Strength Tables in Section II, Part D and in Code Cases	1382

Nonmandatory Appendix E	Material Data for Stress Analysis in the Time-Dependent Regime	1383
E-100	Introduction	1383

FIGURES

G	Geometric Chart for Components Under External or Compressive Loadings (for All Materials)	1197
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 .	1199
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	1200
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	1201
CS-4	Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-537 Thickness 64 mm and Less	1202
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	1203
CS-6	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon Steel With Specified Minimum Yield Strength of 138 MPa	1204
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	1205
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	1206
HA-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr–8Ni, Type 304	1207
HA-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 16Cr–12Ni–2Mo, Type 316	1208
HA-3	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr–8Ni–0.035 Maximum Carbon, Type 304L	1209
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	1210
HA-5	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic–Ferritic Steel 18Cr–5Ni–3Mo S31500 and Austenitic–Ferritic Steel 25Cr–6Ni–Mo–N S32053	1211
HA-6	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 21Cr–11Ni–N S30815	1212
HA-7	Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-564 Type 630 H1150 (17Cr–4Ni–4Cu S17400)	1213
HA-8	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic–Ferritic Steel 25Cr–7Ni–3Mo–2W–0.28N S39274	1214
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	1215
HA-10	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Stainless Steel 24Cr–17Ni–6Mn–4.5Mo–N S34565	1216
CI-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Iron	1217
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	1218
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	1219
NFA-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3003 in O Temper	1220
NFA-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3003 in H14 Temper	1221

NFA-3	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3004 in O Temper	1222
NFA-4	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3004 in H34 Temper	1223
NFA-5	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5154 in O Temper	1224
NFA-6	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5454 in O Temper	1225
NFA-7	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 1060 in O Temper	1226
NFA-8	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5052 in O Temper	1227
NFA-9	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5086 in O Temper	1228
NFA-10	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5456 in O Temper	1229
NFA-11	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 5083 in O Temper	1230
NFA-12	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Aluminum Alloy 6061-T6	1231
NFA-13	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Aluminum Alloy 6061-T4	1232
NFC-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Copper, Type DHP	1233
NFC-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Copper-Silicon Alloy C65500	1234
NFC-3	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed 90-10 Copper-Nickel Alloy	1235
NFC-4	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed 70-30 Copper-Nickel Alloy	1236
NFC-5	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded Copper-Iron Alloy Tube C19400 (SB-543 Welded)	1237
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	1238
NFC-7	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Copper, SB-75, UNS C12200, Temper O50	1239
NFC-8	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Bronze Alloy C61400	1240
NFN-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Low Carbon Nickel N02201	1241
NFN-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel N02200	1242
NFN-3	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel-Copper Alloy N04400	1243
NFN-4	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel-Chromium-Iron Alloy N06600	1244
NFN-5	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Molybdenum Alloy N10001	1245
NFN-6	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Molybdenum-Chromium-Iron Alloy N10003	1246
NFN-7	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Iron-Chromium-Molybdenum-Copper Alloy N08825	1247
NFN-8	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel-Iron-Chromium Alloy N08800	1248

NFN-9	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel-Iron-Chromium Alloy N08810	1249
NFN-10	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Low Carbon Nickel-Molybdenum-Chromium Alloy N10276	1250
NFN-11	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution Treated Nickel-Chromium-Iron-Molybdenum-Copper Alloy N06007	1251
NFN-12	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Chromium-Nickel-Iron-Molybdenum-Copper-Columbium Alloy N08020	1252
NFN-13	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Iron-Chromium-Silicon Alloy N08330	1253
NFN-14	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Chromium-Molybdenum Alloy N06455	1254
NFN-15	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Molybdenum Alloy N06002	1255
NFN-16	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel-Molybdenum Alloy N10665	1256
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)	1257
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	1258
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	1259
NFN-20	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Work-Hardened Nickel	1260
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)	1261
NFN-22	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution Annealed Ni-Cr-Mo-Cb Alloy, Grade 2 N06625	1262
NFN-23	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cold Worked Nickel-Iron-Chromium Alloy N08800	1263
NFN-24	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel Alloy N06230	1264
NFN-25	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Stress Relieved Nickel Alloy N02200	1265
NFN-26	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy S31277	1266
NFN-27	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy N06035	1267
NFT-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Unalloyed Titanium Grade 3 (UNS R50550)	1268
NFT-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Unalloyed Titanium Grade 2 (UNS R50400)	1269
NFT-3	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 1 (UNS R50250)	1270
NFT-4	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 9 Alloy (UNS R56320)	1271
NFT-5	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 12 Alloy (UNS R53400)	1272
NFT-6	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 38 (UNS R54250)	1273
NFZ-1	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Zirconium Alloy (UNS R60702)	1274

NFZ-2	Chart for Determining Shell Thickness of Components Under External Pressure Developed for Zirconium Alloy (UNS R60705)	1275
3-500.1	Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under External Pressure	1333
3-500.2	Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under Axial Compression	1334
3-500.3	Temperature Limits for Application of Section II External Pressure Charts for Sphere Under External Pressure	1335
3-700.1	Normalization of Test σ - ϵ to σ_{ymin} and E_{code}	1336
E-100.2-1	Permissible Time/Temperature Conditions for Material That Has Been Cold Worked >5% and <20% and Subjected to Short-Time High Temperature Transients	1385
E-100.4-1	S_{mt} — Allowable Stress Intensity Values, MPa, Type 304 SS — 207-YS, 518-UTS (207-YS, 483-UTS)	1388
E-100.4-2	S_{mt} — Allowable Stress Intensity Values, MPa, Type 316 SS — 207-YS, 518-UTS (207-YS, 483-UTS)	1389
E-100.4-3	S_{mt} — Allowable Stress Intensity Values, MPa, Ni-Fe-Cr (Alloy 800H)	1390
E-100.4-4	S_{mt} — Allowable Stress Intensity Values, MPa, 2 $\frac{1}{4}$ Cr-1Mo	1392
E-100.4-5	S_{mt} — Allowable Stress Intensity Values, MPa, 9Cr-1Mo-V	1393
E-100.5-1	S_t — Allowable Stress Intensity Values, MPa, Type 304 SS	1394
E-100.5-2	S_t — Allowable Stress Intensity Values, MPa, Type 316 SS	1395
E-100.5-3	S_t — Allowable Stress Intensity Values, MPa, Ni-Fe-Cr (Alloy 800H)	1396
E-100.5-4	S_t — Allowable Stress Intensity Values, MPa, 2 $\frac{1}{4}$ Cr-1Mo	1397
E-100.5-5	S_t — Allowable Stress Intensity Values, MPa, 9Cr-1Mo-V	1398
E-100.7-1	Expected Minimum Stress-to-Rupture Values, MPa, Type 304 SS	1400
E-100.7-2	Expected Minimum Stress-to-Rupture Values, MPa, Type 316 SS	1401
E-100.7-3	Expected Minimum Stress-to-Rupture Values, MPa, Ni-Fe-Cr (Alloy 800H)	1402
E-100.7-4	Expected Minimum Stress-to-Rupture Values, MPa, 2 $\frac{1}{4}$ Cr-1Mo	1403
E-100.7-5	Expected Minimum Stress-to-Rupture Values, MPa, Ni-Cr-Fe-Mo-Cb (Alloy 718)	1404
E-100.7-6	Expected Minimum Stress-to-Rupture Values, MPa, 9Cr-1Mo-V	1405
E-100.15-1	S_{mt} — Allowable Stress Intensity, Type 304 SS, Bolting	1410
E-100.15-2	S_{mt} — Allowable Stress Intensity, Type 316 SS, Bolting	1411
E-100.15-3	S_{mt} — Allowable Stress Values, MPa, Alloy 718, Bolting	1412
E-100.16-1	Design Fatigue Strain Range, ϵ_t , for 304 SS	1413
E-100.16-2	Design Fatigue Strain Range, ϵ_t , for 316 SS	1414
E-100.16-3	Design Fatigue Strain Range, ϵ_t , for Ni-Fe-Cr Alloy 800H	1415
E-100.16-4	Design Fatigue Strain Range, ϵ_t , for 2 $\frac{1}{4}$ Cr-1Mo Steel	1416
E-100.16-5	Design Fatigue Strain Range, ϵ_t , for 9Cr-1Mo-V Steel	1417
E-100.17-1	Time-Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under Axial Compression	1418
E-100.17-2	Time-Temperature Limits for Application of Section II External Pressure Charts for Sphere Under External Pressure	1419
E-100.17-3	Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under External Pressure	1420
E-100.18-1	Average Isochronous Stress-Strain Curves for Type 304 SS at 427°C	1421
E-100.18-2	Average Isochronous Stress-Strain Curves for Type 304 SS at 454°C	1422
E-100.18-3	Average Isochronous Stress-Strain Curves for Type 304 SS at 482°C	1423
E-100.18-4	Average Isochronous Stress-Strain Curves for Type 304 SS at 510°C	1424
E-100.18-5	Average Isochronous Stress-Strain Curves for Type 304 SS at 538°C	1425
E-100.18-6	Average Isochronous Stress-Strain Curves for Type 304 SS at 566°C	1426
E-100.18-7	Average Isochronous Stress-Strain Curves for Type 304 SS at 593°C	1427
E-100.18-8	Average Isochronous Stress-Strain Curves for Type 304 SS at 621°C	1428
E-100.18-9	Average Isochronous Stress-Strain Curves for Type 304 SS at 649°C	1429
E-100.18-10	Average Isochronous Stress-Strain Curves for Type 304 SS at 677°C	1430
E-100.18-11	Average Isochronous Stress-Strain Curves for Type 304 SS at 704°C	1431
E-100.18-12	Average Isochronous Stress-Strain Curves for Type 304 SS at 732°C	1432
E-100.18-13	Average Isochronous Stress-Strain Curves for Type 304 SS at 760°C	1433

E-100.18-14	Average Isochronous Stress–Strain Curves for Type 304 SS at 788°C	1434
E-100.18-15	Average Isochronous Stress–Strain Curves for Type 304 SS at 816°C	1435
E-100.19-1	Average Isochronous Stress–Strain Curves for Type 316 SS at 427°C	1436
E-100.19-2	Average Isochronous Stress–Strain Curves for Type 316 SS at 454°C	1437
E-100.19-3	Average Isochronous Stress–Strain Curves for Type 316 SS at 482°C	1438
E-100.19-4	Average Isochronous Stress–Strain Curves for Type 316 SS at 510°C	1439
E-100.19-5	Average Isochronous Stress–Strain Curves for Type 316 SS at 538°C	1440
E-100.19-6	Average Isochronous Stress–Strain Curves for Type 316 SS at 566°C	1441
E-100.19-7	Average Isochronous Stress–Strain Curves for Type 316 SS at 593°C	1442
E-100.19-8	Average Isochronous Stress–Strain Curves for Type 316 SS at 621°C	1443
E-100.19-9	Average Isochronous Stress–Strain Curves for Type 316 SS at 649°C	1444
E-100.19-10	Average Isochronous Stress–Strain Curves for Type 316 SS at 677°C	1445
E-100.19-11	Average Isochronous Stress–Strain Curves for Type 316 SS at 704°C	1446
E-100.19-12	Average Isochronous Stress–Strain Curves for Type 316 SS at 732°C	1447
E-100.19-13	Average Isochronous Stress–Strain Curves for Type 316 SS at 760°C	1448
E-100.19-14	Average Isochronous Stress–Strain Curves for Type 316 SS at 788°C	1449
E-100.19-15	Average Isochronous Stress–Strain Curves for Type 316 SS at 816°C	1450
E-100.20-1	Average Isochronous Stress–Strain Curves for Alloy 800H at 427°C and 454°C	1451
E-100.20-2	Average Isochronous Stress–Strain Curves for Alloy 800H at 482°C	1452
E-100.20-3	Average Isochronous Stress–Strain Curves for Alloy 800H at 510°C	1453
E-100.20-4	Average Isochronous Stress–Strain Curves for Alloy 800H at 538°C	1454
E-100.20-5	Average Isochronous Stress–Strain Curves for Alloy 800H at 566°C	1455
E-100.20-6	Average Isochronous Stress–Strain Curves for Alloy 800H at 593°C	1456
E-100.20-7	Average Isochronous Stress–Strain Curves for Alloy 800H at 621°C	1457
E-100.20-8	Average Isochronous Stress–Strain Curves for Alloy 800H at 649°C	1458
E-100.20-9	Average Isochronous Stress–Strain Curves for Alloy 800H at 677°C	1459
E-100.20-10	Average Isochronous Stress–Strain Curves for Alloy 800H at 704°C	1460
E-100.20-11	Average Isochronous Stress–Strain Curves for Alloy 800H at 732°C	1461
E-100.20-12	Average Isochronous Stress–Strain Curves for Alloy 800H at 760°C	1462
E-100.21-1	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 371°C	1463
E-100.21-2	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 399°C	1464
E-100.21-3	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 427°C	1465
E-100.21-4	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 454°C	1466
E-100.21-5	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 482°C	1467
E-100.21-6	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 510°C	1468
E-100.21-7	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 538°C	1469
E-100.21-8	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 566°C	1470
E-100.21-9	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 593°C	1471
E-100.21-10	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 621°C	1472
E-100.21-11	Average Isochronous Stress–Strain Curves for Annealed 2 $\frac{1}{4}$ Cr–1Mo at 649°C	1473
E-100.22-1	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 371°C	1474
E-100.22-2	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 399°C	1474
E-100.22-3	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 426°C	1475
E-100.22-4	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 454°C	1475
E-100.22-5	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 482°C	1476
E-100.22-6	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 510°C	1476
E-100.22-7	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 538°C	1477
E-100.22-8	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 566°C	1477
E-100.22-9	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 593°C	1478
E-100.22-10	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 621°C	1478
E-100.22-11	Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 649°C	1479

TABLES

1A	Section I; Section III, Classes 2 and 3; Section VIII, Division 1; and Section XII Maximum Allowable Stress Values, S , for Ferrous Materials	8
1B	Section I; Section III, Classes 2 and 3; Section VIII, Division 1; and Section XII Maximum Allowable Stress Values, S , for Nonferrous Materials	176
2A	Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5 Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable Stress Values, S , for Ferrous Materials	308
2B	Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5 Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable Stress Values, S , for Nonferrous Materials	402
3	Section III, Division 1, Classes 2 and 3; Section VIII, Divisions 1 and 2; and Section XII Maximum Allowable Stress Values, S , for Bolting Materials	430
4	Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5 Design Stress Intensity Values, S_m , and Section VIII, Division 2 Maximum Allowable Stress Values, S , for Bolting Materials	460
5A	Section VIII, Division 2, Class 2 Maximum Allowable Stress Values, S , for Ferrous Materials	472
5B	Section VIII, Division 2, Class 2 Maximum Allowable Stress Values, S , for Nonferrous Materials	534
6A	Section IV Maximum Allowable Stress Values, S , for Ferrous Materials	560
6B	Section IV Maximum Allowable Stress Values, S , for Nonferrous Materials	570
6C	Section IV Maximum Allowable Stress Values, S , for Lined Water Heater Materials	578
6D	Section IV Maximum Allowable Stress Values, S , for Unlined Water Heater Materials	584
U	Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials	592
Y-1	Yield Strength Values, S_y , for Ferrous and Nonferrous Materials	818
Y-2	Factors for Limiting Permanent Strain in Austenitic Stainless Steels, High-Nickel Alloy Steels, Nickel, Nickel Alloys, Copper, and Copper Alloys	1154
TE-1	Thermal Expansion for Ferrous Materials	1156
TE-2	Thermal Expansion for Aluminum Alloys	1161
TE-3	Thermal Expansion for Copper Alloys	1162
TE-4	Thermal Expansion for Nickel Alloys	1163
TE-5	Thermal Expansion for Titanium Alloys	1173
TCD	Nominal Coefficients of Thermal Conductivity (TC) and Thermal Diffusivity (TD)	1174
TM-1	Moduli of Elasticity E of Ferrous Materials for Given Temperatures	1188
TM-2	Moduli of Elasticity E of Aluminum and Aluminum Alloys for Given Temperatures	1191
TM-3	Moduli of Elasticity E of Copper and Copper Alloys for Given Temperatures	1192
TM-4	Moduli of Elasticity E of High Nickel Alloys for Given Temperatures	1193
TM-5	Moduli of Elasticity E of Titanium and Zirconium for Given Temperatures	1194
PRD	Poisson's Ratio and Density of Materials	1194
G	Tabular Values for Figure G	1276
CS-1	Tabular Values for Figure CS-1	1278
CS-2	Tabular Values for Figure CS-2	1279
CS-3	Tabular Values for Figure CS-3	1280
CS-4	Tabular Values for Figure CS-4	1281
CS-5	Tabular Values for Figure CS-5	1281
CS-6	Tabular Values for Figure CS-6	1282
HT-1	Tabular Values for Figure HT-1	1282
HT-2	Tabular Values for Figure HT-2	1283
HA-1	Tabular Values for Figure HA-1	1283
HA-2	Tabular Values for Figure HA-2	1284
HA-3	Tabular Values for Figure HA-3	1285
HA-4	Tabular Values for Figure HA-4	1285
HA-5	Tabular Values for Figure HA-5	1286
HA-6	Tabular Values for Figure HA-6	1286
HA-7	Tabular Values for Figure HA-7	1287
HA-8	Tabular Values for Figure HA-8	1287

HA-9	Tabular Values for Figure HA-9	1288
HA-10	Tabular Values for Figure HA-10	1289
CI-1	Tabular Values for Figure CI-1	1290
CD-1	Tabular Values for Figure CD-1	1290
CD-2	Tabular Values for Figure CD-2	1290
NFA-1	Tabular Values for Figure NFA-1	1291
NFA-2	Tabular Values for Figure NFA-2	1292
NFA-3	Tabular Values for Figure NFA-3	1293
NFA-4	Tabular Values for Figure NFA-4	1294
NFA-5	Tabular Values for Figure NFA-5	1294
NFA-6	Tabular Values for Figure NFA-6	1295
NFA-7	Tabular Values for Figure NFA-7	1295
NFA-8	Tabular Values for Figure NFA-8	1296
NFA-9	Tabular Values for Figure NFA-9	1296
NFA-10	Tabular Values for Figure NFA-10	1297
NFA-11	Tabular Values for Figure NFA-11	1297
NFA-12	Tabular Values for Figure NFA-12	1298
NFA-13	Tabular Values for Figure NFA-13	1298
NFC-1	Tabular Values for Figure NFC-1	1298
NFC-2	Tabular Values for Figure NFC-2	1299
NFC-3	Tabular Values for Figure NFC-3	1299
NFC-4	Tabular Values for Figure NFC-4	1300
NFC-5	Tabular Values for Figure NFC-5	1300
NFC-6	Tabular Values for Figure NFC-6	1301
NFC-7	Tabular Values for Figure NFC-7	1301
NFC-8	Tabular Values for Figure NFC-8	1302
NFN-1	Tabular Values for Figure NFN-1	1302
NFN-2	Tabular Values for Figure NFN-2	1303
NFN-3	Tabular Values for Figure NFN-3	1303
NFN-4	Tabular Values for Figure NFN-4	1304
NFN-5	Tabular Values for Figure NFN-5	1304
NFN-6	Tabular Values for Figure NFN-6	1305
NFN-7	Tabular Values for Figure NFN-7	1305
NFN-8	Tabular Values for Figure NFN-8	1306
NFN-9	Tabular Values for Figure NFN-9	1307
NFN-10	Tabular Values for Figure NFN-10	1308
NFN-11	Tabular Values for Figure NFN-11	1308
NFN-12	Tabular Values for Figure NFN-12	1309
NFN-13	Tabular Values for Figure NFN-13	1309
NFN-14	Tabular Values for Figure NFN-14	1310
NFN-15	Tabular Values for Figure NFN-15	1311
NFN-16	Tabular Values for Figure NFN-16	1312
NFN-17	Tabular Values for Figure NFN-17	1313
NFN-18	Tabular Values for Figure NFN-18	1314
NFN-19	Tabular Values for Figure NFN-19	1315
NFN-20	Tabular Values for Figure NFN-20	1316
NFN-22	Tabular Values for Figure NFN-22	1316
NFN-23	Tabular Values for Figure NFN-23	1317
NFN-24	Tabular Values for Figure NFN-24	1317
NFN-25	Tabular Values for Figure NFN-25	1318
NFN-26	Tabular Values for Figure NFN-26	1318
NFN-27	Tabular Values for Figure NFN-27	1319
NFT-1	Tabular Values for Figure NFT-1	1320
NFT-2	Tabular Values for Figure NFT-2	1321
NFT-3	Tabular Values for Figure NFT-3	1321
NFT-4	Tabular Values for Figure NFT-4	1322

NFT-5	Tabular Values for Figure NFT-5	1323
NFT-6	Tabular Values for Figure NFT-6	1324
NFZ-1	Tabular Values for Figure NFZ-1	1325
NFZ-2	Tabular Values for Figure NFZ-2	1325
1-100	Criteria for Establishing Allowable Stress Values for Tables 1A and 1B	1327
2-100(a)	Criteria for Establishing Design Stress Intensity Values for Tables 2A and 2B	1329
2-100(b)	Criteria for Establishing Allowable Stress Values for Table 3	1330
2-100(c)	Criteria for Establishing Allowable Stress or Design Stress Intensity Values for Table 4	1330
5-100	Hot Isostatically Pressed Component Requirements for Austenitic Stainless Steels, Austenitic-Ferritic (Duplex) Stainless Steels, Martensitic Stainless Steels, Ferritic Steels, and Nickel Alloys	1339
5-800	ASTM Test Methods and Units for Reporting	1342
5-1500	Example of a Comparison of Allowable Stresses of Base Metals With Compositions Similar to Those of Selected Welding Consumables and the Proposed New Base Metal	1345
6-100(a)	Criteria for Establishing Allowable Stress Values for Tables 6A and 6B	1349
6-100(b)	Criteria for Establishing Allowable Stress Values for Table 6C	1349
6-100(c)	Criteria for Establishing Allowable Stress Values for Table 6D	1349
9-100	Standard Units for Use in Equations	1352
10-100	Criteria for Establishing Allowable Stress Values for Tables 5A and 5B	1354
E-100.1-1	Tensile Strength Values, S_u	1383
E-100.1-2	Tensile and Yield Strength Reduction Factor Due to Long Time Prior Elevated Temperature Service	1384
E-100.1-3	Yield Strength Reduction Factors for 2 $\frac{1}{4}$ Cr-1Mo	1384
E-100.1-4	Tensile Strength Reduction Factors for 2 $\frac{1}{4}$ Cr-1Mo	1384
E-100.1-5	Tensile Strength Reduction Factors for 9Cr-1Mo-V	1385
E-100.3-1	Permissible Base Materials for Structures Other Than Bolting	1386
E-100.3-2	Permissible Weld Materials	1387
E-100.3-3	S_o — Maximum Allowable Stress Intensity, MPa, for Design Condition Calculations	1387
E-100.6-1	Yield Strength Values, S_y , Versus Temperature	1399
E-100.8-1	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E308T and E308LT, SFA-5.4 E308 and E308L, and SFA-5.9 ER308 and ER308L	1406
E-100.8-2	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 EXXXT-G (16-8-2 Chemistry), SFA-5.4 E16-8-2, and SFA-5.9 ER16-8-2	1406
E-100.8-3	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E316T and E316LT-1, -2, and -3; SFA-5.4 E316 and E316L; and SFA-5.9 ER316 and ER316L	1406
E-100.9-1	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E308T and E308LT, SFA-5.4 E308 and E308L, and SFA-5.9 ER308 and ER308L	1407
E-100.9-2	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 EXXXT-G (16-8-2 Chemistry), SFA-5.4 E16-8-2, and SFA-5.9 ER16-8-2	1407
E-100.9-3	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E316T and E316LT-1 and -2, SFA-5.4 E316 and E316L, and SFA-5.9 ER316 and ER316L	1407
E-100.10-1	Stress Rupture Factors for Alloy 800H Welded With SFA-5.11 ENiCrFe-2 (INCO A)	1408
E-100.10-2	Stress Rupture Factors for Alloy 800H Welded With SFA-5.14 ERNiCr-3 (INCO 82)	1408
E-100.11-1	Stress Rupture Factors for 2 $\frac{1}{4}$ Cr-1Mo (415/205) Welded With SFA-5.28 E90C-B3, SFA-5.28 ER90S-B3, SFA-5.5 E90XX-B3 (>0.05C), SFA-5.23 EB3, SFA-5.23 ECB3 (>0.05C), and SFA-5.29 E90T1-B3 (>0.05C)	1408
E-100.12-1	Stress Rupture Factors for 9Cr-1Mo-V Welded With SFA-5.28 ER90S-B9, SFA-5.5 E90XX-B9, and SFA-5.23 EB9	1409
E-100.13-1	Permissible Materials for Bolting	1409
E-100.14-1	S_o — Maximum Allowable Stress Intensity, MPa, for Design Condition Calculations of Bolting Materials	1410
E-100.23-1	Recommended Restrictions	1480
E-100.24-1	Cross-Reference Table of Section II, Part D and Section III, Subsection NH 2015 Edition	1480
ENDNOTES		1485

LIST OF SECTIONS

(25)

SECTIONS

- I Rules for Construction of Power Boilers
- II Materials
 - Part A — Ferrous Material Specifications
 - Part B — Nonferrous Material Specifications
 - Part C — Specifications for Welding Rods, Electrodes, and Filler Metals
 - Part D — Properties (Customary)
 - Part D — Properties (Metric)
- III Rules for Construction of Nuclear Facility Components
 - Subsection NCA — General Requirements for Division 1 and Division 2
 - Appendices
 - Division 1
 - Subsection NB — Class 1 Components
 - Subsection NCD — Class 2 and Class 3 Components
 - Subsection NE — Class MC Components
 - Subsection NF — Supports
 - Subsection NG — Core Support Structures
 - Division 2 — Code for Concrete Containments
 - Division 3 — Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
 - Division 4 — Fusion Energy Devices
 - Division 5 — High Temperature Reactors
- IV Rules for Construction of Heating Boilers
- V Nondestructive Examination
- VI Recommended Rules for the Care and Operation of Heating Boilers
- VII Recommended Guidelines for the Care of Power Boilers
- VIII Rules for Construction of Pressure Vessels
 - Division 1
 - Division 2 — Alternative Rules
 - Division 3 — Alternative Rules for Construction of High Pressure Vessels
- IX Welding, Brazing, and Fusing Qualifications
- X Fiber-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Reactor Facility Components
 - Division 1 — Rules for Inservice Inspection of Nuclear Power Plant Components
 - Division 2 — Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Reactor Facilities
- XII Rules for Construction and Continued Service of Transport Tanks
- XIII Rules for Overpressure Protection

FOREWORD^{*}

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

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

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

The Committee’s function is to establish rules of safety relating to pressure integrity. The rules govern the construction^{**} of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. For nuclear items other than pressure-retaining components, the Committee also establishes rules of safety related to structural integrity. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. The 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 and, for nuclear items other than pressure-retaining components, structural 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 components addressed by the Code. 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.

The 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 judgment* 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

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

^{**} *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection.

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.

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 the Code. Requests for revisions, new rules, Code cases, or interpretations shall be addressed to the staff secretary in writing and shall give full particulars in order to receive consideration and action (see the Correspondence With the Committee page). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at <http://go.asme.org/BPVCPublicReview> to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

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

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

When required by context in the Code, the singular shall be interpreted as the plural, and vice versa.

The words "shall," "should," and "may" are used in the Code as follows:

- *Shall* is used to denote a requirement.
- *Should* is used to denote a recommendation.
- *May* is used to denote permission, neither a requirement nor a recommendation.

STATEMENT OF POLICY ON THE USE OF THE ASME SINGLE 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 ASME Single 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 ASME Single Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the ASME Single 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 ASME Single 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 ASME Single 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 ASME Single 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 ASME Single Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the ASME Single Certification Mark.

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 ASME Single Certification Mark described in the governing Section of the Code.

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME” or the ASME Single 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.

PERSONNEL

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

January 1, 2025

TECHNICAL OVERSIGHT MANAGEMENT COMMITTEE (TOMC)

R. E. McLaughlin, *Chair*
N. A. Finney, *Vice Chair*
S. J. Rossi, *Staff Secretary*
R. W. Barnes
T. L. Bedeaux
C. T. Brown
R. P. Deubler
G. W. Galanes
J. A. Hall
T. E. Hansen
G. W. Hembree
R. B. Keating
B. Linnemann
W. M. Lundy
D. I. Morris

M. D. Rana
S. C. Roberts
F. J. Schaaf, Jr.
G. Scribner
W. J. Sperko
D. Srnic
R. W. Swayne
J. Vattappilly
M. Wadkinson
D. W. Lamond, *Ex-Officio Member*
B. K. Nutter, *Ex-Officio Member*
E. M. Ortman, *Ex-Officio Member*
M. J. Pischke, *Ex-Officio Member*
J. F. Henry, *Honorary Member*

Task Group on Remote Inspection and Examination (SI-TOMC)

S. C. Roberts, *Chair*
M. Frediani, *Staff Secretary*
P. J. Coco
N. A. Finney
S. A. Marks
R. Rockwood

C. Stevens
M. Tannenbaum
J. Cameron, *Alternate*
A. Byk, *Contributing Member*
S. J. Rossi, *Contributing Member*
C. A. Sanna, *Contributing Member*

Special Working Group on High Temperature Technology (TOMC)

D. Dewees, *Chair*
F. W. Brust
T. D. Burchell
P. R. Donavin

B. F. Hantz
R. I. Jetter
P. Smith

Subgroup on Research and Development (TOMC)

S. C. Roberts, *Chair*
S. J. Rossi, *Staff Secretary*
R. W. Barnes
N. A. Finney
G. W. Galanes

R. B. Keating
R. E. McLaughlin
E. M. Ortman
D. Andrei, *Contributing Member*

Honors and Awards Committee (TOMC)

E. M. Ortman,
G. W. Galanes
D. W. Lamond

B. K. Nutter
R. E. McLaughlin

Subgroup on Strategic Initiatives (TOMC)

N. A. Finney, *Chair*
S. J. Rossi, *Staff Secretary*
R. W. Barnes
G. W. Galanes
G. W. Hembree

R. B. Keating
R. E. McLaughlin
E. M. Ortman
S. C. Roberts
M. Wadkinson

ADMINISTRATIVE COMMITTEE

R. E. McLaughlin, *Chair*
N. A. Finney, *Vice Chair*
S. J. Rossi, *Staff Secretary*
G. W. Galanes
R. B. Keating
D. W. Lamond
B. Linnemann

B. K. Nutter
E. M. Ortman
M. J. Pischke
M. D. Rana
S. C. Roberts
R. R. Stevenson
M. Wadkinson

Task Group on Field Sites (TOMC)

R. V. Wielgoszinski, *Chair*
M. Vazquez, *Staff Secretary*
P. Becker
T. Bedeaux

J. Hoskinson
D. T. Peters
G. Scribner

MARINE CONFERENCE GROUP

J. Oh, *Staff Secretary*
J. G. Hungerbuhler, Jr.
G. Nair

H. N. Patel
N. Prokopuk
J. D. Reynolds

CONFERENCE COMMITTEE

R. D. Troutt — Texas, *Chair*
J. T. Amato — Ohio, *Secretary*
M. O. Amuzie — New Jersey
R. Becker — Colorado
H. Berny — Minnesota
T. D. Boggs — Missouri
R. A. Boillard — Indiana
D. P. Brockerville —
Newfoundland and Labrador,
Canada
R. J. Bunte — Iowa
A. Buquis — Arizona
J. H. Burpee — Maine
M. Carlson — Washington
T. Carter — Mississippi
N. Chiasson — Prince Edward
Island, Canada
T. G. Clark — Oregon
B. J. Crawford — Georgia
E. L. Creaser — New Brunswick,
Canada
J. J. Dacanay — Hawaii
M. Davidian — California
R. DeLury — Manitoba, Canada
A. Denham — Michigan
C. Derks — Wisconsin
C. Dinic — Ontario, Canada
D. A. Ehler — Nova Scotia, Canada
S. D. Frazier — Washington
A. Gibbs — Wisconsin
T. J. Granneman II — Oklahoma
M. L. Jordan — Kentucky
R. Kamboj — British Columbia,
Canada
E. Kawa — Massachusetts
A. Khssassi — Quebec, Canada
D. Kinney — North Carolina
K. S. Lane — Alaska
A. M. Lorimor — South Dakota
T. Maher — Illinois
M. Mailman — Northwest
Territories, Canada
W. McGivney — City of New York,
New York
S. F. Noonan — Maryland
B. S. Oliver — New Hampshire
J. L. Oliver — Nevada
P. B. Polick — Illinois
B. Ricks — Montana
W. J. Ross — Pennsylvania
M. H. Sansone — New York
T. S. Seime — North Dakota
C. S. Selinger — Saskatchewan,
Canada
J. E. Sharier — Ohio
R. Spiker — North Carolina
D. Srnic — Alberta, Canada
D. J. Stenrose — Michigan
R. J. Stimson II — Kansas
R. K. Sturm — Utah
D. K. Sullivan — Arkansas
J. Taveras — Rhode Island
R. Termini — Louisiana
S. Van Slavens — Delaware
D. M. Warburton — Florida
E. Wiggins — Alabama

INTERNATIONAL INTEREST REVIEW GROUP

V. Felix
Y.-G. Kim
S. H. Leong
W. Lin
O. F. Manafa
C. Minu
Y.-W. Park
A. R. Reynaga Nogales
P. Williamson

COMMITTEE ON POWER BOILERS (BPV I)

E. M. Ortman, *Chair*
D. E. Tompkins, *Vice Chair*
U. D'Urso, *Staff Secretary*
D. I. Anderson
R. Antoniuk
J. L. Arnold
K. K. Coleman
S. Fincher
G. W. Galanes
P. F. Gilston
T. E. Hansen
J. S. Hunter
M. Ishikawa
M. Lemmons
M. Lewis
C. T. McDaris
R. E. McLaughlin
L. Moedinger
Y. Oishi
M. Ortolani
A. Spangenberg
D. E. Tuttle
J. Vattappilly
M. Wadkinson
F. Zeller
H. Michael, *Contributing Member*
D. Berger, *Honorary Member*
P. D. Edwards, *Honorary Member*
J. G. Feldstein, *Honorary Member*
D. N. French, *Honorary Member*
J. Hainsworth, *Honorary Member*
J. F. Henry, *Honorary Member*
P. A. Molvie, *Honorary Member*
J. T. Pillow, *Honorary Member*
B. W. Roberts, *Honorary Member*
J. M. Tanzosh, *Honorary Member*
R. V. Wielgoszinski, *Honorary Member*
R. L. Williams, *Honorary Member*

Executive Committee (BPV I)

D. E. Tompkins, *Chair*
E. M. Ortman, *Vice Chair*
P. Becker
J. R. Braun
P. F. Gilston
A. Hantodkar
M. Lewis
C. T. McDaris
L. S. Nicol
A. Spangenberg
K. Thanupillai
M. Wadkinson

Subgroup on Design (BPV I)

C. T. McDaris, *Chair*
L. S. Tsai, *Secretary*
T. K. Acharya
D. I. Anderson
P. Becker
T. Huynh
L. Krupp
N. S. Ranck
J. Vattappilly
M. Wadkinson
C. Welles

Subgroup on Fabrication and Examination (BPV I)

P. F. Gilston, *Chair*
P. Becker, *Vice Chair*
J. L. Arnold
K. K. Coleman
S. Fincher
G. W. Galanes
T. E. Hansen
M. Lewis
S. J. Lombardo
C. T. McDaris
R. E. McLaughlin
Y. Oishi

Subgroup on General Requirements and Piping (BPV I)

D. E. Tompkins, *Chair*
M. Wadkinson, *Vice Chair*
M. Lemmons, *Secretary*
R. Antoniuk
T. E. Hansen
M. Ishikawa
S. J. Lombardo
R. E. McLaughlin
L. Moedinger
E. M. Ortman
D. E. Tuttle
J. Vattappilly

Subgroup on Locomotive Boilers (BPV I)

J. R. Braun, *Chair*
S. M. Butler, *Secretary*
G. W. Galanes
S. A. Lee
L. Moedinger
G. M. Ray
M. W. Westland

Subgroup on Materials (BPV I)

M. Lewis, *Chair*
L. S. Nicol, *Vice Chair*
S. H. Bowes
K. K. Coleman
G. W. Galanes
P. F. Gilston
K. Hayes
J. S. Hunter
E. Liebl
F. Masuyama
M. Ortolani
D. W. Rahoi
F. Zeller
B. W. Roberts, *Contributing Member*
J. M. Tanzosh, *Contributing Member*

Subgroup on Solar Boilers (BPV I)

R. E. Hearne, *Secretary*
S. Fincher
J. S. Hunter
P. Swarnkar

Task Group on Additive Manufacturing (BPV I)

K. K. Coleman, *Chair*
P. Becker, *Secretary*
J. L. Arnold
G. W. Galanes
P. F. Gilston
L. Moedinger
J. Vattappilly

Task Group on Modernization (BPV I)

S. J. Lombardo, <i>Chair</i>	G. W. Galanes
U. D'Urso, <i>Staff Secretary</i>	R. E. McLaughlin
D. I. Anderson	E. M. Ortman
J. L. Arnold	D. E. Tuttle

European International Working Group (BPV I)

A. Spangenberg, <i>Chair</i>	H. Michael
B. Daume	F. Miunske
J. Fleischfresser	M. Sykora
C. Jaekel	P. Chavdarov, <i>Contributing Member</i>
R. Kauer	J. Henrichsmeyer, <i>Contributing Member</i>
D. Koelbl	B. Müller, <i>Contributing Member</i>
S. Krebs	
T. Ludwig	
R. A. Meyers	

India International Working Group (BPV I)

K. Thanupillai, <i>Chair</i>	R. Madnani
A. Hantodkar, <i>Vice Chair</i>	S. Purkait
A. Ghosh, <i>Secretary</i>	A. Relekar
P. Brahma	M. Shiroya
H. Dalal	D. K. Shrivastava
T. Dhanraj	K. Singha
A. S. Ganesh	R. Sundararaj
S. Gopalakrishnan	S. Velu
A. Jain	S. Venkataramana

COMMITTEE ON MATERIALS (BPV II)

G. W. Galanes, <i>Chair</i>	F. Zeller
M. Ortolani, <i>Vice Chair</i>	J. Cameron, <i>Contributing Member</i>
C. E. Rodrigues, <i>Staff Secretary</i>	A. Chaudouet, <i>Contributing Member</i>
A. Appleton	K. K. Coleman, <i>Contributing Member</i>
P. Chavdarov	D. W. Gandy, <i>Contributing Member</i>
J. F. Grubb	K. L. Hayes, <i>Contributing Member</i>
J. A. Hall	W. Hoffelner, <i>Contributing Member</i>
D. O. Henry	K. E. Orie, <i>Contributing Member</i>
K. M. Hottle	D. T. Peters, <i>Contributing Member</i>
M. Ishikawa	B. W. Roberts, <i>Contributing Member</i>
M. Kowalczyk	J. M. Tanzosh, <i>Contributing Member</i>
D. L. Kurler	E. Uptis, <i>Contributing Member</i>
F. Masuyama	T. M. Cullen, <i>Honorary Member</i>
S. Neilsen	G. C. Hsu, <i>Honorary Member</i>
L. S. Nicol	
D. W. Raho	
W. Ren	
E. Shapiro	
R. C. Sutherland	

Executive Committee (BPV II)

G. W. Galanes, <i>Chair</i>	K. L. Hayes
C. E. Rodrigues, <i>Staff Secretary</i>	K. M. Hottle
E. Alexis	W. MacDonald
A. Appleton	M. Ortolani
J. Cameron	P. K. Rai
P. Chavdarov	J. Robertson
J. F. Grubb	E. Shapiro
S. Guzey	

Subgroup on External Pressure (BPV II)

E. Alexis, <i>Chair</i>	J. F. Grubb
S. Guzey, <i>Vice Chair</i>	S. Krishnamurthy
J. A. A. Morrow, <i>Secretary</i>	D. L. Kurler
L. F. Campbell	R. W. Mikitka
H. Chen	P. K. Rai
M. Ghorashi	M. Wadkinson
D. S. Griffin	

Subgroup on Ferrous Specifications (BPV II)

K. M. Hottle, <i>Chair</i>	Y.-J. Kim
A. Appleton, <i>Vice Chair</i>	W. C. Mack
C. Hyde, <i>Secretary</i>	J. Nickel
D. Amire-Brahimi	D. Poweleit
G. Cuccio	R. Rezaeifar
O. Elkadim	R. Schmidt
D. Fialkowski	E. Uptis
J. Grimm	L. Watzke
J. F. Grubb	C. Meloy, <i>Contributing Member</i>
D. S. Janikowski	

Subgroup on International Material Specifications (BPV II)

P. Chavdarov, <i>Chair</i>	D. O. Henry
M. Ishikawa, <i>Vice Chair</i>	W. M. Lundy
C. Zhou, <i>Secretary</i>	F. Zeller
A. Chaudouet	T. F. Miskell, <i>Contributing Member</i>
H. Chen	E. Uptis, <i>Contributing Member</i>
A. F. Garbolevsky	

Subgroup on Nonferrous Alloys (BPV II)

J. Robertson, <i>Chair</i>	R. Rezaeifar
W. MacDonald, <i>Vice Chair</i>	E. Shapiro
R. M. Beldyk	J. Shubilla
J. M. Downs	R. C. Sutherland
H. Dutta	R. Wright
J. F. Grubb	S. Yem
J. A. Hall	D. B. Denis, <i>Contributing Member</i>
D. Maitra	D. T. Peters, <i>Contributing Member</i>
D. W. Raho	

Subgroup on Physical Properties (BPV II)

P. K. Rai, <i>Chair</i>	P. K. Lam
S. Neilsen, <i>Vice Chair</i>	D. W. Raho
D. Chandiramani	E. Shapiro
H. Eshraghi	D. K. Verma
J. F. Grubb	S. Yem
B. F. Hantz	D. B. Denis, <i>Contributing Member</i>
R. D. Jones	

Subgroup on Strength, Ferrous Alloys (BPV II)

M. Ortolani, <i>Chair</i>	F. Masuyama
S. Rosinski, <i>Vice Chair</i>	M. Osterfoss
L. S. Nicol, <i>Secretary</i>	D. W. Raho
G. W. Galanes	M. Ueyama
J. A. Hall	F. Zeller
M. Ishikawa	F. Abe, <i>Contributing Member</i>
S. W. Knowles	

Subgroup on Strength of Weldments (BPV II & BPV IX)

K. L. Hayes, <i>Chair</i>	W. F. Newell, Jr.
G. W. Galanes, <i>Vice Chair</i>	J. A. Penso
S. H. Bowes, <i>Secretary</i>	D. W. Rahoi
K. K. Coleman, <i>Chair</i>	W. J. Sperko
M. Denault	J. P. Swezy, Jr.
D. W. Gandy	B. W. Roberts, <i>Contributing Member</i>
M. Ghahremani	

China International Working Group (BPV II)

Sanjiang Liu, <i>Chair</i>	C. Wang
H. Zhang, <i>Vice Chair</i>	Jinguang Wang
T. Xu, <i>Secretary</i>	Jiongxiang Wang
W. Cai	Q.-J. Wang
W. Fang	H.-C. Yang
F. Kong	J. Yang
H. Li	L. Yin
J. Li	X.-H. Zhang
Z. Rongcan	Y. Zhang
S. Tan	

COMMITTEE ON CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS (BPV III)**Working Group on Creep Strength Enhanced Ferritic Steels (BPV II)**

M. Ortolani, <i>Chair</i>	J. J. Sanchez-Hanton
G. W. Galanes, <i>Vice Chair</i>	J. A. Siefert
P. Becker, <i>Secretary</i>	W. J. Sperko
S. H. Bowes	F. Zeller
K. Kimura	F. Abe, <i>Contributing Member</i>
M. Lang	K. K. Coleman, <i>Contributing Member</i>
S. Luke	J. M. Tanzosh, <i>Contributing Member</i>
F. Masuyama	
T. Melfi	
W. F. Newell, Jr.	

R. B. Keating, <i>Chair</i>	K. Matsunaga
T. M. Adams, <i>Vice Chair</i>	B. McGlone
D. E. Matthews, <i>Vice Chair</i>	S. McKillop
A. Maslowski, <i>Staff Secretary</i>	J. B. McLean
A. Appleton	J. C. Minichiello
S. Asada	M. N. Mitchell
R. W. Barnes	T. Nagata
W. H. Borter	J. B. Ossmann
M. E. Cohen	S. Pellet
R. P. Deubler	E. L. Pleins
P. R. Donavin	W. J. Sperko
A. C. Eberhardt	Y. J. Wang
J. V. Gardiner	W. Windes
W. J. Geringer	C. Basavaraju, <i>Alternate</i>
J. Grimm	T. P. Davis, <i>Contributing Member</i>
S. Hunter	T.-L. Sham, <i>Contributing Member</i>
R. I. Jetter	C. T. Smith, <i>Contributing Member</i>
J. I. Kim	R. M. Jessee, <i>Honorary Member</i>
G. H. Koo	E. B. Branch, <i>Honorary Member</i>
D. W. Lewis	M. N. Bressler, <i>Honorary Member</i>
M. A. Lockwood	G. D. Cooper, <i>Honorary Member</i>
D. W. Mann	D. F. Landers, <i>Honorary Member</i>
K. A. Manoly	C. Pieper, <i>Honorary Member</i>

Working Group on Data Analysis and the Materials Properties Database (BPV II)

W. MacDonald, <i>Chair</i>	D. Andrei, <i>Contributing Member</i>
C. E. Rodrigues, <i>Staff Secretary</i>	J. Cameron, <i>Contributing Member</i>
J. F. Grubb	G. W. Galanes, <i>Contributing Member</i>
F. Masuyama	W. C. Mack, <i>Contributing Member</i>
S. Neilsen	D. T. Peters, <i>Contributing Member</i>
M. Ortolani	W. Ren, <i>Contributing Member</i>
R. C. Sutherlin	E. Shapiro, <i>Contributing Member</i>
M. J. Swindeman	
F. Abe, <i>Contributing Member</i>	

Executive Committee (BPV III)

R. B. Keating, <i>Chair</i>	K. A. Manoly
A. Maslowski, <i>Secretary</i>	D. E. Matthews
T. M. Adams	B. McGlone
T. P. Davis	S. McKillop
P. R. Donavin	J. B. McLean
D. W. Lewis	Yanli Wang
D. Mann	K. A. Kavanagh, <i>Alternate</i>

Task Group on Modernization of Materials Data (BPV II)

C. E. Rodrigues, <i>Staff Secretary</i>	S. Neilsen
E. Alexis	L. S. Nicol
M. Brijlani	W. Ren
D. B. Denis	J. C. Sowinski
G. W. Galanes	M. Wadkinson
J. A. Hall	J. Cameron, <i>Contributing Member</i>
B. F. Hantz	J. F. Grubb, <i>Contributing Member</i>
A. Hassan	W. Hoffelner, <i>Contributing Member</i>
W. MacDonald	

Latin America International Working Group (BPV III)

M. F. Liendo, <i>Chair</i>	A. J. Dall'Osto
J. Fernández, <i>Vice Chair</i>	J. I. Duo
O. Martinez, <i>Staff Secretary</i>	M. M. Gamizo
P. Yamamoto, <i>Secretary</i>	I. M. Guerreiro
E. H. Aldaz	I. A. Knorr
G. O. Anteri	D. E. Matthews
A. P. Antipasti	A. E. Pastor
D. O. Bordato	M. Rivero
G. Bourguigne	R. Taboada
M. Brusa	O. A. Verastegui
A. Claus	M. D. Vigliano
R. G. Cocco	M. Zunino

China International Working Group (BPV III)

Yong Wang, <i>Chair</i>	C. Peiyin
J. Gu, <i>Vice Chair</i>	Z. Sun
C. Jiang, <i>Vice Chair</i>	G. Tang
H. Yu, <i>Secretary</i>	L. Ting
L. Feng	J. Wen
L. Guo	F. Wu
D. Kang	C. Yang
Y. Li	P. Yang
H. Lin	W. Yang
Shenghua Liu	H. Yin
W. Liu	D. Yuangang
J. Ma	D. Zhao
K. Mao	Z. Zhong
D. E. Matthews	Q. Zhou
J. Ming	H. Zhu
W. Pei	

Korea International Working Group (BPV III)

G. H. Koo, <i>Chair</i>	B. Lee
O.-S. Kim, <i>Secretary</i>	D. Lee
H. Ahn	D. W. Lee
S. Cho	Sanghoon Lee
G.-S. Choi	Sungjae Lee
M. Choi	S.-G. Lee
M.-J. Choi	H. Lim
S. Choi	I.-K. Nam
J. Y. Hong	C.-K. Oh
N.-S. Huh	C.-Y. Oh
S. S. Hwang	E.-J. Oh
C. Jang	C. Park
I.-S. Jeong	H. Park
S. H. Kang	Y.-H. Park
J. Kim	Y. S. Pyun
J. I. Kim	J. H. Seo
J.-S. Kim	T. Shin
M.-W. Kim	S. Song
S.-S. Kim	T.-K. Song
Y.-B. Kim	W. J. Sperko
Y.-S. Kim	J. S. Yang
D. Kwon	O. Yoo

European International Working Group (BPV III)

J. Wendt, <i>Chair</i>	F. Juettemann
D. Koelbl, <i>Vice Chair</i>	M. H. Koeppen
R. Gersinska, <i>Secretary</i>	C. Kuschke
P. Ancion	H.-W. Lange
P. R. Donavin	T. Ludwig
R. Döring	M. Reichert
C. G. Frantescu	G. Roos
T. Hantzka	J. Rudolph
A. Huber	L. Sybertz
R. E. Hueggenberg	I. Tewes
E. Iacopetta	R. Tiete
A. Juengert	F. Wille

Seismic Design Steering Committee (BPV III)

T. M. Adams, <i>Chair</i>	R. M. Pace
K. Gresh, <i>Secretary</i>	M. Pérès
C. Basavaraju	K. Shibukuwa
D. Chowdhury	F. G. Abatt, <i>Contributing Member</i>
R. Döring	M. Arcaro, <i>Contributing Member</i>
G. H. Koo	P. R. Donavin, <i>Contributing Member</i>
A. Maekawa	
J. B. McLean	R. W. Haupt, <i>Contributing Member</i>

Task Group on Alternate Requirements (BPV III)

J. Wen, <i>Chair</i>	K. A. Manoly
R. R. Romano, <i>Secretary</i>	D. E. Matthews
T. Basso	S. McKillop
P. J. Coco	B. P. Nolan
P. R. Donavin	J. B. Ossmann
J. V. Gardiner	E. C. Renaud
F. Grant	M. A. Richter
J. Grimm	R. Summitt
R. S. Hill III	K. Voelsing
M. Kris	Yanli Wang
M. A. Lockwood	I. H. Tseng, <i>Alternate</i>

India International Working Group (BPV III)

S. B. Parkash, <i>Chair</i>	T. Mukherjee
V. Sehgal, <i>Vice Chair</i>	D. Narain
M. Brijlani, <i>Secretary</i>	A. D. Paranjpe
S. Aithal	J. R. Patel
A. D. Bagdare	E. L. Pleins
H. Dalal	S. Ponnappan
S. K. Goyal	T. J. P. Rao
D. Kulkarni	S. Singh
Raj Kumar	B. K. Sreedhar
Ritesh Kumar	N. Mistry, <i>Alternate</i>
S. Kumar	

United Kingdom International Working Group (BPV III)

P. M. James, <i>Chair</i>	S. A. Jones
J. Emslie, <i>Vice Chair</i>	B. McGlone
C. B. Carpenter, <i>Secretary</i>	B. Pellereau
T. Bann	E. I. S. Pendry
M. J. Chevalier	J. Randles
A. J. Cole-Baker	C. R. Schneider
M. Consonni	J. W. Stairmand
M. J. Crathorne	J. Sulley
P. Gill	J. Talamantes-Silva
G. Innes	A. J. Holt, <i>Contributing Member</i>

Special Working Group on New Plant Construction Issues (BPV III)

J. B. Ossmann, <i>Chair</i>	Z. McLucas
A. Maslowski, <i>Staff Secretary</i>	N. J. McTiernan
M. C. Buckley, <i>Secretary</i>	K. Pigg
M. Arcaro	E. L. Pleins
K. Burnett	J. Pollak
A. Cardillo	D. W. Sandusky
P. J. Coco	M. C. Scott
K. Harris	R. R. Stevenson
E. Henry	H. Xu
J. Honcharik	J. Yan
M. Kris	J. C. Minichiello, <i>Contributing Member</i>
R. E. McLaughlin	
A. McLendon	

Special Working Group on Editing and Review (BPV III)

D. E. Matthews, <i>Chair</i>	J. C. Minichiello
R. P. Deubler	J. F. Strunk
A. C. Eberhardt	Yanli Wang
S. Hunter	C. Wilson
B. McGlone	

Special Working Group on HDPE Stakeholders (BPV III)

S. Patterson, <i>Secretary</i>	J. E. O'Sullivan
M. Kuntz	

Special Working Group on Honors and Awards (BPV III)

R. W. Barnes, <i>Chair</i>	D. E. Matthews
A. Appleton	J. C. Minichiello
R. M. Jessee	

Special Working Group on International Meetings and IWG Liaisons (BPV III)

D. E. Matthews, <i>Chair</i>	P. R. Donavin
A. Maslowski, <i>Staff Secretary</i>	E. L. Pleins
R. W. Barnes	W. J. Sperko

Joint ACI-ASME Committee on Concrete Components for Nuclear Service (BPV III)

J. B. McLean, <i>Chair</i>	J. S. Saini
L. J. Colarusso, <i>Vice Chair</i>	J. F. Strunk
A. Dinizulu, <i>Staff Secretary</i>	G. Thomas
S. Bae	A. Varma
C. J. Bang	S. Wang
A. C. Eberhardt	A. Istar, <i>Alternate</i>
B. D. Hovis	A. Adediran, <i>Contributing Member</i>
T. C. Inman	J.-B. Domage, <i>Contributing Member</i>
C. Jones	P. S. Ghosal, <i>Contributing Member</i>
T. Kang	M. R. Senecal, <i>Contributing Member</i>
N.-H. Lee	Z. Shang, <i>Contributing Member</i>
S. Malushte	M. Sircar, <i>Contributing Member</i>
J. A. Munshi	C. T. Smith, <i>Contributing Member</i>
T. Muraki	

Special Working Group on Modernization (SG Div 2) (BPV III)

A. Varma, <i>Chair</i>	S. Wang
J. B. McLean, <i>Vice Chair</i>	I. Zivanovic
J. S. Saini, <i>Vice Chair</i>	R. Janowiak, <i>Contributing Member</i>
A. Adediran	F. Lin, <i>Contributing Member</i>
S. Malushte	J. A. Pires, <i>Contributing Member</i>

Task Group on Steel-Concrete Composite Containments (SG Div 2) (BPV III)

A. Varma, <i>Chair</i>	J. B. McLean
R. Janowiak	J. A. Pires
S. Malushte	J. S. Saini

Working Group on Design (SG Div 2) (BPV III)

N.-H. Lee, <i>Chair</i>	S. Wang
S. Bae	A. Istar, <i>Alternate</i>
L. J. Colarusso	P. S. Ghosal, <i>Contributing Member</i>
A. C. Eberhardt	S.-Y. Kim, <i>Contributing Member</i>
B. D. Hovis	J. Kwon, <i>Contributing Member</i>
T. C. Inman	S. E. Ohler-Schmitz, <i>Contributing Member</i>
C. Jones	B. B. Scott, <i>Contributing Member</i>
J. A. Munshi	Z. Shang, <i>Contributing Member</i>
T. Muraki	M. Shin, <i>Contributing Member</i>
J. S. Saini	M. Sircar, <i>Contributing Member</i>
G. Thomas	

Working Group on Materials, Fabrication, and Examination (SG Div 2) (BPV III)

C. Jones, <i>Chair</i>	Z. Shang
A. Eberhardt, <i>Vice Chair</i>	J. F. Strunk
C. J. Bang	I. Zivanovic
B. Birch	A. A. Aboelmagd, <i>Contributing Member</i>
J.-B. Domage	P. S. Ghosal, <i>Contributing Member</i>
T. Kang	
N.-H. Lee	

Subcommittee on Design (BPV III)

P. R. Donavin, <i>Chair</i>	M. N. Mitchell
S. McKillop, <i>Vice Chair</i>	B. Pellereau
R. P. Deubler, <i>Secretary</i>	Yanli Wang
T. P. Davis	W. F. Weitz
M. A. Gray	C. Basavaraju, <i>Alternate</i>
R. I. Jetter	G. L. Hollinger, <i>Contributing Member</i>
R. B. Keating	W. J. O'Donnell, Sr., <i>Contributing Member</i>
J. I. Kim	K. Wright, <i>Contributing Member</i>
K. A. Manoly	
D. E. Matthews	

Subgroup on Component Design (SC-D) (BPV III)

D. E. Matthews, <i>Chair</i>	J. C. Minichiello
P. Vock, <i>Vice Chair</i>	T. Mitsuhashi
D. Chowdhury, <i>Secretary</i>	D. Murphy
D. J. Ammerman	T. M. Musto
G. A. Antaki	T. Nagata
J. J. Arthur	S. Pellet
S. Asada	S. Willoughby-Braun
C. Basavaraju	C. Wilson
N. A. Costanzo	T. M. Adams, <i>Contributing Member</i>
R. P. Deubler	R. B. Keating, <i>Contributing Member</i>
P. Hirschberg	O.-S. Kim, <i>Contributing Member</i>
M. Kassir	R. J. Masterson, <i>Contributing Member</i>
D. Keck	H. S. Mehta, <i>Contributing Member</i>
T. R. Liszkai	G. Z. Tokarski, <i>Contributing Member</i>
K. A. Manoly	J. P. Tucker, <i>Contributing Member</i>
R. Martin	
K. R. May	

Task Group on Pressurized Heavy Water Reactor (SG-CD) (BPV III)

R. W. Barnes, <i>Chair</i>	E. L. Pleins
M. Brijlani	W. D. Reinhardt
D. E. Matthews	C. A. Sanna
B. McGlone	V. Sehgal
J. B. Ossmann	S. Singh
S. B. Parkash	

Task Group to Improve Section III/XI Interface (SG-CD) (BPV III)

P. Vock, <i>Chair</i>	C. A. Nove
E. Henry, <i>Secretary</i>	T. Nuoffer
G. A. Antaki	J. B. Ossmann
A. Cardillo	A. T. Roberts III
D. Chowdhury	J. Sciulli
J. Honcharik	A. Udyawar
J. Hurst	S. Willoughby-Braun
J. Lambin	

Working Group on Core Support Structures (SG-CD) (BPV III)

R. Martin, <i>Chair</i>	M. D. Snyder
R. Z. Ziegler, <i>Secretary</i>	R. O. Vollmer
G. W. Delpont	T. M. Wiger
L. C. Hartless	C. Wilson
D. Keck	Y. Wong
T. R. Liszkai	K. Hsu, <i>Alternate</i>
M. Nakajima	H. S. Mehta, <i>Contributing Member</i>

Working Group on Design of Division 3 Containment Systems (SG-CD) (BPV III)

D. J. Ammerman, <i>Chair</i>	D. Siromani
S. Klein, <i>Secretary</i>	C. R. Sydnor
J. Bignell	R. Sypulski
G. Bjorkman	R. Williamson
V. Broz	X. Zhai
D. D. Imholte	X. Zhang
D. W. Lewis	J. Smith, <i>Alternate</i>
A. Rigato	J. C. Minichiello, <i>Contributing Member</i>
P. Sakalaukus, Jr.	

Working Group on HDPE Design of Components (SG-CD) (BPV III)

M. Brandes	K. A. Manoly
J. R. Hebeisen	D. P. Munson
P. Krishnaswamy	R. Stakenborghs
M. Kuntz	B. Lin, <i>Alternate</i>

Working Group on Piping (SG-CD) (BPV III)

G. A. Antaki, <i>Chair</i>	W. F. Weitze
S. Weindorf, <i>Secretary</i>	K. Hsu, <i>Alternate</i>
C. Basavaraju	R. B. Keating, <i>Contributing Member</i>
J. Catalano	T. B. Littleton, <i>Contributing Member</i>
C. M. Faidy	Y. Liu, <i>Contributing Member</i>
R. G. Gilada	J. F. McCabe, <i>Contributing Member</i>
M. A. Gray	J. C. Minichiello, <i>Contributing Member</i>
R. J. Gurdal	A. N. Nguyen, <i>Contributing Member</i>
R. W. Haupt	M. S. Sills, <i>Contributing Member</i>
A. Hirano	N. C. Sutherland, <i>Contributing Member</i>
P. Hirschberg	G. Z. Tokarski, <i>Contributing Member</i>
M. Kassir	E. A. Wais, <i>Contributing Member</i>
D. Lieb	C.-I. Wu, <i>Contributing Member</i>
M. Moenssens	
I.-K. Nam	
K. E. Reid II	
B. Still	
D. Vlaicu	

Working Group on Pressure Relief (SG-CD) (BPV III)

K. R. May, <i>Chair</i>	B. J. Yonsky
J. F. Ball, <i>Vice Chair</i>	Y. Wong, <i>Alternate</i>
R. Krithivasan, <i>Secretary</i>	J. Yu, <i>Alternate</i>
J. W. Dickson	M. Brown, <i>Contributing Member</i>
N. Hansing	S. T. French, <i>Contributing Member</i>
S. Jones	S. Ruesenberg, <i>Contributing Member</i>
D. Miller	
T. Patel	

Working Group on Pumps (SG-CD) (BPV III)

D. Chowdhury, <i>Chair</i>	K. J. Noel
J. V. Gregg, Jr., <i>Secretary</i>	D. Skidmore
B. Busse	J. Sulley
R. Ibrahim	Y. Wong
T. Johnson	N. Chandran, <i>Alternate</i>

Working Group on Supports (SG-CD) (BPV III)

N. A. Costanzo, <i>Chair</i>	G. Z. Tokarski
U. S. Bandyopadhyay, <i>Secretary</i>	L. Vandersip
K. Avrithi	P. Wiseman
N. M. Bisceglia	J. Bozga, <i>Alternate</i>
R. P. Deubler	R. J. Masterson, <i>Contributing Member</i>
N. M. Graham	R. Roche-Rivera, <i>Contributing Member</i>
Y. Matsubara	J. R. Stinson, <i>Contributing Member</i>
S. Pellet	
G. Thomas	

Working Group on Valves (SG-CD) (BPV III)

P. Vock, <i>Chair</i>	C. A. Mizer
S. Jones, <i>Secretary</i>	H. O'Brien
M. C. Buckley	J. O'Callaghan
N. Hansing	M. Rain
G. A. Jolly	K. E. Reid II
J. Lambin	J. Sulley
T. Lippucci	Y. Wong, <i>Alternate</i>

Working Group on Design Methodology (SG-DM) (BPV III)

B. Pellereau, <i>Chair</i>	W. F. Weitze
R. O. Vollmer, <i>Secretary</i>	J. Wen
K. Avrithi	T. M. Wiger
C. Basavaraju	J. Wu
F. Berkepile	K. Hsu, <i>Alternate</i>
M. Cho	G. Banyay, <i>Contributing Member</i>
D. Clarkson	D. S. Bartran, <i>Contributing Member</i>
C. M. Faigy	R. D. Blevins, <i>Contributing Member</i>
Y.-J. Gao	M. R. Breach, <i>Contributing Member</i>
M. Kassar	H. T. Harrison III, <i>Contributing Member</i>
J. I. Kim	P. Hirschberg, <i>Contributing Member</i>
T. R. Liszkai	S. McKillop, <i>Contributing Member</i>
D. Lytle	A. Walker, <i>Contributing Member</i>
K. Matsunaga	K. Wright, <i>Contributing Member</i>
S. Ranganath	
W. D. Reinhardt	
S. Wang	

Working Group on Vessels (SG-CD) (BPV III)

D. Murphy, <i>Chair</i>	M. C. Scott
S. Willoughby-Braun, <i>Secretary</i>	J. Shupert
J. J. Arthur	D. Vlaicu
C. Basavaraju	C. Wilson
M. Brijlani	R. Z. Ziegler
L. Constantinescu	M. R. Breach, <i>Alternate</i>
J. I. Kim	B. Basu, <i>Contributing Member</i>
D. E. Matthews	R. B. Keating, <i>Contributing Member</i>
T. Mitsuhashi	W. F. Weitze, <i>Contributing Member</i>
T. J. Schrieffer	

Working Group on Environmental Fatigue Evaluation Methods (SG-DM) (BPV III)

M. A. Gray, <i>Chair</i>	B. Pellereau
W. F. Weitze, <i>Secretary</i>	T. Seppanen
S. Asada	D. Vlaicu
K. Avrithi	K. Wang
R. C. Cipolla	K. A. Manoly, <i>Alternate</i>
T. M. Damiani	S. Cuvilliez, <i>Contributing Member</i>
C. M. Faigy	T. D. Gilman, <i>Contributing Member</i>
A. Hirano	S. R. Gosselin, <i>Contributing Member</i>
P. Hirschberg	Y. He, <i>Contributing Member</i>
K. Hsu	H. S. Mehta, <i>Contributing Member</i>
A. Morley	K. Wright, <i>Contributing Member</i>
J.-S. Park	

Subgroup on Design Methods (SC-D) (BPV III)

S. McKillop, <i>Chair</i>	W. D. Reinhardt
P. R. Donavin, <i>Vice Chair</i>	P. Smith
J. Wen, <i>Secretary</i>	R. O. Vollmer
K. Avrithi	W. F. Weitze
M. A. Gray	Y. Wong, <i>Alternate</i>
J. V. Gregg, Jr.	S. R. Gosselin, <i>Contributing Member</i>
K. Hsu	H. T. Harrison III, <i>Contributing Member</i>
E. Isom	W. J. O'Donnell, Sr., <i>Contributing Member</i>
R. Kalnas	K. Wright, <i>Contributing Member</i>
D. Keck	
J. I. Kim	
B. Pellereau	

Working Group on Fatigue Strength (SG-DM) (BPV III)

P. R. Donavin, <i>Chair</i>	Y. Zou
T. M. Damiani	C. E. Hinnant, <i>Contributing Member</i>
D. W. DeJohn	P. Hirschberg, <i>Contributing Member</i>
C. M. Faigy	S. H. Kleinsmith, <i>Contributing Member</i>
P. Gill	S. Majumdar, <i>Contributing Member</i>
R. J. Gurdal	H. S. Mehta, <i>Contributing Member</i>
K. Hsu	W. J. O'Donnell, Sr., <i>Contributing Member</i>
J. I. Kim	S. Ranganath, <i>Contributing Member</i>
A. Morley	K. Wright, <i>Contributing Member</i>
B. Pellereau	
M. S. Shelton	
I. Viscarra	
Yanli Wang	
W. F. Weitze	

Special Working Group on Computational Modeling for Explicit Dynamics (SG-DM) (BPV III)

G. Bjorkman, <i>Chair</i>	P. Sakalaukus, Jr.
D. J. Ammerman, <i>Vice Chair</i>	D. Siromani
V. Broz, <i>Secretary</i>	C.-F. Tso
J. Bignell	M. C. Yaksh
S. Kuehner	U. Zencker
D. Molitoris	X. Zhang
W. D. Reinhardt	M. R. Breach, <i>Contributing Member</i>
E. Rosvall	Y. Wong, <i>Contributing Member</i>

Working Group on Probabilistic Methods in Design (SG-DM) (BPV III)

M. Golliet, <i>Chair</i>	K. A. Manoly
R. Kalnas, <i>Vice Chair</i>	A. Morley
G. Brouette	B. Pellereau
R. Fougousse	A. Weaver
J. Hakii	M. Yagodich
E. Hanson	I. H. Tseng, <i>Alternate</i>
D. O. Henry	K. Avrithi, <i>Contributing Member</i>
A. Hirano	R. S. Hill III, <i>Contributing Member</i>

Subgroup on Containment Systems for Spent Nuclear Fuel and High-Level Radioactive Material (BPV III)

D. W. Lewis, <i>Chair</i>	C. R. Sydnor
D. J. Ammerman, <i>Vice Chair</i>	R. Sypulski
S. Klein, <i>Secretary</i>	J. Wellwood
J. Bignell	X. J. Zhai
G. Bjorkman	X. Zhang
V. Broz	J. Smith, <i>Alternate</i>
D. D. Imholte	W. H. Borter, <i>Contributing Member</i>
A. Rigato	E. L. Pleins, <i>Contributing Member</i>
P. Sakalaukus, Jr.	N. M. Simpson, <i>Contributing Member</i>
D. Siromani	

Subgroup on Fusion Energy Devices (BPV III)

T. P. Davis, <i>Chair</i>	I. Kimihiro
A. Maslowski, <i>Staff Secretary</i>	P. Mokaria
M. Ellis, <i>Secretary</i>	F. J. Schaaf, Jr.
L. Babu	P. Smith
M. Bashir	Y. Song
J. P. Blanchard	D. White
B. R. Doshi	R. W. Barnes, <i>Contributing Member</i>
L. El-Guebaly	W. K. Sowder, Jr., <i>Contributing Member</i>
R. Holmes	
D. Johnson	

Special Working Group on Fusion Stakeholders (SG-FED) (BPV III)

R. Holmes, <i>Chair</i>	S. S. Desai
C. Barnes	F. Deschamps
R. W. Barnes	M. Hua
J. Brister	S. Krishnan
A. A. Campbell	W. K. Sowder, Jr.
V. Chugh	N. Young
T. P. Davis	

Working Group on General Requirements (SG-FED) (BPV III)

P. Smith, <i>Chair</i>	B. McGlone
L. Babu	P. Mokaria
T. P. Davis	W. K. Sowder, Jr.
M. Ellis	D. White, <i>Contributing Member</i>

Working Group on In-Vessel Components (SG-FED) (BPV III)

M. Bashir, <i>Chair</i>	S. T. Madabusi
T. P. Davis	

Working Group on Magnets (SG-FED) (BPV III)

D. S. Bartran	W. K. Sowder, Jr., <i>Contributing Member</i>

Working Group on Materials (SG-FED) (BPV III)

T. P. Davis

Working Group on Vacuum Vessels (SG-FED) (BPV III)

I. Kimihiro, <i>Chair</i>	D. Johnson
B. R. Doshi	

Subgroup on General Requirements (BPV III)

B. McGlone, <i>Chair</i>	L. Noyes
A. McLendon, <i>Secretary</i>	E. C. Renaud
V. Apostolescu	T. N. Rezk
A. Appleton	J. Rogers
S. Bell	B. S. Sandhu
G. Brouette	R. Spuhl
P. J. Coco	J. L. Williams
G. C. Deleanu	Y. Diaz-Castillo, <i>Alternate</i>
N. DeSantis	J. DeKleine, <i>Contributing Member</i>
O. Elkadim	S. F. Harrison, Jr., <i>Contributing Member</i>
J. V. Gardiner	H. Michael, <i>Contributing Member</i>
J. Grimm	D. J. Roszman, <i>Contributing Member</i>
J. Harris	C. T. Smith, <i>Contributing Member</i>
J. W. Highlands	G. E. Szabatura, <i>Contributing Member</i>
E. V. Imbro	
K. A. Kavanagh	
Y.-S. Kim	
D. T. Meisch	

Working Group on General Requirements for Graphite and Ceramic Composite Core Components and Assemblies (SG-GR) (BPV III)

W. J. Geringer, <i>Chair</i>	M. N. Mitchell
A. Appleton	J. Potgieter
J. R. Berry	E. C. Renaud
A. A. Campbell	S. Sekar
C. Cruz	R. Spuhl
Y. Diaz-Castillo	W. Windes
J. Lang	B. Lin, <i>Alternate</i>

Subgroup on High Temperature Reactors (BPV III)

Yanli Wang, <i>Chair</i>	X. Wei
N. Broom	W. Windes
F. W. Brust	R. Wright
M. E. Cohen	G. L. Zeng
W. J. Geringer	J. Bass, <i>Alternate</i>
B. F. Hantz	P. Carter, <i>Contributing Member</i>
M. Hiser	W. O'Donnell, Sr., <i>Contributing Member</i>
R. I. Jetter	T.-L. Sham
K. Kimura	L. Shi, <i>Contributing Member</i>
G. H. Koo	R. W. Swindeman, <i>Contributing Member</i>
W. Li	
M. C. Messner	

Special Working Group on High Temperature Reactor Stakeholders (SG-HTR) (BPV III)

M. E. Cohen, <i>Chair</i>	R. I. Jetter
M. C. Albert	G. H. Koo
M. Arcaro	N. J. McTiernan
R. W. Barnes	M. N. Mitchell
R. Bass	K. J. Noel
N. Broom	J. Roll
K. Burnett	B. Song
A. A. Campbell	Yanli Wang
V. Chugh	X. Wei
W. Corwin	G. L. Zeng
G. C. Deleanu	R. M. Iyengar, <i>Alternate</i>
R. A. Fleming	T. Asayama, <i>Contributing Member</i>
K. Harris	

Task Group on Alloy 709 Code Case (SG-HTR) (BPV III)

Yanli Wang, <i>Chair</i>	W. J. Sperko
H. Mahajan, <i>Secretary</i>	R. Wright
R. I. Jetter	T.-L. Sham, <i>Contributing Member</i>
M. C. Messner	

Working Group on Allowable Stress Criteria (SG-HTR) (BPV III)

R. Wright, <i>Chair</i>	M. C. Messner
M. McMurtrey, <i>Secretary</i>	T. Patterson
R. W. Barnes	Yanli Wang
R. Bass	X. Wei
K. Kimura	R. M. Iyengar, <i>Alternate</i>
W. Li	R. W. Swindeman, <i>Contributing Member</i>
D. Maitra	
R. J. McReynolds	

Task Group on Class A Rewrite (SG-HTR) (BPV III)

Yanli Wang, <i>Chair</i>	N. J. McTiernan
R. W. Barnes	M. C. Messner
M. E. Cohen	T. Nguyen
R. I. Jetter	D. Pease
H. Mahajan	X. Wei
S. McKillop	J. Young

Working Group on Analysis Methods (SG-HTR) (BPV III)

M. C. Messner, <i>Chair</i>	X. Song
H. Mahajan, <i>Secretary</i>	Yanli Wang
R. Adibi-Asl	X. Wei
R. W. Barnes	S. X. Xu
J. A. Blanco	J. Young
P. Carter	J. Bass, <i>Alternate</i>
R. I. Jetter	M. R. Breach, <i>Contributing Member</i>
G. H. Koo	Y.-J. Gao, <i>Contributing Member</i>
T. Nguyen	T. Hassan, <i>Contributing Member</i>
M. Petkov	S. Krishnamurthy, <i>Contributing Member</i>
K. Pigg	M. J. Swindeman, <i>Contributing Member</i>
H. Qian	
T. Riordan	

Task Group on Division 5 AM Components (SG-HTR) (BPV III)

R. Wright, <i>Chair</i>	T. Patterson
R. W. Barnes	E. C. Renaud
F. W. Brust	D. Rudland
Z. Feng	B. Sutton
S. Lawler	I. J. Van Rooyen
X. Lou	Yanli Wang
M. McMurtrey	X. Wei
M. C. Messner	R. Bass, <i>Alternate</i>

Working Group on Creep-Fatigue and Negligible Creep (SG-HTR) (BPV III)

W. Li, <i>Chair</i>	M. McMurtrey
J. Bass	M. C. Messner
C. M. Brusconi	H. Qian
P. Carter	R. Rajasekaran
M. E. Cohen	M. Shah
J. I. Duo	Yanli Wang
R. I. Jetter	X. Wei
G. H. Koo	J. Young
H. Mahajan	R. Bass, <i>Alternate</i>

Task Group on Graphite Design Analysis (SG-HTR) (BPV III)

A. Mack, <i>Chair</i>	P.-A. Juan
J. Bass	J. Potgieter
S. Baylis	J. Quick
G. Beirnaert	M. Saitta
O. Booler	A. Walker

Working Group on Nonmetallic Design and Materials (SG-HTR) (BPV III)

W. Windes, <i>Chair</i>	J. Parks
W. J. Geringer, <i>Vice Chair</i>	K. Pigg
J. Potgieter, <i>Secretary</i>	J. Podhiny
G. Beirnaert	J. Roll
A. A. Campbell	A. Tzelepi
C. Chen	A. Walker
A. N. Chereskin	Yanli Wang
V. Chugh	G. L. Zeng
C. Contescu	J. Bass, <i>Alternate</i>
N. Gallego	A. Appleton, <i>Contributing Member</i>
S. T. Gonczy	R. W. Barnes, <i>Contributing Member</i>
K. Harris	S.-H. Chi, <i>Contributing Member</i>
M. G. Jenkins	Y. Katoh, <i>Contributing Member</i>
P.-A. Juan	J. B. Ossmann, <i>Contributing Member</i>
J. Lang	J. Quick, <i>Contributing Member</i>
A. Mack	M. Saitta, <i>Contributing Member</i>
M. P. Metcalfe	
M. N. Mitchell	

Task Group on High Temperature Piping Design (SG-HTR) (BPV-III)

G. A. Antaki, <i>Chair</i>	H. Mahajan
S. Weindorf, <i>Secretary</i>	J. C. Minichiello
R. Adibi-Asl	D. Pease
T. D. Al-Shawaf	Yanli Wang
D. Bankston, Jr.	C. D. Weary
R. P. Deubler	T.-L. Sham, <i>Contributing Member</i>
R. I. Jetter	

Subgroup on Materials, Fabrication, and Examination (BPV III)

D. W. Mann, <i>Chair</i>	M. Kris
J. Grimm, <i>Vice Chair</i>	T. Melfi
J. B. Ossmann, <i>Vice Chair</i>	I.-K. Nam
S. Hunter, <i>Secretary</i>	J. E. O'Sullivan
W. H. Borter	M. C. Scott
M. Brijlani	W. J. Sperko
G. R. Cannell	J. F. Strunk
A. Cardillo	W. Windes
S. Cho	R. Wright
P. J. Coco	H. Xu
R. H. Davis	S. Yee
D. B. Denis	J. Wise, Jr., <i>Alternate</i>
B. D. Frew	S. Wolbert, Jr., <i>Alternate</i>
D. W. Gandy	R. W. Barnes, <i>Contributing Member</i>
S. E. Gingrich	S. Levitus, <i>Contributing Member</i>
M. Golliet	H. Michael, <i>Contributing Member</i>
L. S. Harbison	

Working Group on Advanced Manufacturing (SG-MFE) (BPV III)

D. W. Mann, <i>Chair</i>	E. C. Renaud
D. W. Gandy, <i>Secretary</i>	W. J. Sperko
D. Chowdhury	J. F. Strunk
P. J. Coco	J. Sulley
B. D. Frew	S. Tate
J. Grimm	J. Wise
J. Lambin	S. Wolbert
T. Lippucci	H. Xu
T. Melfi	R. H. Davis, <i>Alternate</i>
A. Mori	S. Malik, <i>Contributing Member</i>

Joint Working Group on HDPE (SG-MFE) (BPV III)

M. Brandes, <i>Chair</i>	K. Manoly
T. M. Musto, <i>Chair</i>	D. P. Munson
J. B. Ossmann, <i>Secretary</i>	J. O'Sullivan
G. Brouette	V. Rohatgi
M. C. Buckley	F. Schaaf, Jr.
S. Choi	S. Schuessler
M. Golliet	R. Stakenborgs
J. Hebeisen	M. Troughton
J. Johnston, Jr.	P. Vibien
P. Krishnaswamy	J. Wright
M. Kuntz	T. Adams, <i>Contributing Member</i>
B. Lin	

COMMITTEE ON HEATING BOILERS (BPV IV)

M. Wadkinson, <i>Chair</i>	J. A. Hall
J. L. Kleiss, <i>Vice Chair</i>	M. Mengon
C. R. Ramcharran, <i>Staff Secretary</i>	Y. Teng
B. Ahee	D. Picart, <i>Delegate</i>
L. Badziagowski	Y. R. Cho, <i>Alternate</i>
T. L. Bedeaux	B. J. Iske, <i>Alternate</i>
B. Calderon	T. Wagner, <i>Alternate</i>
J. P. Chicoine	H. Michael, <i>Contributing Member</i>
C. Dinic	P. A. Molvie, <i>Contributing Member</i>
J. M. Downs	

Executive Committee (BPV IV)

M. Wadkinson, <i>Chair</i>	J. P. Chicoine
C. R. Ramcharran, <i>Staff Secretary</i>	J. A. Hall
T. L. Bedeaux	J. L. Kleiss

Subgroup on Cast Boilers (BPV IV)

J. P. Chicoine, <i>Chair</i>	J. L. Kleiss
J. M. Downs, <i>Vice Chair</i>	M. Mengon
C. R. Ramcharran, <i>Staff Secretary</i>	B. J. Iske, <i>Alternate</i>
T. L. Bedeaux	T. Wagner, <i>Alternate</i>
J. A. Hall	

Subgroup on Materials (BPV IV)

J. A. Hall, <i>Chair</i>	T. L. Bedeaux
J. M. Downs, <i>Vice Chair</i>	Y. Teng
C. R. Ramcharran, <i>Staff Secretary</i>	M. Wadkinson
L. Badziagowski	

Subgroup on Water Heaters (BPV IV)

J. L. Kleiss, <i>Chair</i>	C. Dinic
L. Badziagowski, <i>Vice Chair</i>	M. Mengon
C. R. Ramcharran, <i>Staff Secretary</i>	Y. Teng
B. Ahee	B. J. Iske, <i>Alternate</i>
M. Carlson	T. Wagner, <i>Alternate</i>
J. P. Chicoine	P. A. Molvie, <i>Contributing Member</i>

Subgroup on Welded Boilers (BPV IV)

T. L. Bedeaux, <i>Chair</i>	J. L. Kleiss
J. P. Chicoine, <i>Vice Chair</i>	M. Mengon
C. R. Ramcharran, <i>Staff Secretary</i>	M. Wadkinson
B. Ahee	M. Washington
E. Alexis	B. J. Iske, <i>Alternate</i>
L. Badziagowski	M. J. Melita, <i>Alternate</i>
B. Calderon	T. J. Wagner, <i>Alternate</i>
M. Carlson	P. A. Molvie, <i>Contributing Member</i>
C. Dinic	

COMMITTEE ON NONDESTRUCTIVE EXAMINATION (BPV V)

N. A. Finney, <i>Chair</i>	P. Lang
C. May, <i>Vice Chair</i>	T. R. Lerohl
C. R. Ramcharran, <i>Staff Secretary</i>	J. Schoneweis
D. Bajula	P. B. Shaw
P. L. Brown	C. Vorwald
M. A. Burns	M. Carlson, <i>Alternate</i>
N. Carter	J. E. Batey, <i>Contributing Member</i>
C. Emslander	T. Clausing, <i>Contributing Member</i>
A. F. Garbolevsky	J. F. Halley, <i>Contributing Member</i>
P. T. Hayes	R. W. Kruzic, <i>Contributing Member</i>
G. W. Hembree	L. E. Mullins, <i>Contributing Member</i>
F. B. Kovacs	H. C. Graber, <i>Honorary Member</i>
K. Krueger	T. G. McCarty, <i>Honorary Member</i>
B. D. Laite	

Executive Committee (BPV V)

C. May, <i>Chair</i>	F. B. Kovacs
N. A. Finney, <i>Vice Chair</i>	K. Krueger
C. R. Ramcharran, <i>Staff Secretary</i>	B. D. Laite
V. F. Godinez-Azcuaga	E. Peloquin
P. T. Hayes	C. Vorwald
G. W. Hembree	

**Subgroup on General Requirements/Personnel Qualifications and
Inquiries (BPV V)**

C. Vorwald, <i>Chair</i>	P. Lang
K. Krueger, <i>Vice Chair</i>	T. R. Lerohl
D. Bajula	C. May
N. Carter	J. Schoneweis
P. Chavdarov	T. Clausing, <i>Contributing Member</i>
C. Emslander	J. F. Halley, <i>Contributing Member</i>
N. A. Finney	D. I. Morris, <i>Contributing Member</i>
G. W. Hembree	J. P. Swezy, Jr., <i>Contributing Member</i>
F. B. Kovacs	

Subgroup on Volumetric Methods (BPV V)

C. May, <i>Chair</i>	K. Krueger
P. T. Hayes, <i>Vice Chair</i>	N. Pasemko
P. L. Brown	E. Peloquin
N. A. Finney	J. Schoneweis
A. F. Garbolevsky	C. Vorwald
V. F. Godinez-Azcuaga	J. F. Halley, <i>Contributing Member</i>
C. Hansen	R. W. Kruzic, <i>Contributing Member</i>
R. W. Hardy	L. E. Mullins, <i>Contributing Member</i>
G. W. Hembree	C. Wassink, <i>Contributing Member</i>
F. B. Kovacs	

Working Group on Radiography (SG-VM) (BPV V)

C. Vorwald, <i>Chair</i>	B. D. Laite
D. M. Woodward, <i>Vice Chair</i>	T. R. Lerohl
D. Bajula	C. May
P. L. Brown	R. J. Mills
C. Emslander	J. F. Molinaro
A. F. Garbolevsky	N. Pasemko
R. W. Hardy	J. Schoneweis
G. W. Hembree	T. L. Clifford, <i>Contributing Member</i>
P. Howie	R. W. Kruzic, <i>Contributing Member</i>
F. B. Kovacs	

Working Group on Ultrasonics (SG-VM) (BPV V)

K. Krueger, <i>Chair</i>	C. May
D. Bajula, <i>Vice Chair</i>	E. Peloquin
D. Adkins	J. Schoneweis
C. T. Brown	D. Van Allen
C. Emslander	C. Vorwald
N. A. Finney	J. F. Halley, <i>Contributing Member</i>
P. Furr	R. W. Kruzic, <i>Contributing Member</i>
C. Hansen	P. Mudge, <i>Contributing Member</i>
P. T. Hayes	L. E. Mullins, <i>Contributing Member</i>
G. W. Hembree	M. J. Quarry, <i>Contributing Member</i>
B. D. Laite	J. Vanvelsor, <i>Contributing Member</i>
T. R. Lerohl	

**Special Working Group for Advance UT Techniques
(WG-UT) (BPV V)**

K. Krueger, <i>Chair</i>	P. Hayes
J. Schoneweis, <i>Vice Chair</i>	B. D. Laite
D. Bajula	T. R. Lerohl
C. David	E. Peloquin
N. A. Finney	D. Tompkins
P. Furr	D. Van Allen
J. Garner	C. Wassink
C. Hansen	

Working Group on Acoustic Emissions (SG-VM) (BPV V)

V. F. Godinez-Azcuaga, <i>Chair</i>	S. R. Doctor
J. Catty, <i>Vice Chair</i>	N. F. Douglas, Jr.

Working Group on Full Matrix Capture (SG-VM) (BPV V)

E. Peloquin, <i>Chair</i>	M. Lozev
P. T. Hayes, <i>Vice Chair</i>	R. Nogueira
D. Bajula	D. Richard
J. Catty	M. Sens
N. A. Finney	D. Tompkins
J. L. Garner	J. F. Halley, <i>Contributing Member</i>
R. T. Grotenhuis	L. E. Mullins, <i>Contributing Member</i>
G. W. Hembree	C. Wassink, <i>Contributing Member</i>
K. Krueger	

**Subgroup on Inservice Examination Methods and Techniques
(BPV V)**

P. T. Hayes, <i>Chair</i>	V. F. Godinez-Azcuaga
E. Peloquin, <i>Vice Chair</i>	C. Hansen
D. Bajula	G. W. Hembree
R. Barker	K. Krueger
R. J. Bunte	C. May
M. A. Burns	N. Pasemko
M. Carlson	D. D. Raimander
T. Demmer	B. Ray
N. Douglas, Jr.	J. Schoneweis
N. A. Finney	C. Vorwald

Working Group on Assisted Analysis (SG-ISI) (BPV V)

T. Demmer, <i>Chair</i>	G. W. Hembree
C. Hansen, <i>Vice Chair</i>	G. I. Kraljic
J. Aldrin	G. M. Lozev
J. Chen	R. S. F. Orozco
M. Elen	E. Peloquin
N. A. Finney	T. Thulien
V. F. Godinez-Azcuaga	J. Williams
R. T. Grotenhuis	S. Zafar
K. Hayes	

Working Group on Methods and Techniques (SG-ISI) (BPV V)

C. May, <i>Chair</i>	P. T. Hayes
R. J. Bunte, <i>Vice Chair</i>	K. Krueger
D. Bajula	B. D. Laite
R. Barker	G. Morais
M. A. Burns	N. Pasemko
M. Carlson	J. Schoneweis
J. Catty	

**Working Group on Supplemental Requirements for Corrosion and
Other Damage Mechanisms (SG-ISI) (BPV V)**

J. Schoneweis, <i>Chair</i>	C. Hansen
N. Pasemko, <i>Vice Chair</i>	P. T. Hayes
D. Bajula	K. Krueger
R. Barker	E. Peloquin
N. A. Finney	I. Roux

Subgroup on Surface Examination Methods (BPV V)

B. D. Laite, <i>Chair</i>	C. May
D. Bajula	G. Morais
R. Behe	J. Schoneweis
R. M. Beldyk	P. B. Shaw
P. L. Brown	R. Tedder
N. Carter	C. Vorwald
C. Emslander	D. M. Woodward
N. Farenbaugh	T. Clausing, <i>Contributing Member</i>
N. A. Finney	J. F. Halley, <i>Contributing Member</i>
A. F. Garbolevsky	K. Hayes, <i>Contributing Member</i>
G. W. Hembree	R. W. Kruzic, <i>Contributing Member</i>
K. Krueger	L. E. Mullins, <i>Contributing Member</i>
T. R. Lerohl	C. Wassink, <i>Contributing Member</i>

Germany International Working Group (BPV V)

P. Chavdarov, <i>Chair</i>	C. Kringe
V. Pohl, <i>Vice Chair</i>	S. Mann
H.-P. Schmitz, <i>Secretary</i>	V. Reusch
D. Kaiser	P. Van IJS

India International Working Group (BPV V)

P. Kumar, <i>Chair</i>	J. V. Muthukumaraswamy
A. V. Bhagwat, <i>Vice Chair</i>	A. Relekar
V. Ligade, <i>Secretary</i>	V. J. Sonawane
S. Jobanputra	N. Suryawanshi
D. Joshi	D. B. Tanpure
G. R. Joshi	

Italy International Working Group (BPV V)

D. D. Raimander, <i>Chair</i>	E. Ferrari
O. Oldani, <i>Vice Chair</i>	M. A. Grimoldi
C. R. Ramcharan, <i>Staff Secretary</i>	G. Luoni
P. Campli, <i>Secretary</i>	U. Papponetti
M. Agostini	P. Pedersoli
T. Aldo	A. Veroni
F. Bresciani	M. Zambon
N. Caputo	G. Gobbi, <i>Contributing Member</i>
M. Colombo	A. Gusmaroli, <i>Contributing Member</i>
P. L. Dinelli	G. Pontiggia, <i>Contributing Member</i>
F. Ferrarese	

COMMITTEE ON PRESSURE VESSELS (BPV VIII)

S. C. Roberts, <i>Chair</i>	J. P. Swezy, Jr.
M. D. Lower, <i>Vice Chair</i>	S. Terada
J. Oh, <i>Staff Secretary</i>	E. Upitis
S. J. Rossi, <i>Staff Secretary</i>	A. Viet
S. R. Babka	K. Xu
L. Bower	K. Oyamada, <i>Delegate</i>
P. Chavdarov	M. E. Papponetti, <i>Delegate</i>
B. F. Hantz	G. Auriolles, Sr., <i>Contributing Member</i>
C. S. Hinson	R. J. Basile
J. Hoskinson	A. Chaudouet, <i>Contributing Member</i>
M. Kowalczyk	D. B. DeMichael, <i>Contributing Member</i>
D. L. Kurle	K. T. Lau, <i>Contributing Member</i>
R. Mahadeen	H. Michael, <i>Contributing Member</i>
S. A. Marks	R. W. Mikitka, <i>Contributing Member</i>
P. Matkovics	D. A. Swanson, <i>Contributing Member</i>
D. T. Peters	G. G. Karcher, <i>Honorary Member</i>
M. J. Pischke	U. R. Miller, <i>Honorary Member</i>
M. D. Rana	T. P. Pastor, <i>Honorary Member</i>
G. B. Rawls, Jr.	K. K. Tam, <i>Honorary Member</i>
F. L. Richter	
C. D. Rodery	
J. C. Sowinski	
D. Sronic	
P. L. Sturgill	
K. Subramanian	

Executive Committee (BPV VIII)

M. D. Lower, <i>Chair</i>	J. Hoskinson
S. J. Rossi, <i>Staff Secretary</i>	P. Matkovics
G. Auriolles, Sr.	S. C. Roberts
C. W. Cary	J. C. Sowinski
P. Chavdarov	K. Subramanian
T. Halligan	K. Xu

Subgroup on Design (BPV VIII)

J. C. Sowinski, <i>Chair</i>	S. Terada
C. S. Hinson, <i>Vice Chair</i>	K. Xu
S. R. Babka	K. Oyamada, <i>Delegate</i>
O. A. Barsky	M. E. Papponetti, <i>Delegate</i>
M. Faulkner	G. Auriolles, Sr., <i>Contributing Member</i>
D. Francis	R. J. Basile, <i>Contributing Member</i>
B. F. Hantz	D. Chandiramani, <i>Contributing Member</i>
C. E. Hinnant	M. H. Jawad, <i>Contributing Member</i>
S. Krishnamurthy	P. K. Lam, <i>Contributing Member</i>
D. L. Kurle	K. Mokhtarian, <i>Contributing Member</i>
K. Kusu	C. D. Rodery, <i>Contributing Member</i>
M. D. Lower	D. A. Swanson, <i>Contributing Member</i>
R. W. Mikitka	K. K. Tam, <i>Contributing Member</i>
B. Millet	E. Upitis, <i>Contributing Member</i>
M. D. Rana	
G. B. Rawls, Jr.	
S. C. Roberts	
T. G. Seipp	
D. Sronic	

Working Group on Design-by-Analysis (BPV VIII)

B. F. Hantz, <i>Chair</i>	S. Krishnamurthy
T. W. Norton, <i>Secretary</i>	C. Nadarajah
J. Bedoya	T. G. Seipp
A. Feller	M. Shah
S. Guzey	S. Terada
C. E. Hinnant	D. A. Arnett, <i>Contributing Member</i>
S. Kataoka	A. Mann, <i>Contributing Member</i>
S. Kilambi	K. Saboda, <i>Contributing Member</i>
K. D. Kirkpatrick	

Task Group on Electrochemical Cell Stacks (TG-ECS) (BPV VIII)

K. Xu, <i>Chair</i>	K. Choi, <i>Contributing Member</i>
K. Quackenbush, <i>Vice Chair</i>	L. T. Dalton, <i>Contributing Member</i>
N. Barkley	M. Duda, <i>Contributing Member</i>
E. Gadsby	R. Fournier, <i>Contributing Member</i>
S. Goyette	E. Gernot, <i>Contributing Member</i>
T. Halligan	S. Grimm, <i>Contributing Member</i>
R. Kauer	N. Hart, <i>Contributing Member</i>
P. Matkovics	R. Müller, <i>Contributing Member</i>
L. Moulthrop	P. K. Panigrahy, <i>Contributing Member</i>
J. Panicker	R. Robles, <i>Contributing Member</i>
E. Prause	M. Stelzel, <i>Contributing Member</i>
P. T. Shanks	M. Sweetland, <i>Contributing Member</i>
S. Ulemek	
E. Andrade, <i>Contributing Member</i>	
B. D. Carter, <i>Contributing Member</i>	

Working Group on Elevated Temperature Design (BPV I and VIII)

C. Nadarajah, <i>Chair</i>	C. T. McDaris
L. S. Tsai, <i>Secretary</i>	M. C. Messner
D. Anderson	M. N. Mitchell
D. Dewees	P. Prueter
B. F. Hantz	A. Ramos
R. I. Jetter	M. Rathinasabapathy
S. Kataoka	M. J. Swindeman
S. Krishnamurthy	A. Mann, <i>Contributing Member</i>
S. R. Kummari	N. McMurray, <i>Contributing Member</i>
T. Le	B. J. Mollitor, <i>Contributing Member</i>
B.-L. Lyow	

Task Group on Fired Heater Pressure Vessels (BPV VIII)

J. Hoskinson, <i>Chair</i>	P. T. Shanks
D. Nelson	E. Smith
R. Robles	D. Srnic
J. Rust	

Subgroup on Fabrication and Examination (BPV VIII)

T. Halligan, <i>Chair</i>	B. F. Shelley
D. I. Morris, <i>Vice Chair</i>	P. L. Sturgill
D. Smith, <i>Secretary</i>	J. P. Swezy, Jr.
J. Lu	E. Uptis
S. A. Marks	C. Violand
O. Mulet	K. Oyamada, <i>Delegate</i>
M. J. Pischke	W. J. Bees, <i>Contributing Member</i>
M. J. Rice	L. F. Campbell, <i>Contributing Member</i>
J. Roberts	N. Carter, <i>Contributing Member</i>
C. D. Rodery	

Subgroup on Heat Transfer Equipment (BPV VIII)

P. Matkovics, <i>Chair</i>	E. Smith
L. Bower, <i>Vice Chair</i>	A. M. Voytko
T. Bunyarattaphantu, <i>Secretary</i>	R. P. Wiberg
S. R. Babka	G. Auriolles, Sr., <i>Contributing Member</i>
J. H. Barbee	K. M. Chikhaliya, <i>Contributing Member</i>
O. A. Barsky	J. Pasek, <i>Contributing Member</i>
A. Chaudouet	D. Srnic, <i>Contributing Member</i>
D. L. Kurle	Z. Tong, <i>Contributing Member</i>
R. Mahadeen	
S. Mayeux	
S. Neilsen	

Subgroup on General Requirements (BPV VIII)

J. Hoskinson, <i>Chair</i>	J. Rust
M. Faulkner, <i>Vice Chair</i>	P. T. Shanks
N. Barkley	J. C. Sowinski
T. P. Beirne	P. Speranza
R. Darby	D. Srnic
Z. Jakovljevic	D. B. Stewart
M. D. Lower	D. B. DeMichael, <i>Contributing Member</i>
T. Newman	T. P. Pastor, <i>Contributing Member</i>
I. A. Powell	R. Robles, <i>Contributing Member</i>
J. Qu	D. A. Swanson, <i>Contributing Member</i>
G. B. Rawls, Jr.	Y. Yang, <i>Contributing Member</i>
F. L. Richter	
S. C. Roberts	

Working Group on Plate Heat Exchangers (BPV VIII)

D. I. Morris, <i>Chair</i>	P. Matkovics
S. R. Babka	M. J. Pischke
V. Gudge	P. T. Shanks
T. Halligan	E. Smith
Z. Jakovljevic	D. Srnic

Subgroup on High Pressure Vessels (BPV VIII)

K. Subramanian, <i>Chair</i>	F. W. Tatar
M. Sarzynski, <i>Vice Chair</i>	S. Terada
A. Dinizulu, <i>Staff Secretary</i>	Y. Xu
L. P. Antalffy	A. M. Clayton, <i>Contributing Member</i>
N. Barkley	R. Cordes, <i>Contributing Member</i>
J. Barlow	R. D. Dixon, <i>Contributing Member</i>
R. C. Biel	J. Hademenos, <i>Contributing Member</i>
P. N. Chaku	R. M. Hoshman, <i>Contributing Member</i>
L. Fridlund	F. Kirkemo, <i>Contributing Member</i>
D. Fuenmayor	G. M. Mital, <i>Contributing Member</i>
J. Gibson	M. Parr, <i>Contributing Member</i>
R. T. Hallman	M. D. Rana, <i>Contributing Member</i>
K. Karpanan	C. Tipple, <i>Contributing Member</i>
A. K. Khare	K.-J. Young, <i>Contributing Member</i>
G. T. Nelson	D. J. Burns, <i>Honorary Member</i>
D. T. Peters	G. J. Mraz, <i>Honorary Member</i>
E. D. Roll	
J. R. Sims	
E. Smith	

Argentina International Working Group (BPV VIII)

A. Dominguez, <i>Chair</i>	M. A. Mendez
R. Robles, <i>Vice Chair</i>	J. J. Monaco
G. Glissent, <i>Secretary</i>	C. Parente
A. Antipasti	M. A. A. Pipponzi
D. A. Bardelli	L. C. Rigoli
R. A. Barey	A. Rivas
O. S. Bretones	D. Rizzo
A. Burgueno	M. A. Sena
G. Casanas	G. Telleria
D. A. Del Teglia	C. Alderetes, <i>Contributing Member</i>
M. Favareto	D. H. Da Rold, <i>Contributing Member</i>
J. A. Labastidas	J. C. Rubedo, <i>Contributing Member</i>
F. P. Larrosa	

China International Working Group (BPV VIII)

X. Chen, <i>Chair</i>	C. Miao
B. Shou, <i>Vice Chair</i>	L. Sun
Z. Fan, <i>Secretary</i>	C. Wu
Y. Chen	J. Xiaobin
J. Cui	F. Xu
R. Duan	G. Xu
J.-G. Gong	F. Yang
B. Han	Y. Yang
J. Hu	Y. Yuan
Q. Hu	Yanfeng Zhang
H. Hui	Yijun Zhang
K. Li	S. Zhao
D. Luo	J. Zheng
Y. Luo	G. Zhu

Subgroup on Materials (BPV VIII)

P. Chavdarov, <i>Chair</i>	D. Pugh
M. Kowalczyk, <i>Vice Chair</i>	D. W. Rahoi
S. Kilambi, <i>Secretary</i>	E. Uptis
J. Cameron	K. Xu
H. Dutta	M. Katcher, <i>Contributing Member</i>
J. F. Grubb	R. C. Sutherlin, <i>Contributing Member</i>
D. Maitra	
R. K. Patadia	

Subgroup on Toughness (BPV VIII)

K. Xu, <i>Chair</i>	J. P. Swezy, Jr.
T. Halligan, <i>Vice Chair</i>	S. Terada
T. Finn	E. Uptis
C. S. Hinson	J. Vattappilly
S. Kilambi	K. Oyamada, <i>Delegate</i>
D. L. Kurle	L. Dong, <i>Contributing Member</i>
T. Newman	S. Krishnamurthy, <i>Contributing Member</i>
J. Qu	D. A. Swanson, <i>Contributing Member</i>
M. D. Rana	
F. L. Richter	
K. Subramanian	

Germany International Working Group (BPV VIII)

R. Kauer, <i>Chair</i>	S. Krebs
M. Sykora, <i>Vice Chair</i>	T. Ludwig
A. Aloui	R. A. Meyers
P. Chavdarov	H. Michael
M. Delzeit	R. Müller
A. Emrich	S. Reich
C. Jaekel	A. Spangenberg
S. Jetzlsperger	C. Stobbe
D. Koelbl	

India International Working Group (BPV VIII)

D. Chandiramani, <i>Chair</i>	T. Mukherjee
D. Kulkarni, <i>Vice Chair</i>	P. C. Pathak
A. D. Dalal, <i>Secretary</i>	D. Prabhu
P. Arulkumar	A. Sadasivam
P. Gandhi	M. P. Shah
U. Ganesan	Y. Z. Shaikh
S. K. Goyal	R. Tiru
V. Jayabalan	V. T. Valavan
V. K. Joshi	M. Sharma, <i>Contributing Member</i>
A. Kakumanu	

Subgroup on Graphite Pressure Equipment (BPV VIII)

C. W. Cary, <i>Chair</i>	H. Lee, Jr.
A. Viet, <i>Vice Chair</i>	S. Mehrez
G. C. Becherer	T. Rudy
F. L. Brown	A. A. Stupica
J. D. Clements	J. Wince

Italy International Working Group (BPV VIII)

M. Millefanti, <i>Chair</i>	A. F. Magri
P. Campli, <i>Secretary</i>	L. Moracchioli
P. Aliprandi	P. Pacor
A. Avogadri	S. Sarti
A. Camanni	A. Teli
M. Camposaragna	N. Wagner
N. Caputo	V. Calo, <i>Contributing Member</i>
M. Colombo	G. Gobbi, <i>Contributing Member</i>
P. Conti	A. Gusmaroli, <i>Contributing Member</i>
D. Cortassa	G. Pontiggia, <i>Contributing Member</i>
A. Fabiano	D. D. Raimander, <i>Contributing Member</i>
F. Finco	
M. Guglielmetti	

COMMITTEE ON WELDING, BRAZING, AND FUSING (BPV IX)

M. J. Pischke, <i>Chair</i>	E. G. Reichelt
P. L. Sturgill, <i>Vice Chair</i>	M. J. Rice
R. Rahaman, <i>Staff Secretary</i>	W. J. Sperko
D. Barborak	J. P. Swezy, Jr.
M. Bernasek	A. D. Wilson
M. A. Boring	L. Costa, <i>Delegate</i>
D. A. Bowers	D. Pojatar, <i>Delegate</i>
N. Carter	D. D. Raimander, <i>Delegate</i>
J. G. Feldstein	A. Roza, <i>Delegate</i>
P. Gilston	M. Consonni, <i>Contributing Member</i>
S. E. Gingrich	R. M. Jessee, <i>Contributing Member</i>
K. L. Hayes	P. L. Van Fosson, <i>Contributing Member</i>
J. S. Lee	R. K. Brown, Jr., <i>Honorary Member</i>
W. M. Lundy	M. L. Carpenter, <i>Honorary Member</i>
D. W. Mann	B. R. Newmark, <i>Honorary Member</i>
S. A. Marks	S. D. Reynolds, Jr., <i>Honorary Member</i>
T. Melfi	
W. F. Newell, Jr.	

Special Working Group on Bolted Flanged Joints (BPV VIII)

W. Brown, <i>Chair</i>	R. W. Mikitka
M. Osterfoss, <i>Vice Chair</i>	D. Nash
D. Bankston, Jr.	M. Ruffin
C. W. Cary	M. Siddiqui
A. Chaudouet	E. Jamalyaria, <i>Contributing Member</i>
H. Chen	G. Van Zyl, <i>Contributing Member</i>
D. Francis	J. Veiga, <i>Contributing Member</i>
H. Lejeune	R. Wacker, <i>Contributing Member</i>
A. Mann	
W. McDaniel	

Subgroup on Brazing (BPV IX)

S. A. Marks, <i>Chair</i>	M. J. Pischke
E. W. Beckman	P. L. Sturgill
A. F. Garbolevsky	J. P. Swezy, Jr.
N. Mohr	

Subgroup on General Requirements (BPV IX)

N. Carter, <i>Chair</i>	K. Meszaros
P. Gilston, <i>Vice Chair</i>	H. B. Porter
S. A. Marks, <i>Secretary</i>	D. Smith
J. P. Bell	P. L. Sturgill
D. A. Bowers	J. P. Swezy, Jr.
T. Bunyarattaphantu	E. W. Woelfel
M. Cox	L. Costa, <i>Delegate</i>
M. Heinrichs	E. W. Beckman, <i>Contributing Member</i>
R. M. Jessee	A. Davis, <i>Contributing Member</i>
P. Matkovics	B. R. Newmark, <i>Honorary Member</i>
W. May	

Subgroup on Interpretations (BPV VIII)

P. Matkovics, <i>Chair</i>	D. T. Peters
J. Oh, <i>Staff Secretary</i>	J. Qu
S. R. Babka	F. L. Richter
L. Bower	S. C. Roberts
T. Bunyarattaphantu	C. D. Rodery
J. Cameron	T. G. Seipp
C. W. Cary	E. Smith
P. Chavdarov	J. C. Sowinski
M. Faulkner	K. Subramanian
T. Halligan	J. P. Swezy, Jr.
B. F. Hantz	A. Viet
J. Hoskinson	K. Xu
M. Kowalczyk	G. Auriolos, Sr., <i>Contributing Member</i>
D. L. Kurlie	R. J. Basile, <i>Contributing Member</i>
K. Kescu	D. A. Swanson, <i>Contributing Member</i>
M. D. Lower	
S. A. Marks	
D. I. Morris	

Subgroup on Materials (BPV IX)

M. Bernasek, <i>Chair</i>	D. D. Raimander
T. Anderson	A. Roza
L. Constantinescu	C. E. Sainz
E. Cutlip	P. L. Sturgill
S. E. Gingrich	C. Zafir
L. S. Harbison	L. Costa, <i>Delegate</i>
M. James	V. G. V. Giunto, <i>Delegate</i>
R. M. Jessee	D. J. Kotecki, <i>Contributing Member</i>
T. Melfi	B. Krueger, <i>Contributing Member</i>
S. D. Nelson	W. J. Sperko, <i>Contributing Member</i>
M. J. Pischke	M. J. Stanko, <i>Contributing Member</i>

Subgroup on Plastic Fusing (BPV IX)

K. L. Hayes, <i>Chair</i>	M. J. Rice
M. Brandes	S. Schuessler
R. M. Jessee	M. Troughton
J. Johnston, Jr.	C. Violand
J. E. O'Sullivan	E. W. Woelfel
E. G. Reichelt	J. Wright

Subgroup on Welding Qualifications (BPV IX)

T. Melfi, <i>Chair</i>	M. J. Rice
A. D. Wilson, <i>Vice Chair</i>	M. B. Sims
K. L. Hayes, <i>Secretary</i>	A. Spangenberg
M. Bernasek	W. J. Sperko
M. A. Boring	P. L. Sturgill
D. A. Bowers	J. P. Swezy, Jr.
R. Campbell	C. Violand
R. B. Corbit	L. Costa, <i>Delegate</i>
L. S. Harbison	D. D. Raimander, <i>Delegate</i>
M. Heinrichs	D. Chandiramani, <i>Contributing Member</i>
J. S. Lee	M. Consonni, <i>Contributing Member</i>
W. M. Lundy	M. Dehghan, <i>Contributing Member</i>
D. W. Mann	T. C. Wiesner, <i>Contributing Member</i>
K. Meszaros	
W. F. Newell, Jr.	
E. G. Reichelt	

Argentina International Working Group (BPV IX)

A. Burgueno, <i>Chair</i>	J. Caprarulo
A. R. G. Frinchaboy, <i>Vice Chair</i>	M. Favareto
R. Rahaman, <i>Staff Secretary</i>	J. A. Gandola
M. D. Kuhn, <i>Secretary</i>	M. A. Mendez
P. J. Cabot	A. E. Pastor

Germany International Working Group (BPV IX)

P. Chavadarov, <i>Chair</i>	P. Müller
R. Rahaman, <i>Staff Secretary</i>	S. Wegener
P. Khwaja, <i>Secretary</i>	J. Daldrup, <i>Contributing Member</i>
B. Daume	E. Floer, <i>Contributing Member</i>
D. Haase	A. Scherpenisse, <i>Contributing Member</i>
S. Krebs	K.-G. Toelle, <i>Contributing Member</i>
T. Ludwig	

Italy International Working Group (BPV IX)

D. D. Raimander, <i>Chair</i>	P. Pacor
F. Ferrarese, <i>Vice Chair</i>	G. Signoretta
R. Rahaman, <i>Staff Secretary</i>	V. Calo, <i>Contributing Member</i>
P. Campli, <i>Secretary</i>	G. Gobbi, <i>Contributing Member</i>
M. Bernasek	A. Gusmaroli, <i>Contributing Member</i>
A. Camanni	G. Pontiggia, <i>Contributing Member</i>
M. Mandina	P. Siboni, <i>Contributing Member</i>
A. S. Monastra	
L. Moracchioli	

Spain International Working Group (BPV IX)

F. J. Q. Pandelo, <i>Chair</i>	B. B. Miguel
F. Manas, <i>Vice Chair</i>	A. D. G. Munoz
R. Rahaman, <i>Staff Secretary</i>	A. B. Pascual
F. R. Hermida, <i>Secretary</i>	G. Gobbi, <i>Contributing Member</i>
C. A. Celimendiz	R. G. Garcia, <i>Contributing Member</i>
M. A. F. Garcia	

COMMITTEE ON FIBER-REINFORCED PLASTIC PRESSURE VESSELS (BPV X)

J. L. Bustillos, <i>Chair</i>	D. H. McCauley
D. Eisberg, <i>Vice Chair</i>	N. L. Newhouse
C. R. Ramcharran, <i>Staff Secretary</i>	G. Ramirez
A. L. Beckwith	J. R. Richter
B. R. Colley	B. F. Shelley
T. W. Cowley	G. A. Van Beek
I. L. Dinovo	S. L. Wagner
J. Eihusen	D. O. Yancey, Jr.
K. L. Gilmore	P. H. Ziehl
M. R. Gorman	D. H. Hodgkinson, <i>Contributing Member</i>
B. Hebb	D. L. Keeler, <i>Contributing Member</i>
L. E. Hunt	
B. Linnemann	

COMMITTEE ON NUCLEAR INSERVICE INSPECTION (BPV XI)

D. W. Lamond, <i>Chair</i>	G. C. Park
S. D. Kulat, <i>Vice Chair</i>	D. A. Scarth
A. T. Roberts III, <i>Vice Chair</i>	F. J. Schaaf, Jr.
D. Miro-Quesada, <i>Staff Secretary</i>	R. W. Swayne
M. L. Benson	S. Takaya
C. T. Brown	A. Udyawar
S. B. Brown	D. Vetter
T. L. Chan	J. G. Weicks
R. C. Cipolla	M. Weis
R. Clow	B. K. Welch
D. R. Cordes	Y.-K. Chung, <i>Delegate</i>
H. Do	C. Ye, <i>Delegate</i>
E. V. Farrell, Jr.	M. Homiack, <i>Alternate</i>
M. J. Ferlisi	C. Latiolais, <i>Alternate</i>
J. Hakii	R. O. McGill, <i>Alternate</i>
M. L. Hall	T. J. Griesbach, <i>Contributing Member</i>
P. J. Hennessey	J. T. Lindberg, <i>Contributing Member</i>
D. O. Henry	T. V. Vo, <i>Contributing Member</i>
R. Hinkle	C. D. Cowfer, <i>Honorary Member</i>
K. Hojo	E. B. Gerlach, <i>Honorary Member</i>
A. E. Keyser	R. E. Gimple, <i>Honorary Member</i>
H. Malikowski	F. E. Gregor, <i>Honorary Member</i>
S. L. McCracken	R. D. Kerr, <i>Honorary Member</i>
L. A. Melder	P. C. Riccardella, <i>Honorary Member</i>
S. A. Norman	R. A. West, <i>Honorary Member</i>
T. Nuoffer	C. J. Wirtz, <i>Honorary Member</i>
J. Nygaard	R. A. Yonekawa, <i>Honorary Member</i>
J. E. O'Sullivan	
N. A. Palm	

Executive Committee (BPV XI)

S. D. Kulat, <i>Chair</i>	N. A. Palm
D. W. Lamond, <i>Vice Chair</i>	G. C. Park
D. Miro-Quesada, <i>Staff Secretary</i>	A. T. Roberts III
M. L. Benson	R. W. Swayne
M. J. Ferlisi	D. Vetter
D. O. Henry	M. Homiack, <i>Alternate</i>
S. L. McCracken	

Latin American International Working Group (BPV XI)

O. Martinez, <i>Staff Secretary</i>	F. J. Schaaf, Jr.
A. Claus	F. M. Schroeter
I. M. Guerreiro	P. Yamamoto
L. R. Miño	

China International Working Group (BPV XI)

T. Yuchun, <i>Chair</i>	W. N. Pei
J. F. Cai, <i>Vice Chair</i>	L. Shiwei
C. Ye, <i>Vice Chair</i>	S. Shuo
M. W. Zhou, <i>Secretary</i>	Y. Sixin
M. Chao	Y. X. Sun
H. D. Chen	Z. Wan
Y. Cheng	Q. Wang
C. Gao	Q. W. Wang
Y. Guanghua	Z. S. Wang
Y. B. Guo	L. Xing
Y. Hongqi	F. Xu
D. R. Horn	S. X. Xu
Y. Hou	Q. Yin
Y. S. Li	Y. Zhe
Shangyuan Liu	Z. M. Zhong
Y. Nie	

Working Group on Spent Nuclear Fuel Storage and Transportation Containment Systems (BPV XI)

K. Hunter, <i>Chair</i>	K. Mauskar
M. Orihuela, <i>Secretary</i>	R. M. Meyer
D. J. Ammerman	R. M. Pace
J. Broussard	M. A. Richter
C. R. Bryan	B. Sarno
T. Carraher	R. Sindelar
D. Dunn	M. Staley
N. Fales	J. Tatman
R. C. Folley	J. Wellwood
A. Gonzalez	K. A. Whitney
G. Grant	X. J. Zhai
B. Gutherman	P.-S. Lam, <i>Alternate</i>
M. W. Joseph	G. White, <i>Alternate</i>
M. Keene	H. Smith, <i>Contributing Member</i>
M. Liu	

European International Working Group (BPV XI)

R. Döring, <i>Chair</i>	H.-W. Lange
M. Hagenbruch, <i>Vice Chair</i>	N. Legl
R. Piel, <i>Secretary</i>	T. Ludwig
P. Ancion	M. Reichert
A. Casse	L. Sybertz
C. G. Frantescu	I. Tewes
T. Hantzka	R. Tiete
E. Iacopetta	Yixing Wang
A. Juengert	J. Wendt
S. D. Kulat	

Task Group on Mitigation and Repair of Spent Nuclear Fuel Canisters (WG-SNFS & TCS) (BPV XI)

J. Tatman, <i>Chair</i>	M. Kris
D. J. Ammerman	M. Liu
J. Broussard	K. Mauskar
C. R. Bryan	S. L. McCracken
G. R. Cannell	M. Orihuela
K. Dietrich	M. Richter
D. Dunn	K. E. Ross
N. Fales	B. Sarno
R. C. Folley	R. Sindelar
D. Jacobs	J. Wellwood
N. Klymyshyn	A. Williams

India International Working Group (BPV XI)

S. B. Parkash, <i>Chair</i>	K. K. Rai
D. Narain, <i>Vice Chair</i>	D. Rawal
Z. M. Mansuri	R. Sahai
M. R. Nadgouda	R. K. Sharma
N. Palm	

Subgroup on Evaluation Standards (BPV XI)

N. A. Palm, <i>Chair</i>	R. O. McGill
S. X. Xu, <i>Secretary</i>	R. M. Pace
M. L. Benson	S. Ranganath
R. C. Cipolla	C. J. Sallaberry
C. M. Faigy	D. A. Scarth
M. M. Farooq	D. J. Shim
T. J. Griesbach	A. Udyawar
K. Hojo	T. V. Vo
M. Kirk	G. M. Wilkowski
D. R. Lee	K. Hasegawa, <i>Contributing Member</i>
Y. S. Li	H. S. Mehta, <i>Contributing Member</i>

Special Working Group on Editing and Review (BPV XI)

R. W. Swayne, <i>Chair</i>	M. Orihuela
R. C. Cipolla	D. A. Scarth
D. O. Henry	A. Udyawar

Task Group on Inspectability (BPV XI)

E. Henry, <i>Chair</i>	J. Honcharik
B. Langston, <i>Secretary</i>	C. Latiolais
D. Brown	J. T. Lindberg
A. Bushmire	L. Loomis
A. Cardillo	S. Matsumoto
K. Caver	D. E. Matthews
D. R. Cordes	P. J. O'Regan
D. O. Henry	J. B. Ossmann

Task Group on Evaluation of Beyond Design Basis Events (SG-ES) (BPV XI)

R. M. Pace, <i>Chair</i>	S. A. Kleinsmith
S. X. Xu, <i>Secretary</i>	M. Moenssens
G. A. Antaki	T. V. Vo
P. R. Donavin	K. Voelsing
R. G. Gilada	G. M. Wilkowski
T. J. Griesbach	F. G. Abatt, <i>Contributing Member</i>
M. Hayashi	H. S. Mehta, <i>Contributing Member</i>
K. Hojo	

**Working Group on Flaw Evaluation
(SG-ES) (BPV XI)**

R. C. Cipolla, <i>Chair</i>	C. Liu
S. X. Xu, <i>Secretary</i>	M. Liu
M. L. Benson	G. A. Miessi
H. D. Chung	S. Noronha
N. G. Cofie	R. K. Qashu
M. A. Erickson	D. A. Scarth
C. M. Faidy	W. L. Server
M. M. Farooq	D. J. Shim
B. R. Ganta	S. Smith
R. G. Gilada	M. Uddin
C. Guzman-Leong	A. Udyawar
K. Hojo	T. V. Vo
F. Iwamatsu	M. Walter
S. Kalyanam	K. Wang
Y. Kim	B. Wasiluk
V. Lacroix	G. M. Wilkowski
D. R. Lee	H. S. Mehta, <i>Contributing Member</i>
Y. S. Li	

**Working Group on Flaw Evaluation Reference Curves
(SG-ES) (BPV XI)**

A. Udyawar, <i>Chair</i>	A. Morley
D. A. Scarth, <i>Secretary</i>	B. Pellereau
M. L. Benson	S. Ranganath
F. W. Brust	D. J. Shim
R. C. Cipolla	S. Smith
M. M. Farooq	M. Uddin
A. E. Freed	T. V. Vo
K. Hasegawa	G. White
K. Hojo	S. X. Xu
F. Iwamatsu	H. S. Mehta, <i>Contributing Member</i>
V. Lacroix	

**Working Group on High Temperature Flaw Evaluation
(SG-ES) (BPV XI)**

C. J. Sallaberry, <i>Chair</i>	M. Petkov
F. W. Brust	H. Qian
P. Carter	D. A. Scarth
K. Gresh	D. J. Shim
S. Kalyanam	A. Udyawar
B. Lin	X. Wei
B.-L. Lyow	S. X. Xu
M. C. Messner	J. Bass, <i>Alternate</i>

Working Group on Operating Plant Criteria (SG-ES) (BPV XI)

M. Kirk, <i>Chair</i>	R. M. Pace
D. Rudland, <i>Secretary</i>	N. A. Palm
D. B. Denis	S. Ranganath
M. A. Erickson	W. L. Server
A. E. Freed	C. A. Tomes
T. J. Griesbach	A. Udyawar
B. Hall	T. V. Vo
M. Hayashi	H. Q. Xu
R. Janowiak	M. Yamamoto
S. A. Kleinsmith	E. Haywood, <i>Alternate</i>
H. Kobayashi	H. S. Mehta, <i>Contributing Member</i>
A. D. Odell	

Task Group on Appendix L (WG-OPC) (SG-ES) (BPV XI)

N. Glunt, <i>Chair</i>	A. D. Odell
R. M. Pace, <i>Secretary</i>	C.-S. Oh
C. Coleman	H. Park
J. I. Duo	S. Ranganath
A. E. Freed	A. Scott
M. A. Gray	D. J. Shim
T. J. Griesbach	S. Smith
H. Nam	A. Udyawar
A. Nana	T. V. Vo

Working Group on Pipe Flaw Evaluation (SG-ES) (BPV XI)

D. A. Scarth, <i>Chair</i>	Y. S. Li
S. Kalyanam, <i>Secretary</i>	R. O. McGill
K. Azuma	G. A. Miessi
F. W. Brust	S. M. Parker
H. D. Chung	S. H. Pellet
R. C. Cipolla	D. Rudland
N. G. Cofie	C. J. Sallaberry
C. M. Faidy	W. L. Server
M. M. Farooq	D. J. Shim
B. R. Ganta	S. Smith
R. G. Gilada	M. F. Uddin
S. R. Gosselin	A. Udyawar
C. E. Guzman-Leong	T. V. Vo
K. Hasegawa	K. Wang
K. Hojo	B. Wasiluk
D. N. Hopkins	G. M. Wilkowski
E. J. Houston	S. X. Xu
F. Iwamatsu	Y. Zou
R. Janowiak	K. Gresh, <i>Alternate</i>
Y. Kim	H. S. Mehta, <i>Contributing Member</i>
V. Lacroix	

Task Group on Code Case N-513 (WG-PFE) (SG-ES) (BPV XI)

R. O. McGill, <i>Chair</i>	R. Janowiak
S. M. Parker, <i>Secretary</i>	M. Kassir
G. A. Antaki	S. H. Pellet
R. C. Cipolla	D. Rudland
M. M. Farooq	D. A. Scarth
K. Gresh	S. X. Xu
E. J. Houston	

**Task Group on Evaluation Procedures for Degraded Buried Pipe
(WG-PFE) (SG-ES) (BPV XI)**

R. O. McGill, <i>Chair</i>	M. Kassir
S. X. Xu, <i>Secretary</i>	M. Moenssens
F. G. Abatt	R. M. Pace
G. A. Antaki	S. H. Pellet
R. C. Cipolla	D. Rudland
R. G. Gilada	D. A. Scarth
R. Janowiak	

**Task Group on Flaw Evaluation for HDPE Pipe
(WG-PFE) (SG-ES) (BPV XI)**

S. Kalyanam, <i>Chair</i>	D. J. Shim
P. Krishnaswamy	M. Troughton
C. Liu	R. Wolfe
M. Moenssens	J. Wright
D. P. Munson	S. X. Xu
D. A. Scarth	

Subgroup on Nondestructive Examination (BPV XI)

D. O. Henry, <i>Chair</i>	J. Harrison
T. Cinson, <i>Secretary</i>	D. A. Kull
C. T. Brown	C. Latiolais
A. Bushmire	J. T. Lindberg
T. L. Chan	F. J. Schaaf, Jr.
D. R. Cordes	D. R. Slivon
S. E. Cumblidge	R. V. Swain
K. J. Hacker	C. A. Nove, <i>Alternate</i>

Task Group on Nonmetallic Component Degradation and Failure Monitoring (SG-RIM) (BPV XI)

M. P. Metcalfe, <i>Chair</i>	N. Craft
A. Tzelepi, <i>Secretary</i>	W. J. Geringer
M. T. Audrain	K. Harris
S. Baylis	P.-A. Juan
G. Beirnaert	J. Lang
A. A. Campbell	C. Marks
C. Chen	J. Potgieter

Working Group on Personnel Qualification and Surface Visual and Eddy Current Examination (SG-NDE) (BPV XI)

C. T. Brown, <i>Chair</i>	D. O. Henry
M. Orihuela, <i>Secretary</i>	B. Langston
D. Brown	C. Shinsky
T. Cinson	R. Tedder
S. E. Cumblidge	T. Thulien
N. Farenbaugh	J. T. Timm
J. Harrison	

ASME/JSME Joint Working Group on RIM Processes and System-Based Code (SG-RIM) (BPV XI)

S. Takaya, <i>Chair</i>	R. Meyer
C. Wax, <i>Vice Chair</i>	T. Muraki
M. T. Audrain	S. Okajima
K. Dozaki	A. T. Roberts III
J. T. Fong	C. J. Sallaberry
J. Hakii	F. J. Schaaf, Jr.
K. Harris	R. Vayda
M. Hayashi	D. Watanabe
S. Kalyanam	H. Yada
D. R. Lee	K. Yamada
H. Machida	T. Asayama, <i>Contributing Member</i>
M. Mallet	T. Lupold, <i>Contributing Member</i>
R. J. McReynolds	

Working Group on Procedure Qualification and Volumetric Examination (SG-NDE) (BPV XI)

J. Harrison, <i>Chair</i>	C. Latiolais
D. A. Kull, <i>Secretary</i>	C. A. Nove
A. Bushmire	D. R. Slivon
D. R. Cordes	R. V. Swain
K. J. Hacker	D. Van Allen
R. E. Jacob	J. Williams
W. A. Jensen	B. Lin, <i>Alternate</i>

Subgroup on Repair/Replacement Activities (BPV XI)

S. L. McCracken, <i>Chair</i>	L. A. Melder
E. V. Farrell, Jr., <i>Secretary</i>	G. T. Olson
M. Brandes	J. E. O'Sullivan
S. B. Brown	G. C. Park
R. Clow	A. Patel
S. J. Findlan	R. A. Patel
M. L. Hall	R. R. Stevenson
R. Hinkle	R. W. Swayne
J. Honcharik	J. G. Weicks
A. B. Meichler	

Subgroup on Reliability and Integrity Management Program (BPV XI)

A. T. Roberts III, <i>Chair</i>	M. P. Metcalfe
D. Vetter, <i>Secretary</i>	R. Meyer
T. Anselmi	M. Orihuela
M. T. Audrain	C. J. Sallaberry
N. Broom	F. J. Schaaf, Jr.
F. W. Brust	H. M. Stephens, Jr.
S. R. Doctor	R. W. Swayne
J. D. Fletcher	S. Takaya
J. T. Fong	C. Wax
K. Harris	B. K. Welch
P. J. Hennessey	R. W. Youngblood
S. Kalyanam	B. Lin, <i>Alternate</i>
D. R. Lee	V. Chugh, <i>Contributing Member</i>
C. Mallet	R. Grantom, <i>Contributing Member</i>
R. J. McReynolds	T. Lupold, <i>Contributing Member</i>

Working Group on Design and Programs (SG-RRR) (BPV XI)

S. B. Brown, <i>Chair</i>	A. B. Meichler
R. A. Patel, <i>Secretary</i>	G. C. Park
O. Bhatti	M. A. Pyne
R. Clow	A. Rezaei
R. R. Croft	R. R. Stevenson
E. V. Farrell, Jr.	K. Sullivan
K. Harris	R. W. Swayne
H. Malikowski	

Task Group on Repair and Replacement Optimization (WG-D&P) (SG-RRR) (BPV XI)

H. M. Stephens, Jr., <i>Chair</i>	J. T. Fong
M. Orihuela, <i>Vice Chair</i>	D. O. Henry
M. Turnbow, <i>Secretary</i>	R. J. McReynolds
T. Anselmi	R. Meyer
M. T. Audrain	K. Yamada
S. R. Doctor	T. Lupold, <i>Contributing Member</i>
N. A. Finney	

S. L. McCracken, <i>Chair</i>	M. L. Hall
S. J. Findlan, <i>Secretary</i>	D. Jacobs
T. Basso	H. Malikowski
R. Clow	G. C. Park
K. Dietrich	A. Patel
E. V. Farrell, Jr.	R. R. Stevenson
M. J. Ferlisi	J. G. Weicks
R. C. Folley	

**Working Group on Nonmetals Repair/Replacement Activities
(SG-RRR) (BPV XI)**

J. E. O'Sullivan, <i>Chair</i>	A. Rezaei
S. Schuessler, <i>Secretary</i>	S. Rios
M. Brandes	F. J. Schaaf, Jr.
S. W. Choi	R. Stakenborghs
M. Golliet	P. Vibien
J. Johnston, Jr.	M. P. Marohl, <i>Contributing Member</i>
T. M. Musto	A. Pridmore, <i>Contributing Member</i>

Subgroup on Water-Cooled Systems (BPV XI)

M. J. Ferlisi, <i>Chair</i>	D. W. Lamond
J. Nygaard, <i>Secretary</i>	T. Nomura
S. T. Chesworth	S. A. Norman
J. Collins	M. A. Pyne
H. Q. Do	H. M. Stephens, Jr.
K. W. Hall	M. Weis
P. J. Hennessey	B. K. Welch
A. Keller	I. A. Anchondo-Lopez, <i>Alternate</i>
A. E. Keyser	Y.-K. Chung, <i>Contributing Member</i>
S. D. Kulat	

**Task Group on Repair by Carbon Fiber Composites
(WG-NMRR) (SG-RRR) (BPV XI)**

S. W. Choi, <i>Chair</i>	R. P. Ojdovic
W. Bushika	J. E. O'Sullivan
D. Cimock	N. Otten
M. J. Constable	A. Pridmore
M. Elen	S. Rios
M. Golliet	J. Sealey
P. Krishnaswamy	R. Stakenborghs
M. Kuntz	D. J. Swaim
H. Lu	M. Tatkowski
L. Nadeau	M. F. Uddin
C. A. Nove	J. Wen

Task Group on High Strength Nickel Alloys Issues (SG-WCS) (BPV XI)

H. Malikowski, <i>Chair</i>	H. Kobayashi
C. Waskey, <i>Secretary</i>	S. E. Marlette
T. Cinson	J. Robinson
J. Collins	D. Van Allen
O. Cruz	G. White
K. Dietrich	K. A. Whitney

Working Group on Containment (SG-WCS) (BPV XI)

M. J. Ferlisi, <i>Chair</i>	M. Sircar
S. Walden, <i>Secretary</i>	P. C. Smith
H. T. Hill	R. S. Spencer
S. Johnson	A. Staller
A. E. Keyser	J. Swan
P. Leininger	C. Tillotson
J. A. Munshi	G. Z. Wang
S. Richter	M. Weis

**Working Group on Welding and Special Repair Processes
(SG-RRR) (BPV XI)**

J. G. Weicks, <i>Chair</i>	D. Jacobs
G. T. Olson, <i>Secretary</i>	M. Kris
D. Barborak	S. E. Marlette
K. Dietrich	S. L. McCracken
S. J. Findlan	L. A. Melder
R. C. Folley	J. E. O'Sullivan
M. L. Hall	A. Patel
J. Honcharik	

**Working Group on Inspection of Systems and Components
(SG-WCS) (BPV XI)**

H. Q. Do, <i>Chair</i>	A. Keller
M. Weis, <i>Secretary</i>	E. E. Keyser
R. W. Blyde	S. D. Kulat
J. Collins	E. Lantz
M. J. Ferlisi	J. C. Nygaard
M. L. Garcia Heras	S. Orita
K. W. Hall	R. S. Spencer
E. Henry	M. Walter
J. Howard	A. W. Wilkens

**Task Group on Temper Bead Welding
(WG-W&SRP) (SG-RRR) (BPV XI)**

S. J. Findlan, <i>Chair</i>	H. Kobayashi
J. Tatman, <i>Secretary</i>	S. L. McCracken
D. Barborak	N. Mohr
D. Barton	G. T. Olson
R. C. Folley	J. E. O'Sullivan
J. Graham	A. Patel
M. L. Hall	J. G. Weicks
D. Jacobs	

Working Group on Pressure Testing (SG-WCS) (BPV XI)

S. A. Norman, <i>Chair</i>	S. Levitus
M. Moenssens, <i>Secretary</i>	R. A. Nettles
T. Anselmi	J. Swan
A. Knighton	K. Whitney
D. W. Lamond	

Task Group on Weld Overlay (WG-W&SRP) (SG-RRR) (BPV XI)

S. L. McCracken, <i>Chair</i>	S. E. Marlette
S. Hunter, <i>Secretary</i>	S. K. Min
D. Barborak	G. T. Olson
D. Barton	A. Patel
S. J. Findlan	D. W. Sandusky
J. Graham	J. Tatman
M. L. Hall	J. G. Weicks
D. Jacobs	

Working Group on Risk-Informed Activities (SG-WCS) (BPV XI)

M. A. Pyne, <i>Chair</i>	J. T. Jewell
S. T. Chesworth, <i>Secretary</i>	S. D. Kulat
G. Brouette	D. W. Lamond
R. Fougereousse	E. Lantz
J. Hakii	P. J. O'Regan
K. W. Hall	N. A. Palm
M. J. Homiack	S. E. Woolf

Working Group on General Requirements (BPV XI)

D. Vetter, <i>Chair</i>	A. Mills
S. E. Woolf, <i>Secretary</i>	G. Ramaraj
T. L. Chan	T. N. Rezk
P. J. Hennessey	A. T. Roberts III
R. Hinkle	B. K. Welch
K. A. Kavanagh	B. Harris, <i>Alternate</i>

Subgroup on Nonmandatory Appendices (BPV XII)

T. A. Rogers, <i>Chair</i>	T. J. Rishel
S. Staniszewski, <i>Secretary</i>	R. C. Sallash
P. Chilukuri	D. G. Shelton
N. J. Paulick	Y. Doron, <i>Contributing Member</i>
M. Pitts	

COMMITTEE ON TRANSPORT TANKS (BPV XII)

N. J. Paulick, <i>Chair</i>	J. Roberts
M. D. Rana, <i>Vice Chair</i>	T. A. Rogers
J. Oh, <i>Staff Secretary</i>	R. C. Sallash
A. N. Antoniou	M. Shah
K. W. A. Cheng	S. Staniszewski
P. Chilukuri	A. P. Varghese
O. Mulet	R. Meyers, <i>Contributing Member</i>
M. Pitts	

COMMITTEE ON OVERPRESSURE PROTECTION (BPV XIII)

B. K. Nutter, <i>Chair</i>	J. F. Ball, <i>Contributing Member</i>
A. Donaldson, <i>Vice Chair</i>	R. W. Barnes, <i>Contributing Member</i>
C. E. Rodrigues, <i>Staff Secretary</i>	R. D. Danzy, <i>Contributing Member</i>
R. Antoniuk	J. Grace, <i>Contributing Member</i>
T. P. Beirne	S. F. Harrison, Jr., <i>Contributing Member</i>
Joey Burgess	A. Hassan, <i>Contributing Member</i>
D. B. DeMichael	P. K. Lam, <i>Contributing Member</i>
J. W. Dickson	M. Mengon, <i>Contributing Member</i>
B. Engman	J. Mize, <i>Contributing Member</i>
K. R. May	M. Mullavey, <i>Contributing Member</i>
D. Miller	J. Phillips, <i>Contributing Member</i>
T. Patel	S. Ruesenberg, <i>Contributing Member</i>
B. F. Pittel	K. Shores, <i>Contributing Member</i>
T. R. Tarbay	D. E. Tezzo, <i>Contributing Member</i>
D. E. Tompkins	A. Wilson, <i>Contributing Member</i>
J. A. West	
M. Edwards, <i>Alternate</i>	

Executive Committee (BPV XII)

M. D. Rana, <i>Chair</i>	M. Pitts
N. J. Paulick, <i>Vice Chair</i>	T. A. Rogers
J. Oh, <i>Staff Secretary</i>	S. Staniszewski
P. Chilukuri	

Executive Committee (BPV XIII)

A. Donaldson, <i>Chair</i>	K. R. May
B. K. Nutter, <i>Vice Chair</i>	T. Patel
C. E. Rodrigues, <i>Staff Secretary</i>	B. F. Pittel
T. Beirne	

Subgroup on Design and Materials (BPV XII)

P. Chilukuri, <i>Chair</i>	A. P. Varghese
K. W. A. Cheng	K. Xu
S. L. McWilliams	D. K. Chandiramani, <i>Contributing Member</i>
N. J. Paulick	Y. Doron, <i>Contributing Member</i>
M. D. Rana	M. Pitts, <i>Contributing Member</i>
T. J. Rishel	D. G. Shelton, <i>Contributing Member</i>
T. A. Rogers	B. E. Spencer, <i>Contributing Member</i>
R. C. Sallash	J. Zheng, <i>Contributing Member</i>
M. Shah	
S. Staniszewski	

Subgroup on Design and Materials (BPV XIII)

T. Patel, <i>Chair</i>	D. Miller
V. Kalyanasundaram, <i>Vice Chair</i>	T. R. Tarbay
A. Williams, <i>Secretary</i>	J. A. West
T. K. Acharya	D. J. Azukas, <i>Contributing Member</i>
W. E. Chapin	R. D. Danzy, <i>Contributing Member</i>
B. Joergensen	M. Mullavey, <i>Contributing Member</i>
R. Krithivasan	G. Ramirez, <i>Contributing Member</i>
J. Latshaw	S. Zalar, <i>Contributing Member</i>

Subgroup on Fabrication, Inspection, and Continued Service (BPV XII)

M. Pitts, <i>Chair</i>	J. Roberts
P. Chilukuri, <i>Secretary</i>	R. C. Sallash
K. W. A. Cheng	S. Staniszewski
Y. Doron	K. Mansker, <i>Contributing Member</i>
M. Koprivnak	G. McRae, <i>Contributing Member</i>
O. Mulet	T. A. Rogers, <i>Contributing Member</i>
T. J. Rishel	

Subgroup on General Requirements (BPV XII)

S. Staniszewski, <i>Chair</i>	T. J. Rishel
A. N. Antoniou	R. C. Sallash
P. Chilukuri	Y. Doron, <i>Contributing Member</i>
J. L. Freiler	S. L. McWilliams, <i>Contributing Member</i>
O. Mulet	T. A. Rogers, <i>Contributing Member</i>
B. F. Pittel	D. G. Shelton, <i>Contributing Member</i>
M. Pitts	

Subgroup on General Requirements (BPV XIII)

B. F. Pittel, <i>Chair</i>	D. E. Tezzo
J. Grace, <i>Secretary</i>	D. E. Tompkins
R. Antoniuk	J. F. White
J. F. Ball	M. Edwards, <i>Alternate</i>
Joey Burgess	P. Chavdarov, <i>Contributing Member</i>
John Burgess	J. L. Freiler, <i>Contributing Member</i>
D. B. DeMichael	G. D. Goodson, <i>Contributing Member</i>
A. Donaldson	B. Joergensen, <i>Contributing Member</i>
S. T. French	P. K. Lam, <i>Contributing Member</i>
J. Horne	E. Pearson, <i>Contributing Member</i>
R. Klimas, Jr.	J. Phillips, <i>Contributing Member</i>
Z. E. Kumana	S. Ruesenberg, <i>Contributing Member</i>
D. Mainiero-Cessna	S. Zalar, <i>Contributing Member</i>
K. R. May	
J. Mize	
L. Moedinger	
M. Mullavey	
A. Peck	

Subgroup on Nuclear (BPV XIII)

K. R. May, <i>Chair</i>	S. Jones
J. F. Ball, <i>Vice Chair</i>	D. Miller
R. Krithivasan, <i>Secretary</i>	T. Patel
M. Brown	B. J. Yonsky
J. W. Dickson	J. Yu, <i>Alternate</i>
N. Hansing	S. T. French, <i>Contributing Member</i>

Subgroup on Testing (BPV XIII)

T. P. Beirne, <i>Chair</i>	R. Lack, <i>Alternate</i>
J. W. Dickson, <i>Vice Chair</i>	M. Brown, <i>Contributing Member</i>
C. Hofmeister, <i>Secretary</i>	J. Mize, <i>Contributing Member</i>
V. Chicola III	M. Mullavey, <i>Contributing Member</i>
B. Engman	S. Ruesenberg, <i>Contributing Member</i>
R. J. Garnett	C. Sharpe, <i>Contributing Member</i>
R. Houk	K. Shores, <i>Contributing Member</i>
N. Jump	A. Strecker, <i>Contributing Member</i>
B. K. Nutter	A. Wilson, <i>Contributing Member</i>
J. R. Thomas, Jr.	
C. Bauer, <i>Alternate</i>	

COMMITTEE ON NUCLEAR CERTIFICATION (CNC)

R. R. Stevenson, <i>Chair</i>	T. N. Rezk
M. A. Lockwood, <i>Vice Chair</i>	E. A. Whittle
H. Ruan, <i>Secretary</i>	T. Aldo, <i>Alternate</i>
S. Andrews	M. Blankinship, <i>Alternate</i>
A. Appleton	G. Brouette, <i>Alternate</i>
G. Claffey	Y. Diaz-Castillo, <i>Alternate</i>
N. DeSantis	P. D. Edwards, <i>Alternate</i>
C. Dinic	R. Hinkle, <i>Alternate</i>
G. Gobbi	K. M. Hottle, <i>Alternate</i>
J. Grimm	J. Kiefer, <i>Alternate</i>
J. W. Highlands	S. J. Montano, <i>Alternate</i>
K. A. Kavanagh	R. Spuhl, <i>Alternate</i>
J. C. Krane	M. Wilson, <i>Alternate</i>
B. McGlone	S. Yang, <i>Alternate</i>
I. Olson	M. Burke, <i>Contributing Member</i>
E. L. Pleins	S. F. Harrison, Jr., <i>Contributing Member</i>
L. Ponce	
T. E. Quaka	

**COMMITTEE ON BOILER AND PRESSURE VESSEL CONFORMITY
ASSESSMENT (CBPVCA)**

L. E. McDonald, <i>Chair</i>	P. Williams
E. Whittle, <i>Vice Chair</i>	T. P. Beirne, <i>Alternate</i>
G. Moino, <i>Staff Secretary</i>	N. Caputo, <i>Alternate</i>
P. Chavdarov	J. M. Downs, <i>Alternate</i>
J. P. Chicoine	Y.-S. Kim, <i>Alternate</i>
A. Donaldson	B. L. Krasiun, <i>Alternate</i>
T. E. Hansen	K. Roewe, <i>Alternate</i>
W. Hibdon	B. C. Turczynski, <i>Alternate</i>
M. Prefumo	R. Underwood, <i>Alternate</i>
R. Rockwood	J. Yu, <i>Alternate</i>
G. Scribner	D. Cheetham, <i>Contributing Member</i>
D. E. Tuttle	A. J. Spencer, <i>Honorary Member</i>
R. V. Wielgoszinski	

CORRESPONDENCE WITH THE COMMITTEE

General

ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Section of the ASME Boiler and Pressure Vessel Code (BPVC) should be sent to the staff secretary noted on the Section's committee web page, accessible at <https://go.asme.org/CSCcommittees>.

NOTE: See ASME BPVC Section II, Part D for guidelines on requesting approval of new materials. See Section II, Part C for guidelines on requesting approval of new welding and brazing materials ("consumables").

Revisions and Errata

The committee processes revisions to this Code on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Code. Approved revisions will be published in the next edition of the Code.

In addition, the committee may post errata and Special Notices at <http://go.asme.org/BPVCerrata>. Errata and Special Notices become effective on the date posted. Users can register on the committee web page to receive email notifications of posted errata and Special Notices.

This Code is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

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

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Code

(4) to permit use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases 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.

(c) The committee will consider proposed cases concerning the following topics only:

(1) equipment to be marked with the ASME Single Certification Mark, or

(2) equipment to be constructed as a repair/replacement activity under the requirements of Section XI

(d) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Code Section and the paragraph, figure, or table number to which the proposed case applies

(4) the editions of the Code to which the proposed case applies

(e) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Cases that have been approved will appear in the next edition or supplement of the Code Cases books, "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements. Supplements will be sent or made available automatically to the purchasers of the Code Cases books until the next edition of the Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. The status of any case is available at <http://go.asme.org/BPVCCDatabase>. An index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases is available at <http://go.asme.org/BPVCC>.

Interpretations

(a) Interpretations clarify existing Code requirements and are written as a question and reply. Interpretations do not introduce new requirements. If a revision to resolve conflicting or incorrect wording is required to support the interpretation, the committee will issue an intent interpretation in parallel with a revision to the Code.

(b) Upon request, the committee will render an interpretation of any requirement of the Code. An interpretation can be rendered only in response to a request submitted through the online Inquiry Submittal Form at <http://go.asme.org/InterpretationRequest>. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

(c) ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers may track the status of their requests at <http://go.asme.org/Interpretations>.

(d) ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee or subcommittee. ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

(e) Interpretations are published in the ASME Interpretations Database at <http://go.asme.org/Interpretations> as they are issued.

Committee Meetings

The ASME BPVC committees regularly hold meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the applicable committee. Information on future committee meetings can be found at <http://go.asme.org/BCW>.

SUMMARY OF CHANGES

Changes listed below are identified on the pages by a margin note, **(25)**, placed next to the affected area.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xiii	List of Sections	Title of Section XI, Division 1 revised
xiv	Foreword	Third, fourth, seventh, tenth, and eleventh paragraphs editorially revised
xvii	Personnel	Updated
1	Statement of Policy on Information Provided in the Stress Tables	Last paragraph added
8–11	Table 1A	(1) Lines 8 and 15 revised (2) Line 14 deleted
12–15	Table 1A	Lines 24–27 and 30–33 revised
16–19	Table 1A	(1) Lines 11 and 30 revised (2) Line 33 deleted
20–23	Table 1A	Lines 19 and 22 revised
24–27	Table 1A	(1) Lines 7 and 31 revised (2) Line 15 deleted (3) Lines 32 and 38 added
32–35	Table 1A	Lines 11, 14, and 19 revised
36–39	Table 1A	Lines 7, 14, 32, and 44 revised
40–43	Table 1A	Lines 1, 17, and 37 revised
44–47	Table 1A	Line 13 revised
52–55	Table 1A	Lines 10, 15, 24, 27, 30, 36, 37, 39, 40, 42, and 43 revised
56–59	Table 1A	Line 5, 6, and 22–25 deleted
60–63	Table 1A	Line 34 revised
64–67	Table 1A	Lines 11, 13, 28, and 30 added
72–75	Table 1A	Lines 3–45 added
76–79	Table 1A	(1) Lines 1, 3–22, and 31–45 added (2) Line 27 revised
80–83	Table 1A	Lines 1–44 added
88–91	Table 1A	Lines 15, 16, 19, 20, 22, 23, 26, 27, 39, 40, and 45 revised
92–95	Table 1A	Lines 1, 3, 4, 6, 7, 36, 37, 40, 41, 43, and 44 revised
96–99	Table 1A	Lines 1 and 2 revised
100–103	Table 1A	Lines 25 and 26 revised
104–107	Table 1A	Lines 4, 9, 10, 13, 14, 17, 18, 21, 22, and 26–29 revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
108–111	Table 1A	Lines 31, 32, 36, 37, 39, and 40 revised
112–115	Table 1A	Line 12, 13, 19–24, 27, 28, 31–34, 39, 40, and 43–45 revised
116–119	Table 1A	Lines 1, 2, 4, 7–13, 16–27, 41, and 42 revised
120–123	Table 1A	Lines 18, 19, 36, 37, 42, and 45 revised
124–127	Table 1A	Lines 1–5, 19, 20, 26, 31–34, 36–41, 44, and 45 revised
128–131	Table 1A	Lines 5–9, 13, and 14 revised
148–151	Table 1A	Lines 20, 21, 31, 32, 38, and 39 revised
152–155	Table 1A	Lines 37, 39, 40, and 44 revised
156–159	Table 1A	Lines 33 and 34 revised
160–163	Table 1A	Lines 21, 22, 39, and 40 revised
172, 173	Notes to Table 1A	General Note (a) revised and Notes H3 and H4 deleted
196–199	Table 1B	Lines 36–45 revised
200–203	Table 1B	Lines 1–25 and 40–45 revised
204–207	Table 1B	Lines 1, 8, 9, 12–18, 20–33, and 36–40 revised
208–211	Table 1B	(1) Lines 3, 6, 7 added (2) Lines 4, 11, 16–25, 28–31, 34–37, 42, and 43 revised
212–215	Table 1B	(1) Lines 1, 2, 5–7, 9, 10, 12–14, 16, 18, 20–23, 25, 28–31, 33, 35, and 38–43 revised (2) Lines 8, 11, 15, 17, and 19 deleted
228–231	Table 1B	Lines 16–22, 26, and 31 revised
252–255	Table 1B	Lines 21 and 27 revised
305	Notes to Table 1B	Notes G37 and G38 revised
312–314	Table 2A	Lines 25 and 26 revised
316–318	Table 2A	(1) Lines 21, 23, and 25 added (2) Lines 22 and 24 revised
324–326	Table 2A	Lines 30 and 31 revised
328–330	Table 2A	Line 41 revised
336–338	Table 2A	Lines 36 and 37 revised
340–342	Table 2A	Line 32 deleted
344–346	Table 2A	Lines 14, 16, 27, and 29 added
348–350	Table 2A	Lines 29–39 added
399, 400	Notes to Table 2A	(1) General Note (a) and Note E4 revised (2) Notes G23, G24, and W8 added
406–408	Table 2B	(1) Lines 10, 22–25, 27–29, 31–40, and 43–45 revised (2) Lines 11–14 added
410–412	Table 2B	Lines 1, 3, 4, 26, 36, and 37 revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
430–433	Table 3	(1) Line 4 deleted (2) Line 5 revised
438–441	Table 3	(1) Lines 16 and 17 added (2) Line 33 revised
446–449	Table 3	(1) Lines 11–14, 16, 18, 35, 36, 40, 44, and 45 revised (2) Line 17 deleted
450–453	Table 3	Lines 1–4 revised
472–475	Table 5A	Lines 38 and 39 revised
476–479	Table 5A	(1) Line 21 revised (2) Lines 22 and 24 added
484–487	Table 5A	Lines 5 and 6 revised
488–491	Table 5A	Line 5 revised
492–495	Table 5A	Lines 22, 23, and 30–32 revised
496–499	Table 5A	(1) Line 10 deleted (2) Lines 35, 37, and 45 added
500–503	Table 5A	Lines 2 and 39–45 added
504–507	Table 5A	Lines 1–4 added
520–523	Table 5A	Lines 33–38 revised
532	Notes to Table 5A	General Note (a) revised and Notes G18 through G20 added
538–541	Table 5B	(1) Lines 17–20 added (2) Lines 34–40, 42, 43, and 45 revised
560, 561	Table 6A	Line 32 added
562, 563	Table 6A	(1) Lines 20 and 32–35 revised (2) Line 22 added (3) Line 25 deleted
564, 565	Table 6A	(1) Line 13 revised (2) Line 29 deleted
566, 567	Table 6A	Lines 1–5 and 10 added
570, 571	Table 6B	(1) Lines 4 and 25–45 revised (2) Lines 5, 17, and 18 added
572, 573	Table 6B	Lines 1–24, 28–30, 33, 36, 39, and 44 revised
574, 575	Table 6B	Lines 1 and 25–28 revised
586, 587	Table 6D	Lines 21–40 added
588, 589	Table 6D	Lines 1–5 added
592–595	Table U	(1) Lines 1–5, 8, 14, 22, 28, 35, and 39 added (2) Line 20 deleted
600–603	Table U	(1) Line 16 deleted (2) Line 43 added

<i>Page</i>	<i>Location</i>	<i>Change</i>
604–607	Table U	Line 37 deleted
608–611	Table U	(1) Line 7 added (2) Lines 9 and 14 revised
612–615	Table U	(1) Lines 2, 7, 13, 15–17, 22, and 28–37 added (2) Line 18 deleted (3) Line 19 revised
616–619	Table U	Line 12 added
620–623	Table U	Lines 17–35, 40, and 41 added
624–627	Table U	Line 7 added
636–639	Table U	Line 10 revised
644–647	Table U	Lines 19–32 and 35–45 revised
648–651	Table U	(1) Lines 1–3, 21–35, and 41 revised (2) Lines 40 and 42 added (3) Line 45 deleted
652–655	Table U	Lines 11 and 12 deleted
656–659	Table U	Lines 22, 23, 30, 38, and 39 added
660–663	Table U	Lines 9, 11, 25, and 27 added
664–667	Table U	Lines 3–6, 8, 10, 12, 13, and 34–45 added
668–671	Table U	Lines 1–3, 8–14, and 20–38 added
680–683	Table U	Line 22 added
692–695	Table U	Lines 7 and 8 added
744–747	Table U	Lines 36 and 44 revised
748–751	Table U	Lines 12–17 and 25–42 revised
752–755	Table U	(1) Lines 22–27 and 44 revised (2) Line 37 added
756–759	Table U	(1) Lines 15, 16, 22, 23, 28, 29, 34, 35, 40, 41, and 44 revised (2) Lines 17, 18, 20, and 21 deleted
760–763	Table U	Lines 1, 3, 12, 15, 16, 27, 28, 30, and 33–35 revised
784–787	Table U	Lines 5 and 11 revised
792–795	Table U	Lines 36–45 added
796–799	Table U	Lines 1–10 and 31–36 added
812–815	Table U	Lines 32 and 40 added
818–822	Table Y-1	(1) Lines 3, 9, 17, 23, 30, and 34 added (2) Line 15 deleted
830–834	Table Y-1	Line 25 deleted
836–840	Table Y-1	(1) Line 12 added (2) Lines 14 and 18 revised
842–846	Table Y-1	(1) Line 16 deleted (2) Lines 31, 34, and 40 added (3) Line 33 revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
848–852	Table Y-1	Lines 30, 35, 41, and 43–45 added
854–858	Table Y-1	(1) Line 1 deleted (2) Line 2 revised (3) Lines 5 and 44 added
866–870	Table Y-1	(1) Lines 10, 11, and 24 added (2) Lines 41 and 43 revised
878–882	Table Y-1	Line 25 revised
896–900	Table Y-1	Lines 7–20 and 38–45 revised
902–906	Table Y-1	(1) Lines 1–7 revised (2) Lines 12 and 14 added (3) Lines 17, 28, and 29 deleted
914–918	Table Y-1	Lines 10, 11, 26, 28, 42, and 44 added
920–924	Table Y-1	Lines 21–24 added
926–930	Table Y-1	Lines 7–21, 26–32, and 38–45 added
932–936	Table Y-1	Lines 1–11 added
944–948	Table Y-1	Line 41 added
962–966	Table Y-1	Lines 30 and 31 added
1046–1050	Table Y-1	(1) Line 12 deleted (2) Lines 31–36, 44, and 45 revised
1052–1056	Table Y-1	Lines 1–16 and 36–41 revised
1058–1062	Table Y-1	(1) Line 6 added (2) Lines 13, 29, 30, 33, 36, 37, 42, and 43 revised (3) Lines 31, 32, 34, and 35 deleted
1064–1068	Table Y-1	Lines 3, 4, 10, 12, 15, 17, 18, 20–23, 35, 36, and 38 revised
1070–1074	Table Y-1	Lines 4, 5, 7, and 9–11 revised
1082–1086	Table Y-1	Line 3 revised
1100–1104	Table Y-1	Lines 32 and 38 revised
1118–1122	Table Y-1	Lines 15–25 and 32–40 added
1124–1128	Table Y-1	Lines 16–21 added
1148–1152	Table Y-1	Lines 28 and 36 added
1153	Notes to Table Y-1	General Note (a) revised
1156	Table TE-1	Note (1) revised
1163	Table TE-4	N06617 added
1174	Table TCD	(1) Temperatures 925°C, 950°C, and 975°C and N06617 added (2) Note (5) revised
1188	Table TM-1	Note (2) revised
1193	Table TM-4	Modulus of elasticity for 900°C, 950°C, and 1000°C added for N06617
1284	Table HA-2	Revised
1338	5-100	Second and last paragraphs revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
1340	5-300	Revised
1340	5-400	First paragraph revised
1341	5-700	First paragraph revised
1341	5-900	Revised
1344	5-1500	(1) First paragraph and subparas. (b) and (b)(2)(-a) through (b)(2)(-e) revised (2) Subparagraph (c) added

CROSS-REFERENCING IN THE ASME BPVC

Paragraphs within the ASME BPVC may include subparagraph breakdowns, i.e., nested lists. The following is a guide to the designation and cross-referencing of subparagraph breakdowns:

(a) Hierarchy of Subparagraph Breakdowns

- (1) First-level breakdowns are designated as (a), (b), (c), etc.
- (2) Second-level breakdowns are designated as (1), (2), (3), etc.
- (3) Third-level breakdowns are designated as (-a), (-b), (-c), etc.
- (4) Fourth-level breakdowns are designated as (-1), (-2), (-3), etc.
- (5) Fifth-level breakdowns are designated as (+a), (+b), (+c), etc.
- (6) Sixth-level breakdowns are designated as (+1), (+2), etc.

(b) Cross-References to Subparagraph Breakdowns. Cross-references within an alphanumerically designated paragraph (e.g., PG-1, UIG-56.1, NCD-3223) do not include the alphanumerical designator of that paragraph. The cross-references to subparagraph breakdowns follow the hierarchy of the designators under which the breakdown appears.

The following examples show the format:

- (1) If X.1(c)(1)(-a) is referenced in X.1(c)(1), it will be referenced as (-a).
- (2) If X.1(c)(1)(-a) is referenced in X.1(c)(2), it will be referenced as (1)(-a).
- (3) If X.1(c)(1)(-a) is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
- (4) If X.1(c)(1)(-a) is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).

SUBPART 1

STRESS TABLES

STATEMENT OF POLICY ON INFORMATION PROVIDED IN THE STRESS TABLES

(25)

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 Section II, Part D, [Subpart 1](#) are mandatory. It is vital to recognize that lines of information in Tables 1A, 1B, 2A, 2B, 3, 4, 5A, 5B, 6A, 6B, 6C, and 6D 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, 5A, 6A, 6C, and 6D, 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 six 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, 5A, 6A, 6C, and 6D, and Tables 1B, 2B, 5B, and 6B, with regard to the mandatory/nonmandatory nature of the information, is

that in Tables 1B, 2B, 5B, and 6B, 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, 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, Minimum Yield Strength, and Size/Thickness dimension columns is also mandatory; however, the primary source for this information is the material specifications in Section II, Parts A and B. 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 minimum tensile and yield strength values in Parts A and B shall govern. For dual-unit specifications and for product forms for which separate U.S. Customary and Metric specifications are provided, for the Size/Thickness dimensions for size breaks at which the Minimum Specified Yield or Tensile Strengths, or both, decrease with increasing size or thickness, the values in the material specifications in Parts A and B shall govern. When there is a conflict between the maximum size or thickness values in the stress tables and those in the material specifications, the values in the stress tables 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, values may be listed in the stress tables 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.

The stress tables contain External Pressure Chart assignments. The assignments shown in the stress tables are mandatory. The titles shown for the individual charts are for information only and do not establish whether the chart is suitable for any material. The highest temperature shown on the chart represents the maximum temperature that an assigned material can be used for compression or external pressure loading, unless the allowable stress tables' Notes, the chart, or construction code rules say otherwise.

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, 5B, 6A, 6B, 6C, and 6D), tables of mechanical properties (Tables U and Y-1), and tables of physical properties (Tables TE-1 through TE-5, TCD, 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 Section II, Part D, Subpart 1. Tables 1A, 1B, 3, 5A, 5B, 6A, 6B, 6C, and 6D cover allowable stresses, while Tables 2A, 2B, and 4 cover design stress intensities. The governing allowable stresses for those materials are provided in ASME BPVC, Section IV. 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 ferrous¹ 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- $\frac{1}{2}$ Mo steels
- (d) chromium steels, including ferritic stainless steels, by increasing Cr content [$\frac{1}{2}$ Cr, $\frac{3}{4}$ Cr, 1Cr, $1\frac{1}{4}$ Cr, $2\frac{1}{4}$ Cr, 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- $\frac{1}{4}$ Mo, Mn- $\frac{1}{2}$ Mo, Mn- $\frac{1}{2}$ Ni, and Mn-V)
- (f) silicon steel ($1\frac{1}{2}$ Si- $\frac{1}{2}$ Mo)
- (g) nickel steels ($\frac{1}{2}$ Ni, $\frac{3}{4}$ Ni, 1Ni, $1\frac{1}{4}$ Ni, 2Ni, $2\frac{1}{2}$ Ni, $2\frac{3}{4}$ Ni, 3Ni, $3\frac{1}{2}$ Ni, 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 14Cr-16Ni-6Si-Cu-Mo, then 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 29Cr-6.5Ni-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 Section IX, Table QW/QB-422 and find the corresponding nominal composition.

Now, for a given nominal composition, Table 1A is arranged by increasing strength — first tensile strength and then yield strength. For a given nominal composition, tensile strength, and yield strength, stress listings are provided in order of increasing specification number. Sometimes, for a given nominal composition, tensile strength, yield strength, and specification 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, 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, MC, and CS; Section III, Division 3; and Section III, Division 5 construction; and allowable stresses for ferrous materials for Section VIII, Division 2, Class 1 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, MC, and CS; Section III, Division 3; and Section III, Division 5 construction; and allowable stresses for nonferrous materials for Section VIII, Division 2, Class 1 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 Section VIII, Division 2, Part 4.16); 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 and MC; Section III, Division 3; and Section III, Division 5;

and allowable stresses for bolting materials used in Section VIII, Division 2 (using Section VIII, Division 2, Part 5 and Annex 5.F).

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, Class 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, Class 2 construction. This table is organized in the same manner as Table 1B. Refer back to [para. 2.2](#) for that description.

2.9 TABLE 6A

Table 6A provides allowable stresses for ferrous materials for Section IV construction. This Table is organized in the same manner as Table 1A. Refer back to [para. 2.1](#) for that description.

2.10 TABLE 6B

Table 6B provides allowable stresses for nonferrous materials for Section IV construction. This Table is organized in the same manner as Table 1B. Refer back to [para. 2.2](#) for that description.

2.11 TABLE 6C

Table 6C provides allowable stresses for Section IV construction of lined water heaters. This Table is organized in the same manner as Table 1A. Refer back to [para. 2.1](#) for that description.

2.12 TABLE 6D

Table 6D provides allowable stresses for Section IV construction of unlined water heaters. This Table is organized in the same manner as Table 1A. Refer back to [para. 2.1](#) 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.

Tensile (Table U) and yield (Table Y-1) strengths at elevated temperatures are based on trend curves determined by statistical curve fitting of submitted mechanical property data. Wrought materials and cast materials are considered different materials. A material has only one trend curve for tensile strengths and one trend curve for yield strengths. Each curve is anchored to the minimum value at room temperature in its set of units. See Nonmandatory Appendix D for more information.

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 AXXXXX alloys, followed by NXXXXX and RXXXXX alloys. The ordering of materials within these three groups has been previously described in para. 2.2.

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. Table Y-1's nonferrous materials listings 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 Section II, Part D, Subpart 2 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 Section IX, Table QW/QB-422, 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) 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.

INTENTIONALLY LEFT BLANK

Table 1A
Section I; Section III, Division 1, 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
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-285	A	K01700	...	...
6	Carbon steel	Wld. pipe	SA-672	A45	K01700	...	...
7	Carbon steel	Sheet	SA-414	A	K01501	...	...
8	Carbon steel	Wld. tube	SA-178	A	K01200	...	...
(25) 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	...	...
(25) 14	...	...	...	...	...	...	...
(25) 15	Carbon steel	Wld. pipe	SA-53	E/A	K02504	...	...
16	Carbon steel	Wld. pipe	SA-53	E/A	K02504	...	...
17	Carbon steel	Wld. pipe	SA-53	E/A	K02504	...	...
18	Carbon steel	Wld. pipe	SA-53	F/A	...	...	...
19	Carbon steel	Smls. pipe	SA-53	S/A	K02504	...	...
20	Carbon steel	Smls. pipe	SA-53	S/A	K02504	...	...
21	Carbon steel	Smls. pipe	SA-106	A	K02501	...	...
22	Carbon steel	Wld. pipe	SA-135	A	...	...	...
23	Carbon steel	Forged pipe	SA-369	FPA	K02501	...	...
24	Carbon steel	Wld. pipe	SA-587	...	K11500	...	...
25	Carbon steel	Wld. pipe	SA-587	...	K11500	...	...
26	Carbon steel	Bar	SA-675	50	...	...	...
27	Carbon steel	Bar	SA-675	50	...	...	...
28	Carbon steel	Wld. pipe	SA-134	A283B	...	...	...
29	Carbon steel	Plate	SA-285	B	K02200	...	...
30	Carbon steel	Plate	SA-285	B	K02200	...	...
31	Carbon steel	Wld. pipe	SA-672	A50	K02200	...	...
32	Carbon steel	Sheet	SA-414	B	K02201	...	...
33	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...	150 < t ≤ 250
34	Carbon steel	Plate	SA/EN 10028-2	P235GH	...	...	≤ 60
35	Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...	40 < t ≤ 60
36	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...	100 < t ≤ 150
37	Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...	16 < t ≤ 40
38	Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...	t ≤ 16
39	Carbon steel	Sheet, strip	SA-1011	36	SS	Type 1	t ≤ 6
40	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...	60 < t ≤ 100
41	Carbon steel	Sheet, strip	SA-1011	40	SS	...	t ≤ 6
42	Carbon steel	Sheet, strip	SA-1011	45	HSLAS	2	...
43	Carbon steel	Bar	SA-675	55	...	...	...
44	Carbon steel	Bar	SA-675	55	...	...	...
45	Carbon steel	Wld. pipe	SA-134	A283C	K02401	...	...

Table 1A
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	1	1	275	140	NP	NP	343	NP	CS-6	...
2	1	1	275	140	NP	NP	343	NP	CS-6	...
3	1	1	310	155	NP	343 (Cl. 3 only)	482	343	CS-6	G10, G22, T10
4	1	1	310	165	NP	149 (Cl. 3 only)	NP	NP	CS-1	W12
5	1	1	310	165	482	371	482	343	CS-1	G10, T2
6	1	1	310	165	NP	371	NP	NP	CS-1	S6, W10, W12
7	1	1	310	170	NP	NP	482	343	CS-1	G10, T2
8	1	1	325	180	538	NP	NP	NP	CS-1	G4, G10, S1, T2, W13
9	1	1	325	180	538	NP	538	343	CS-1	G10, G24, S1, T2, W6
10	1	1	325	180	NP	NP	482	343	CS-1	G10, T2
11	1	1	325	180	538	NP	538	343	CS-1	G10, S1, T2
12	1	1	325	180	NP	NP	538	343	CS-1	G24, T2, W6
13	1	1	325	180	NP	NP	538	343	CS-1	G10, T2
14	...	...	...	...	...	...	...	...	...	...
15	1	1	330	205	482	NP	NP	NP	CS-2	G10, G24, S1, T2
16	1	1	330	205	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T2, W12, W13
17	1	1	330	205	NP	NP	482	343	CS-2	G24, T2, W6
18	1	1	330	205	399	NP	NP	NP	CS-2	G2, G10, S10, T2, W15
19	1	1	330	205	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T2
20	1	1	330	205	NP	371 (SPT)	482	343	CS-2	G10, T2
21	1	1	330	205	538	371	538	343	CS-2	G10, S1, T1
22	1	1	330	205	NP	NP	482	343	CS-2	G24, T2, W6
23	1	1	330	205	538	NP	NP	NP	CS-2	G10, S1, T1
24	1	1	330	205	NP	149 (Cl. 3 only)	NP	NP	CS-2	...
25	1	1	330	205	NP	NP	454	343	CS-2	G24, T2, W6
26	1	1	345	170	NP	343 (Cl. 3 only)	NP	NP	CS-1	...
27	1	1	345	170	454	371 (SPT)	482	343	CS-1	G10, G15, G22, S1, T2
28	1	1	345	185	NP	149 (Cl. 3 only)	NP	NP	CS-1	W12
29	1	1	345	185	482	NP	NP	NP	CS-1	G10, S1, T1
30	1	1	345	185	NP	371	482	343	CS-1	G10, T1
31	1	1	345	185	NP	371	NP	NP	CS-1	S6, T1, W10, W12
32	1	1	345	205	NP	NP	482	343	CS-2	G10, T1
33	1	1	350	215	NP	NP	204	NP	CS-2	G10
34	1	1	360	215	NP	NP	371	NP	CS-2	T11
35	1	1	360	215	538	NP	538	NP	CS-2	G10, S1, T2, W14
36	1	1	360	225	NP	NP	204	NP	CS-2	G10
37	1	1	360	225	538	NP	538	NP	CS-2	G10, S1, T2, W14
38	1	1	360	235	538	NP	538	NP	CS-2	G10, S1, T2, W14
39	...	...	365	250	NP	NP	316	316	CS-2	...
40	1	1	370	235	NP	NP	204	NP	CS-2	G10
41	...	...	380	275	NP	NP	316	316	CS-2	...
42	...	...	380	310	NP	NP	316	316	CS-3	...
43	1	1	380	190	454	371 (SPT)	482	343	CS-1	G10, G15, G22, S1, T2
44	1	1	380	190	NP	343 (Cl. 3 only)	NP	NP	CS-1	...
45	1	1	380	205	NP	149 (Cl. 3 only)	NP	NP	CS-2	W12

Table 1A
Section I; Section III, Division 1, 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														
	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	78.8	73.4	64.0	56.1	44.5
6	88.9	88.9	88.9	88.9	88.9	88.9	88.9	86.3	83.8	81.4	78.8	...	...	...	...
7	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
8	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
9	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
10	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
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	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
13	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
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	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
16	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
17	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
18	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.0	50.7	43.8	...	...	...
19	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
20	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
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	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
23	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
24	94.5	94.5	94.5	94.5	94.5	...	...	...	...	...	...	...	...	...	...
25	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
26	98.6	98.6	98.6	98.6	98.6	98.1	94.7	89.8	87.3	84.9	...	...	...	...	...
27	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
28	98.6	98.6	98.6	98.6	98.6	...	...	...	...	...	...	...	...	...	...
29	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
30	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
31	98.6	98.6	98.6	98.6	98.6	98.6	98.6	96.6	94.1	90.6	85.1	...	...	...	...
32	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
33	100	100	100	100	100	100	...	...	...	...	...	...	...	...	...
34	103	103	103	103	103	103	103	103	103	96.8	85.0	...	...	...	...
35	103	103	103	103	103	103	103	103	103	103	102	89.1	75.4	62.6	45.5
36	103	103	103	103	103	103	...	...	...	...	...	...	...	...	...
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	103	103	103	103	102	89.1	75.4	62.6	45.5
39	104	104	104	104	104	104	104	104	104	104	...	...	...	...	...
40	105	105	105	105	105	105	...	...	...	...	...	...	...	...	...
41	108	108	108	108	108	108	108	108	108	108	...	...	...	...	...
42	108	108	108	108	108	108	108	108	108	108	...	...	...	...	...
43	108	108	108	108	108	108	104	98.8	96.1	92.9	89.9	87.3	75.4	62.5	46.0
44	108	108	108	108	108	108	104	98.8	96.1	92.9	...	...	...	...	...
45	108	108	108	108	108	...	...	...	...	...	...	...	...	...	...

Table 1A
Section I; Section III, Division 1, 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	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	31.9	21.8	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	27.1	18.5	10.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	31.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	31.9	21.8	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	27.1	18.5	10.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	31.9	21.8	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	21.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	25.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	32.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	25.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	36.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	36.2	23.5	11.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	32.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	25.3	14.9	5.88	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	38.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	24.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	30.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	30.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	28.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Carbon steel	Plate	SA-283	C	K02401	...	...
2	Carbon steel	Plate	SA-285	C	K02801	...	...
3	Carbon steel	Smls. & wld. pipe	SA-333	1	K03008	...	...
4	Carbon steel	Smls. & wld. tube	SA-334	1	K03008	...	...
5	Carbon steel	Wld. tube	SA-334	1	K03008	...	...
6	Carbon steel	Plate	SA-516	55	K01800	...	...
7	Carbon steel	Smls. pipe	SA-524	II	K02104	...	...
8	Carbon steel	Wld. pipe	SA-671	CA55	K02801	...	...
9	Carbon steel	Wld. pipe	SA-671	CE55	K02202	...	...
10	Carbon steel	Wld. pipe	SA-672	A55	K02801	...	...
11	Carbon steel	Wld. pipe	SA-672	B55	K02001	...	...
12	Carbon steel	Wld. pipe	SA-672	C55	K01800	...	...
13	Carbon steel	Wld. pipe	SA-672	E55	K02202	...	...
14	Carbon steel	Sheet	SA-414	C	K02503	...	...
15	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...	≤60
16	Carbon steel	Bar	SA-36	...	K02600	...	...
17	Carbon steel	Plate, sheet	SA-36	...	K02600	...	...
18	Carbon steel	Plate, sheet	SA-662	A	K01701	...	...
19	Carbon steel	Sheet, strip	SA-1011	36	SS	Type 2	$t \leq 6$
20	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	$t > 40$
21	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...	$t > 40$
22	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...	$t > 40$
23	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	$t > 40$
(25) 24	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	$20 \leq t \leq 40$
(25) 25	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...	$20 \leq t \leq 40$
(25) 26	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...	$20 \leq t \leq 40$
(25) 27	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	$20 \leq t \leq 40$
28	Carbon steel	Plate	SA/EN 10028-2	P265GH	...	...	≤60
29	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...	$40 < t \leq 60$
(25) 30	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...	$t < 20$
(25) 31	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...	$t < 20$
(25) 32	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...	$t < 20$
(25) 33	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...	$t < 20$
34	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...	$16 < t \leq 40$
35	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...	$t \leq 16$
36	Carbon steel	Forgings	SA-181	...	K03502	60	...
37	Carbon steel	Castings	SA-216	WCA	J02502	...	...
38	Carbon steel	Forgings	SA-266	1	K03506	...	...
39	Carbon steel	Forgings	SA-350	LF1	K03009	1	...
40	Carbon steel	Castings	SA-352	LCA	J02504	...	...
41	Carbon steel	Cast pipe	SA-660	WCA	J02504	...	...
42	Carbon steel	Bar	SA-675	60	...	...	...
43	Carbon steel	Bar	SA-675	60	...	...	...
44	Carbon steel	Forgings	SA-765	I	K03046	...	...
45	Carbon steel	Plate	SA-515	60	K02401	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	1	1	380	205	NP	149 (Cl. 3 only)	343	343	CS-2	...
2	1	1	380	205	482	371	482	343	CS-2	G10, S1, T2
3	1	1	380	205	NP	371	343	343	CS-2	W12, W14
4	1	1	380	205	NP	371	343	343	CS-2	W12, W14
5	1	1	380	205	NP	NP	343	343	CS-2	G24, W6
6	1	1	380	205	454	371	538	343	CS-2	G10, S1, T2
7	1	1	380	205	NP	NP	538	343	CS-2	G10, T2
8	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
9	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
10	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
11	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
12	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
13	1	1	380	205	NP	371	NP	NP	CS-2	S6, W10, W12
14	1	1	380	230	NP	371	482	343	CS-2	G10, T1
15	1	1	390	...	NP	NP	204	204	CS-2	G10, G18
16	1	1	400	250	343	343 (SPT)	482	343	CS-2	G10, G15, T1
17	1	1	400	250	NP	371	343	343	CS-2	G9, G10, T1
18	1	1	400	275	NP	NP	371	343	CS-2	T1
19	...	...	400	250	NP	NP	316	316	CS-2	...
20	1	1	410	230	NP	NP	343	343	CS-2	...
21	1	1	410	230	NP	NP	343	343	CS-2	...
22	1	1	410	230	NP	NP	343	343	CS-2	...
23	1	1	410	230	NP	NP	343	NP	CS-2	...
24	1	1	410	240	NP	NP	343	343	CS-2	...
25	1	1	410	240	NP	NP	343	343	CS-2	...
26	1	1	410	240	NP	NP	343	343	CS-2	...
27	1	1	410	240	NP	NP	343	343	CS-2	...
28	1	1	410	245	NP	NP	371	NP	CS-2	T1
29	1	1	410	245	538	NP	538	NP	CS-2	G10, S1, T1
30	1	1	410	250	NP	NP	343	343	CS-2	...
31	1	1	410	250	NP	NP	343	343	CS-2	...
32	1	1	410	250	NP	NP	343	343	CS-2	...
33	1	1	410	250	NP	NP	343	343	CS-2	...
34	1	1	410	255	538	NP	538	NP	CS-2	G10, S1, T1
35	1	1	410	265	538	NP	538	NP	CS-2	G10, S1, T1
36	1	1	415	205	538	371	538	343	CS-2	G10, S1, T2
37	1	1	415	205	538	371	538	343	CS-2	G1, G10, G17, S1, T2
38	1	1	415	205	538	371	538	343	CS-2	G10, S1, T2
39	1	1	415	205	NP	371	538	343	CS-2	G10, T2
40	1	1	415	205	NP	371	NP	NP	CS-2	G17
41	1	1	415	205	538	371	NP	NP	CS-2	G1, G10, G17, S1, T2
42	1	1	415	205	454	371 (SPT)	NP	NP	CS-2	G10, G15, S1, T2
43	1	1	415	205	NP	343 (Cl. 3 only)	482	343	CS-2	G10, G22, T2
44	1	1	415	205	NP	NP	538	343	CS-2	G10, T2
45	1	1	415	220	538	371	538	343	CS-2	G10, S1, T2

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	108	108	108	108	108	108	108	107	104	101	...	...	...	...	...
2	108	108	108	108	108	108	108	107	104	101	97.8	89.1	75.4	62.6	45.5
3	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
4	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
5	92.4	92.4	92.4	92.4	92.4	92.4	92.4	90.8	88.7	86.2	...	...	...	...	...
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	89.1	75.4	62.6	45.5
8	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
9	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
10	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
11	108	108	108	108	108	108	108	107	104	101	97.8	...	...	...	...
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	108	108	108	106	88.8	75.2	62.6	45.9
15	111	111	111	111	111	111	...	...	...	...	...	...	...	...	...
16	114	114	114	114	114	114	114	114	114	114	105	88.9	75.3	62.6	45.9
17	114	114	114	114	114	114	114	114	114	114	105	...	...	...	...
18	114	114	114	114	114	114	114	114	114	114	105	...	...	...	...
19	114	114	114	114	114	114	114	114	114	114	...	...	...	...	...
20	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
21	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
22	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
23	117	117	117	117	117	117	117	117	116	113	...	...	...	...	...
24	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
25	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
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	106	...	...	...	...
29	117	117	117	117	117	117	117	117	117	117	105	88.9	75.3	62.7	45.5
30	117	117	117	117	117	117	117	117	117	117	...	...	...	...	...
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	...	...	...	...
41	118	118	118	118	118	118	114	107	104	101	97.8	89.1	75.4	62.6	45.5
42	118	118	118	118	118	118	114	107	104	101	97.8	89.1	75.4	62.6	45.5
43	118	118	118	118	118	118	114	107	104	101	97.8	89.1	75.4	62.6	45.5
44	118	118	118	118	118	118	114	107	104	101	97.8	89.1	75.4	62.6	45.5
45	118	118	118	118	118	118	118	115	112	108	104	88.9	75.3	62.7	45.5

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	28.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	28.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
34	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Carbon steel	Plate	SA-516	60	K02100	...	...
2	Carbon steel	Wld. pipe	SA-671	CB60	K02401	...	...
3	Carbon steel	Wld. pipe	SA-671	CC60	K02100	...	...
4	Carbon steel	Wld. pipe	SA-671	CE60	K02402	...	...
5	Carbon steel	Wld. pipe	SA-672	B60	K02401	...	...
6	Carbon steel	Wld. pipe	SA-672	C60	K02100	...	...
7	Carbon steel	Wld. pipe	SA-672	E60	K02402	...	...
8	Carbon steel	Wld. pipe	SA-134	A283D	K02702	...	...
9	Carbon steel	Plate	SA-283	D	K02702	...	...
10	Carbon steel	Wld. pipe	SA-53	E/B	K03005	...	...
(25) 11	Carbon steel	Wld. pipe	SA-53	E/B	K03005	...	...
12	Carbon steel	Smls. pipe	SA-53	S/B	K03005	...	...
13	Carbon steel	Smls. pipe	SA-53	S/B	K03005	...	...
14	Carbon steel	Smls. pipe	SA-106	B	K03006	...	...
15	Carbon steel	Wld. pipe	SA-135	B	...	...	...
16	Carbon steel	Smls. & wld. fittings	SA-234	WPB	K03006	...	...
17	Carbon steel	Smls. & wld. pipe	SA-333	6	K03006	...	...
18	Carbon steel	Wld. pipe	SA-333	6	K03006	...	...
19	Carbon steel	Smls. & wld. tube	SA-334	6	K03006	...	...
20	Carbon steel	Wld. tube	SA-334	6	K03006	...	...
21	Carbon steel	Forged pipe	SA-369	FPB	K03006	...	...
22	Carbon steel	Forgings	SA-372	A	K03002	...	...
23	Carbon steel	Sheet	SA-414	D	K02505	...	...
24	Carbon steel	Smls. & wld. fittings	SA-420	WPL6	...	...	...
25	Carbon steel	Smls. pipe	SA-524	I	K02104	...	...
26	Carbon steel	Bar	SA-696	B	K03200	...	...
27	Carbon steel	Forgings	SA-727	...	K02506	...	...
28	Carbon steel	Wld. tube	SA-178	C	K03503	...	...
29	Carbon steel	Wld. tube	SA-178	C	K03503	...	...
(25) 30	Carbon steel	Wld. tube	SA-178	C	K03503	...	...
31	Carbon steel	Smls. tube	SA-210	A-1	K02707	...	...
32	Carbon steel	Smls. tube	SA-556	B2	K02707	...	...
(25) 33	...	...	...	...	...	...	...
34	Carbon steel	Plate, bar	SA/CSA-G40.21	38W	...	...	...
35	Carbon steel	Plate, sheet, bar	SA-572	42	...	...	$t \leq 150$
36	Carbon steel	Sheet, strip	SA-1011	45	HSLAS	1	...
37	Carbon steel	Sheet, strip	SA-1011	45	SS	...	$t \leq 6$
38	Carbon steel	Sheet, strip	SA-1011	50	HSLAS	2	...
39	Carbon steel	Plate	SA/AS 1548	PT430N	...	Normalized	≤ 150
40	Carbon steel	Plate	SA/AS 1548	PT430NR	...	Norm. rld.	≤ 150
41	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...	$150 < t \leq 250$
42	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...	$100 < t \leq 150$
43	Carbon steel	Bar	SA-675	65	...	...	...
44	Carbon steel	Castings	SA-352	LCB	J03003	...	...
45	Carbon steel	Plate	SA-515	65	K02800	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	1	1	415	220	454	371	538	343	CS-2	G10, S1, T2
2	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
3	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
4	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
5	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
6	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
7	1	1	415	220	NP	371	NP	NP	CS-2	S6, W10, W12
8	1	1	415	230	NP	149 (Cl. 3 only)	NP	NP	CS-2	W12
9	1	1	415	230	NP	149 (Cl. 3 only)	343	343	CS-2	...
10	1	1	415	240	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T1, W12, W13
11	1	1	415	240	482	NP	482	343	CS-2	G10, G24, S1, T1, W6
12	1	1	415	240	482	149 (Cl. 3 only)	NP	NP	CS-2	G10, S1, T1
13	1	1	415	240	NP	371 (SPT)	482	343	CS-2	G10, T1
14	1	1	415	240	538	371	538	343	CS-2	G10, S1, T1
15	1	1	415	240	NP	NP	482	343	CS-2	G24, T1, W6
16	1	1	415	240	538	371	538	343	CS-2	G10, S1, T1
17	1	1	415	240	371	371	538	343	CS-2	G10, T1, W12, W13, W14
18	1	1	415	240	371	NP	NP	NP	CS-2	T1
19	1	1	415	240	NP	371	343	343	CS-2	T1, W12, W14
20	1	1	415	240	NP	NP	343	343	CS-2	G24, W6
21	1	1	415	240	538	NP	NP	NP	CS-2	G10, S1, T1
22	1	1	415	240	NP	NP	343	343	CS-2	...
23	1	1	415	240	NP	NP	482	343	CS-2	G10, T1
24	1	1	415	240	NP	371	454	343	CS-2	G10, T1, W14
25	1	1	415	240	NP	NP	538	343	CS-2	G10, T1
26	1	1	415	240	NP	371	NP	NP	CS-2	T1
27	1	1	415	250	NP	371	538	343	CS-2	G10, T1
28	1	1	415	255	538	NP	NP	NP	CS-2	G4, G10, S1, T2
29	1	1	415	255	538	371	NP	NP	CS-2	G10, S1, T1, W13
30	1	1	415	255	538	NP	538	343	CS-2	G10, G24, S1, T2, W6
31	1	1	415	255	538	371	538	343	CS-2	G10, S1, T1
32	1	1	415	255	NP	NP	538	343	CS-2	G10, T1
33	...	...	...	...	...	...	...	...	...	...
34	1	1	415	260	NP	NP	343	343	CS-2	...
35	...	...	415	290	NP	NP	316	316	CS-3	...
36	...	...	410	310	NP	NP	316	316	CS-3	...
37	...	...	410	310	NP	NP	316	316	CS-3	...
38	...	...	410	340	NP	NP	316	316	CS-3	...
39	1	1	430	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
40	1	1	430	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
41	1	1	430	220	454	NP	538	NP	CS-2	G10, S1, T2
42	1	1	440	235	454	NP	538	NP	CS-2	G10, S1, T2
43	1	1	450	225	454	343 (Cl. 3 only)	538	343	CS-2	G10, G15, G22, S1, T2
44	1	1	450	240	NP	371	343	343	CS-2	G1, G17
45	1	1	450	240	538	371	538	343	CS-2	G10, S1, T2

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	118	118	118	118	118	118	118	115	112	108	104	88.9	75.3	62.7	45.5
2	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
3	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
4	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
5	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
6	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
7	118	118	118	118	118	118	118	115	112	108	104	...	...	...	...
8	118	118	118	118	118	...	...	...	...	...	...	...	...	...	...
9	118	118	118	118	118	118	118	118	115	111	...	...	...	...	...
10	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
11	101	101	101	101	101	101	101	101	101	99.7	89.7	75.9	64.1	53.3	38.6
12	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
13	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
14	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
15	101	101	101	101	101	101	101	101	101	99.7	89.7	75.9	64.1	53.3	38.6
16	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
17	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
18	101	101	101	101	101	101	101	101	101	99.7	89.7	...	...	...	...
19	118	118	118	118	118	118	118	118	118	117	105	...	...	...	...
20	101	101	101	101	101	101	101	101	101	101	...	...	...	...	...
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	118	...	...	...	...	...
23	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
24	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
25	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
26	118	118	118	118	118	118	118	118	118	117	105	...	...	...	...
27	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
28	118	118	118	118	118	118	118	118	118	117	105	88.9	75.2	63.2	40.5
29	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
30	101	101	101	101	101	101	101	101	101	99.7	89.7	75.9	64.1	53.3	38.6
31	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
32	118	118	118	118	118	118	118	118	118	117	105	88.9	75.3	62.7	45.5
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
35	118	118	118	118	118	118	118	118	118	...	...	...	...	...	...
36	118	118	118	118	118	118	118	118	118	...	...	...	...	...	...
37	118	118	118	118	118	118	118	118	118	...	...	...	...	...	...
38	118	118	118	118	118	118	118	118	118	...	...	...	...	...	...
39	123	123	123	123	123	123	123	123	123	123	114	95.0	79.6	63.2	45.3
40	123	123	123	123	123	123	123	123	123	123	114	95.0	79.6	63.2	45.3
41	123	123	123	123	123	123	121	114	111	108	105	96.2	79.1	62.1	46.0
42	126	126	126	126	126	126	126	122	119	115	112	96.2	79.1	62.1	46.0
43	128	128	128	128	128	128	123	117	113	110	106	95.2	79.6	63.8	39.2
44	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
45	128	128	128	128	128	128	128	125	122	118	114	95.0	79.6	63.2	45.3

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	26.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	26.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	31.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	26.2	18.8	10.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	26.8	18.6	10.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	31.6	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	31.7	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	31.7	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	32.1	21.2	14.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	32.1	21.2	14.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	30.1	22.4	12.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	31.7	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Carbon steel	Plate	SA-516	65	K02403	...	...
2	Carbon steel	Wld. pipe	SA-671	CB65	K02800	...	...
3	Carbon steel	Wld. pipe	SA-671	CC65	K02403	...	...
4	Carbon steel	Wld. pipe	SA-672	B65	K02800	...	...
5	Carbon steel	Wld. pipe	SA-672	C65	K02403	...	...
6	Carbon steel	Sheet	SA-414	E	K02704	...	...
7	Carbon steel	Plate	SA-662	B	K02203	...	...
8	Carbon steel	Plate	SA-537	...	K12437	1	65 < t ≤ 100
9	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...	65 < t ≤ 100
10	Carbon steel	Plate, bar	SA/CSA-G40.21	44W	...	...	t ≤ 200
11	Carbon steel	Plate, bar	SA/CSA-G40.21	50W	...	...	t ≤ 150
12	Carbon steel	Plate, sheet, bar	SA-572	50	...	...	t ≤ 100
13	Carbon steel	Round bar	SA-572	50	...	...	t ≤ 275
14	Carbon steel	Sheet, strip	SA-1011	50	SS	...	t ≤ 6
15	Carbon steel	Sheet, strip	SA-1011	50	HSLAS	1	...
16	Carbon steel	Sheet, strip	SA-1011	55	HSLAS	2	...
17	Carbon steel	Plate	SA/AS 1548	PT460N	...	Normalized	≤150
18	Carbon steel	Plate	SA/AS 1548	PT460NR	...	Norm. rld.	≤150
(25) 19	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	35 < t ≤ 160
20	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...	60 < t ≤ 100
21	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...	≤60
(25) 22	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	t ≤ 35
23	Carbon steel	Plate	SA/GB 713	Q345R	...	...	150 < t ≤ 250
24	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	150 < t ≤ 250
25	Carbon steel	Plate	SA/GB 713	Q345R	...	...	100 < t ≤ 150
26	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	100 < t ≤ 150
27	Carbon steel	Plate	SA-455	...	K03300	...	15 < t ≤ 20
28	Carbon steel	Bar	SA-675	70	...	...	...
29	Carbon steel	Forgings	SA-105	...	K03504	...	...
30	Carbon steel	Forgings	SA-181	...	K03502	70	...
31	Carbon steel	Castings	SA-216	WCB	J03002	...	...
32	Carbon steel	Forgings	SA-266	2	K03506	...	...
33	Carbon steel	Forgings	SA-266	4	K03017	...	...
34	Carbon steel	Forgings	SA-350	LF2	K03011	1	...
35	Carbon steel	Forgings	SA-350	LF2	K03011	2	...
36	Carbon steel	Forgings	SA-508	1	K13502	...	...
37	Carbon steel	Forgings	SA-508	1A	K13502	...	...
38	Carbon steel	Forgings	SA-541	1	K03506	...	...
39	Carbon steel	Forgings	SA-541	1A	K03020	...	...
40	Carbon steel	Cast pipe	SA-660	WCB	J03003	...	...
41	Carbon steel	Forgings	SA-765	II	K03047	...	...
42	Carbon steel	Plate	SA-515	70	K03101	...	...
43	Carbon steel	Plate	SA-516	70	K02700	...	...
44	Carbon steel	Wld. pipe	SA-671	CB70	K03101	...	...
45	Carbon steel	Wld. pipe	SA-671	CC70	K02700	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	1	1	450	240	454	371	538	343	CS-2	G10, S1, T2
2	1	1	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
3	1	1	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
4	1	1	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
5	1	1	450	240	NP	371	NP	NP	CS-2	S6, W10, W12
6	1	1	450	260	NP	NP	482	343	CS-2	G10, T1
7	1	1	450	275	NP	NP	371	343	CS-2	T1
8	1	2	450	310	NP	371	343	343	CS-2	T1
9	1	2	450	310	NP	371	NP	NP	CS-2	G26, T1, W10, W12
10	1	1	450	...	343	NP	343	343	CS-2	G18
11	1	1	450	...	343	NP	343	343	CS-2	G18
12	...	...	450	345	NP	NP	316	316	CS-3	...
13	...	...	450	345	NP	NP	316	316	CS-3	...
14	...	...	450	340	NP	NP	316	316	CS-3	...
15	...	...	450	340	NP	NP	316	316	CS-3	...
16	...	...	450	380	NP	NP	316	316	CS-3	...
17	1	1	460	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
18	1	1	460	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
19	1	1	460	255	538	NP	538	NP	CS-2	G10, S1, T2
20	1	1	460	260	454	NP	538	NP	CS-2	G10, S1, T1
21	1	1	460	...	454	NP	538	343	CS-2	G10, G18, S1, T1
22	1	1	460	280	538	NP	538	NP	CS-2	G10, S1, T2
23	1	2	470	265	427	NP	427	NP	CS-2	T1
24	1	2	470	280	454	NP	538	NP	CS-2	G10, S1, T1
25	1	2	480	285	427	NP	427	NP	CS-2	T1
26	1	2	480	295	454	NP	538	NP	CS-2	G10, S1, T1
27	1	2	485	240	NP	204 (Cl. 3 only)	343	343	CS-2	...
28	1	2	485	240	454	343 (Cl. 3 only)	538	343	CS-2	G10, G15, G22, S1, T2
29	1	2	485	250	538	371	538	343	CS-2	G10, S1, T2
30	1	2	485	250	538	371	538	343	CS-2	G10, S1, T2
31	1	2	485	250	538	371	538	343	CS-2	G1, G10, G17, S1, T2
32	1	2	485	250	538	371	538	343	CS-2	G10, S1, T2
33	1	2	485	250	NP	NP	538	343	CS-2	G10, T2
34	1	2	485	250	454	371	538	343	CS-2	G10, T2
35	1	2	485	250	454	371	538	343	CS-2	G10, T2
36	1	2	485	250	NP	371	538	343	CS-2	G10, T2
37	1	2	485	250	NP	371	538	343	CS-2	G10, T2
38	1	2	485	250	NP	371	538	343	CS-2	G10, T2
39	1	2	485	250	NP	371	538	343	CS-2	G10, T2
40	1	2	485	250	538	371	NP	NP	CS-2	G1, G10, G17, S1, T2
41	1	2	485	250	NP	NP	538	343	CS-2	G10, T2
42	1	2	485	260	538	371	538	343	CS-2	G10, S1, T2
43	1	2	485	260	454	371	538	343	CS-2	G10, S1, T2
44	1	2	485	260	NP	371	NP	NP	CS-2	S5, W10, W12
45	1	2	485	260	NP	371	NP	NP	CS-2	S6, W10, W12

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	128	128	128	128	128	128	128	125	122	118	114	95.0	79.6	63.2	45.3
2	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
3	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
4	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
5	128	128	128	128	128	128	128	125	122	118	114	...	...	...	...
6	128	128	128	128	128	128	128	128	128	127	114	95.1	79.6	63.1	45.7
7	128	128	128	128	128	128	128	128	128	127	114	...	...	...	...
8	128	128	128	128	128	128	128	128	128	127	114	...	...	...	...
9	128	128	128	128	128	128	128	128	128	127	114	...	...	...	...
10	128	128	128	128	128	128	128	128	128	128	...	...	...	...	...
11	128	128	128	128	128	128	128	128	128	128	...	...	...	...	...
12	128	128	128	128	128	128	128	128	128	127	...	...	...	...	...
13	128	128	128	128	128	128	128	128	128	127	...	...	...	...	...
14	128	128	128	128	128	128	128	128	128	127	...	...	...	...	...
15	128	128	128	128	128	128	128	128	128	127	...	...	...	...	...
16	128	128	128	128	128	128	128	128	128	127	...	...	...	...	...
17	131	131	131	131	131	131	131	131	131	129	114	95.1	79.6	63.2	45.3
18	131	131	131	131	131	131	131	131	131	129	114	95.1	79.6	63.2	45.3
19	131	131	131	131	131	131	131	131	131	128	124	101	83.9	67.0	51.1
20	131	131	131	131	131	131	131	131	131	127	112	96.2	79.1	62.1	46.0
21	131	131	131	131	131	131	131	131	131	127	112	96.2	79.1	62.1	46.0
22	131	131	131	131	131	131	131	131	131	131	131	101	83.9	67.0	51.1
23	134	134	134	134	134	134	134	134	134	130	123	101	83.8	67.1	...
24	134	134	134	134	134	134	134	134	134	134	123	101	83.8	67.1	51.0
25	137	137	137	137	137	137	137	137	137	137	123	101	83.8	67.1	...
26	137	137	137	137	137	137	137	137	137	137	123	101	83.8	67.1	51.0
27	138	138	138	138	138	137	132	126	122	119	...	...	...	...	...
28	138	138	138	138	138	137	132	126	122	119	114	101	83.9	67.0	51.1
29	138	138	138	138	138	138	136	129	125	122	117	101	83.9	67.0	51.1
30	138	138	138	138	138	138	136	129	125	122	117	101	83.9	67.0	51.1
31	138	138	138	138	138	138	136	129	125	122	117	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
41	138	138	138	138	138	138	136	129	125	122	117	101	83.9	67.0	51.1
42	138	138	138	138	138	138	138	136	132	128	123	101	83.8	67.1	51.0
43	138	138	138	138	138	138	138	136	132	128	123	101	83.8	67.1	51.0
44	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
45	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	28.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	31.7	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	31.7	21.9	12.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	32.1	21.2	14.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	32.1	21.2	14.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Carbon steel	Wld. pipe	SA-672	B70	K03101	...	...
2	Carbon steel	Wld. pipe	SA-672	C70	K02700	...	...
3	Carbon steel	Plate	SA/JIS G3118	SGV480	...	...	...
4	Carbon steel	Smls. pipe	SA-106	C	K03501	...	...
5	Carbon steel	Wld. tube	SA-178	D	...	...	...
(25) 6	Carbon steel	Wld. tube	SA-178	D	...	...	...
7	Carbon steel	Wld. tube	SA-178	D	...	...	...
8	Carbon steel	Smls. tube	SA-210	C	K03501	...	...
9	Carbon steel	Castings	SA-216	WCC	J02503	...	...
10	Carbon steel	Smls. & wld. fittings	SA-234	WPC	K03501	...	...
11	Carbon steel	Castings	SA-352	LCC	J02505	...	...
12	Carbon steel	Castings	SA-487	16	...	A	...
13	Carbon steel	Plate	SA-537	...	K12437	3	100 < t ≤ 150
14	Carbon steel	Smls. tube	SA-556	C2	K03006	...	...
(25) 15	...	...	...	...	...	...	...
16	Carbon steel	Cast pipe	SA-660	WCC	J02505	...	...
17	Carbon steel	Bar	SA-696	C	K03200	...	...
18	Carbon steel	Sheet	SA-414	F	K03102	...	...
19	Carbon steel	Plate	SA-662	C	K02007	...	...
20	Carbon steel	Plate	SA-537	...	K12437	2	100 < t ≤ 150
21	Carbon steel	Plate	SA-738	C	K02008	...	100 < t ≤ 150
22	Carbon steel	Plate	SA-537	...	K12437	1	≤65
23	Carbon steel	Wld. pipe	SA-671	CD70	K12437	...	≤65
24	Carbon steel	Wld. pipe	SA-672	D70	K12437	...	≤65
25	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...	≤65
26	Carbon steel	Plate	SA-841	A	...	1	≤100
27	Carbon steel	Plate, sheet, bar	SA-572	55	...	...	t ≤ 50
28	Carbon steel	Round bar	SA-572	55	...	...	t ≤ 90
29	Carbon steel	Sheet, strip	SA-1011	55	HSLAS	1	...
30	Carbon steel	Sheet, strip	SA-1011	60	HSLAS	2	...
(25) 31	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	70 < t ≤ 160
(25) 32	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	35 < t ≤ 70
33	Carbon steel	Plate	SA/GB 713	Q345R	...	...	60 < t ≤ 100
34	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	60 < t ≤ 100
35	Carbon steel	Plate	SA/GB 713	Q345R	...	...	36 < t ≤ 60
36	Carbon steel	Plate	SA/GB 713	Q345R	...	...	16 < t ≤ 36
37	Carbon steel	Plate	SA-455	...	K03300	...	9.5 < t ≤ 15
(25) 38	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	t ≤ 35
39	Carbon steel	Plate	SA/GB 713	Q345R	...	...	3 ≤ t ≤ 16
40	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	≤60
41	Carbon steel	Forgings	SA-266	3	K05001	...	...
42	Carbon steel	Plate	SA-455	...	K03300	...	≤9.5
43	Carbon steel	Plate	SA-299	A	K02803	...	>25
44	Carbon steel	Wld. pipe	SA-671	CK75	K02803	...	>25
45	Carbon steel	Wld. pipe	SA-672	N75	K02803	...	>25

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	1	2	485	260	NP	371	NP	NP	CS-2	S5, W10, W12
2	1	2	485	260	NP	371	NP	NP	CS-2	S6, W10, W12
3	1	2	485	260	454	NP	NP	NP	CS-2	G10, S1, T2
4	1	2	485	275	538	371	538	343	CS-2	G10, S1, T1
5	1	2	485	275	538	NP	NP	NP	CS-2	G10, S1, T1, W13
6	1	2	485	275	538	NP	NP	NP	CS-2	G4, G10, S1, T4
7	1	2	485	275	538	NP	NP	NP	CS-2	G10, G24, S1, T2
8	1	2	485	275	538	NP	538	343	CS-2	G10, S1, T1
9	1	2	485	275	538	371	538	343	CS-2	G1, G10, G17, S1, T1
10	1	2	485	275	427	371	427	343	CS-2	G10, T1, W14
11	1	2	485	275	NP	371	NP	NP	CS-2	G17, T1
12	1	2	485	275	NP	371	NP	NP	CS-2	...
13	1	3	485	275	NP	NP	371	343	CS-2	G23, W11
14	1	2	485	275	NP	NP	427	343	CS-2	G10, T1
15	...	...	...	...	...	...	...	...	...	...
16	1	2	485	275	538	371	NP	NP	CS-2	G1, G10, G17, S1, T1
17	1	2	485	275	NP	371	NP	NP	CS-2	T1
18	1	2	485	290	NP	NP	482	343	CS-2	G10, T1
19	1	2	485	295	NP	NP	371	343	CS-3	T1
20	1	3	485	315	NP	371	371	343	CS-3	G23, T1, W11
21	1	3	485	315	NP	343	343	343	CS-3	G23, W11
22	1	2	485	345	NP	371	343	343	CS-3	G23, T1
23	1	2	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
24	1	2	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
25	1	2	485	345	NP	371	NP	NP	CS-3	S6, T1, W10, W12
26	1	2	485	345	NP	NP	343	NP	CS-3	...
27	...	...	485	380	NP	NP	316	316	CS-3	...
28	...	...	485	380	NP	NP	316	316	CS-3	...
29	...	...	480	380	NP	NP	316	316	CS-3	...
30	...	...	480	410	NP	NP	316	316	CS-3	...
31	1	2	490	280	538	NP	538	NP	CS-2	G10, S1, T2
32	1	2	510	285	538	NP	538	NP	CS-2	G10, S1, T2
33	1	2	490	305	427	NP	427	NP	CS-2	T1
34	1	2	490	315	454	NP	538	NP	CS-2	G10, S1, T1
35	1	2	490	315	427	NP	427	NP	CS-2	T1
36	1	2	500	325	427	NP	427	NP	CS-2	T1
37	1	2	505	255	NP	204 (Cl. 3 only)	343	343	CS-2	...
38	1	2	510	305	538	NP	538	NP	CS-2	G10, S1, T1
39	1	2	510	345	427	NP	427	NP	CS-2	T1
40	1	2	510	...	454	NP	538	NP	CS-2	G10, G18, S1, T1
41	1	2	515	260	538	371	538	NP	CS-2	G10, S1, T2, W11
42	1	2	515	260	NP	204 (Cl. 3 only)	343	343	CS-2	...
43	1	2	515	275	538	371	538	343	CS-2	G10, S1, T2
44	1	2	515	275	NP	371	NP	NP	CS-2	S6, W10, W12
45	1	2	515	275	NP	371	NP	NP	CS-2	S6, W10, W12

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
2	138	138	138	138	138	138	138	136	132	128	123	...	...	...	...
3	138	138	138	138	138	138	138	136	132	128	123	101	83.8	67.1	51.0
4	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	51.0
5	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	51.0
6	138	138	138	138	138	138	138	138	138	135	123	101	83.7	67.6	45.5
7	117	117	117	117	117	117	117	117	117	115	104	86.1	71.3	56.9	43.4
8	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	51.0
9	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	51.0
10	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	...
11	138	138	138	138	138	138	138	138	138	135	123	...	...	...	...
12	138	138	137	133	129	125	123	123	123	123	123	...	...	...	...
13	138	138	138	137	136	135	131	126	123	121	118	...	...	...	...
14	138	138	138	138	138	138	138	138	138	135	123	101	83.8	67.0	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...
18	138	138	138	138	138	138	138	138	138	137	123	101	83.8	67.1	50.8
19	138	138	138	138	138	138	138	138	138	137	123	...	...	...	...
20	138	138	138	137	136	134	134	134	134	133	125	...	...	...	...
21	138	138	138	137	136	134	134	134	134	133	...	...	...	...	...
22	138	138	138	137	136	134	134	134	134	133	125	...	...	...	...
23	138	138	138	137	136	134	134	134	134	133	125	...	...	...	...
24	138	138	138	137	136	134	134	134	134	133	125	...	...	...	...
25	138	138	138	137	136	134	134	134	134	133	125	...	...	...	...
26	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
27	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
28	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
29	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
30	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
31	140	140	140	140	140	140	140	140	140	136	132	101	83.9	67.0	51.1
32	146	146	146	146	146	146	146	146	143	139	134	101	83.9	67.0	51.1
33	140	140	140	140	140	140	140	140	140	140	123	101	83.8	67.1	...
34	140	140	140	140	140	140	140	140	140	140	123	101	83.8	67.1	51.0
35	140	140	140	140	140	140	140	140	140	140	123	101	83.8	67.1	...
36	143	143	143	143	143	143	143	143	143	143	123	101	83.8	67.1	...
37	144	144	144	144	144	144	140	133	129	125	...	...	...	...	...
38	146	146	146	146	146	146	146	146	146	146	136	101	83.9	67.0	51.1
39	146	146	146	146	146	146	146	146	146	146	123	101	83.8	67.1	...
40	146	146	146	146	146	146	146	146	146	146	123	101	83.8	67.1	51.0
41	148	148	148	148	148	148	142	135	131	127	122	107	88.3	67.5	50.9
42	148	148	148	148	148	148	143	136	132	129	...	...	...	...	...
43	148	148	148	148	148	148	148	143	139	135	130	107	88.1	67.5	50.8
44	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...
45	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	27.9	18.3	10.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	28.6	18.1	10.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	34.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...	>25
2	Carbon steel	Plate	SA-299	A	K02803	...	≤25
3	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...	≤25
4	Carbon steel	Forgings	SA-372	B	K04001	...	...
5	Carbon steel	Sheet	SA-414	G	K03103	...	...
6	Carbon steel	Plate	SA-738	A	K12447	...	...
7	Carbon steel	Plate	SA-537	...	K12437	3	65 < t ≤ 100
8	Carbon steel	Plate	SA-537	...	K12437	2	65 < t ≤ 100
9	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...	65 < t ≤ 100
10	Carbon steel	Plate	SA-738	C	K02008	...	65 < t ≤ 100
11	Carbon steel	Plate, sheet, bar	SA-572	60	...	...	t ≤ 32
12	Carbon steel	Round bar	SA-572	60	...	...	t ≤ 90
13	Carbon steel	Sheet, strip	SA-1011	60	HSLAS	1	...
14	Carbon steel	Plate	SA-299	B	K02803	...	>25
15	Carbon steel	Plate	SA-299	B	K02803	...	≤25
16	Carbon steel	Forgings	SA-765	IV	K02009	...	...
17	Carbon steel	Plate	SA-537	...	K12437	3	≤65
18	Carbon steel	Plate	SA-537	...	K12437	2	≤65
19	Carbon steel	Wld. pipe	SA-671	CD80	K12437	...	≤65
20	Carbon steel	Wld. pipe	SA-672	D80	K12437	...	≤65
21	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...	≤65
22	Carbon steel	Plate	SA-738	C	K02008	...	≤65
23	Carbon steel	Plate	SA-841	B	...	2	≤65
24	Carbon steel	Plate, sheet, bar	SA-572	65	...	...	t ≤ 32
25	Carbon steel	Plate	SA-612	...	K02900	...	12.5 < t ≤ 25
26	Carbon steel	Plate	SA-612	...	K02900	...	≤12.5
27	Carbon steel	Plate	SA-738	B	K12007	...	...
28	Carbon steel	Forgings	SA-372	C	K04801	...	...
29	Carbon steel	Plate	SA-724	A	K11831	...	...
30	Carbon steel	Plate	SA-724	C	K12037	...	...
31	Carbon steel	Plate	SA-724	B	K12031	...	...
32	C-Mn-Si-Cb	Plate	SA-737	B	K12001	...	...
33	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490N	...	Normalized	≤150
34	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490NR	...	Norm. rld.	≤150
35	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized	64 < t ≤ 100
36	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized	36 < t ≤ 60
37	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized	16 < t ≤ 36
38	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized	10 ≤ t ≤ 16
39	C-Mn-Si-V	Plate	SA-737	C	K12202	...	...
40	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...	≤50
41	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...	≤50
42	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...	≤40
43	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...	≤40
44	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...	≤25
45	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...	≤25

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	1	2	515	275	NP	371	NP	NP	CS-2	S6, W10, W12
2	1	2	515	290	538	371	538	343	CS-2	G10, S1, T1
3	1	2	515	290	NP	371	NP	NP	CS-2	T1, W10, W12
4	1	2	515	310	NP	NP	343	343	CS-3	W11
5	1	2	515	310	NP	NP	482	343	CS-3	G10, T1
6	1	2	515	310	NP	NP	371	343	CS-2	T1
7	1	3	515	345	NP	NP	371	343	CS-5	G23, T1, W11
8	1	3	515	380	NP	371	343	343	CS-5	G23, T1, W11
9	1	3	515	380	NP	371	NP	NP	CS-5	G26, T1, W10, W12
10	1	3	515	380	NP	343	343	343	CS-5	G23, W11
11	...	...	520	415	NP	NP	316	316	CS-3	...
12	...	...	520	415	NP	NP	316	316	CS-3	...
13	...	...	520	410	NP	NP	316	316	CS-3	...
14	1	3	550	310	427	NP	538	343	CS-3	G10, S1, T1
15	1	3	550	325	427	NP	538	343	CS-3	G10, S1, T1
16	1	3	550	345	NP	NP	371	NP	CS-3	...
17	1	3	550	380	NP	NP	371	343	CS-5	G23, T1, W11
18	1	3	550	415	NP	371	343	343	CS-5	G23, S6, T1, W10, W11, W12
19	1	3	550	415	NP	371	NP	NP	CS-5	S6, T1, W10, W12
20	1	3	550	415	NP	371	NP	NP	CS-5	S6, T1, W10, W12
21	1	3	550	415	NP	371	NP	NP	CS-5	S6, T1, W10, W12
22	1	3	550	415	NP	343	343	343	CS-5	G23, W11
23	1	3	550	415	NP	NP	343	NP	CS-3	...
24	...	...	550	450	NP	NP	316	316	CS-3	...
25	10C	1	560	345	NP	371	343	343	CS-3	T1
26	10C	1	570	345	NP	343	343	343	CS-3	...
27	1	3	585	415	NP	343	343	343	CS-5	...
28	...	...	620	380	NP	NP	343	343	CS-3	W11
29	1	4	620	485	NP	NP	371	343	CS-5	...
30	1	4	620	485	NP	NP	371	343	CS-5	...
31	1	4	655	515	NP	NP	371	343	CS-5	...
32	1	2	485	345	NP	371	371	343	CS-3	T1
33	1	2	490	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
34	1	2	490	...	538	NP	538	NP	CS-2	G10, G18, S1, T1
35	1	2	510	330	427	NP	NP	NP	CS-3	T1
36	1	2	520	340	427	NP	NP	NP	CS-3	T1
37	1	2	530	360	427	NP	NP	NP	CS-3	T1
38	1	2	530	370	427	NP	NP	NP	CS-3	T1
39	1	3	550	415	NP	371	371	343	CS-3	...
40	1	1	414	345	NP	NP	NP	343	...	...
41	1	1	414	345	NP	NP	NP	343	...	...
42	1	2	483	414	NP	NP	NP	343	...	...
43	1	2	483	414	NP	NP	NP	343	...	...
44	1	3	552	483	NP	NP	NP	343	...	...
45	1	3	552	483	NP	NP	NP	343	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	148	148	148	148	148	148	148	143	139	135	130	...	...	...	...
2	148	148	148	148	148	148	148	148	147	141	133	107	88.1	67.6	50.8
3	148	148	148	148	148	148	148	148	147	141	133	...	...	...	...
4	148	148	148	148	148	148	148	148	148	148	...	...	...	...	...
5	148	148	148	148	148	148	148	148	148	146	132	107	88.2	67.6	50.6
6	148	148	148	148	148	148	148	148	148	146	132	...	...	...	...
7	148	148	147	147	145	144	144	144	144	142	123	...	...	...	...
8	148	148	147	147	145	144	144	144	144	143	134	...	...	...	...
9	148	148	147	147	145	144	144	144	144	143	134	...	...	...	...
10	148	148	147	147	145	144	144	144	144	143	...	...	...	...	...
11	148	148	147	147	145	144	144	144	144	143	...	...	...	...	...
12	148	148	147	147	145	144	144	144	144	143	...	...	...	...	...
13	148	148	147	147	145	144	144	144	144	143	...	...	...	...	...
14	158	158	158	158	158	158	158	158	157	152	133	107	88.1	67.6	50.8
15	158	158	158	158	158	158	158	158	158	158	133	107	88.1	67.6	50.8
16	158	158	158	158	158	156	156	156	156	155	153	...	...	...	...
17	158	158	158	157	156	154	154	154	154	151	132	...	...	...	...
18	158	158	158	157	156	154	154	154	154	151	132	...	...	...	...
19	158	158	158	157	156	154	154	154	154	151	132	...	...	...	...
20	158	158	158	157	156	154	154	154	154	151	132	...	...	...	...
21	158	158	158	157	156	154	154	154	154	151	132	...	...	...	...
22	158	158	158	157	156	154	154	154	154	151	...	...	...	...	...
23	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
24	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
25	159	159	159	158	157	156	156	155	155	149	133	...	...	...	...
26	163	163	163	162	161	160	160	157	154	151	...	...	...	...	...
27	168	168	168	168	168	168	168	167	165	163	...	...	...	...	...
28	177	177	177	177	177	177	177	177	175	166	...	...	...	...	...
29	177	177	177	176	175	173	173	173	173	165	148	...	...	...	...
30	177	177	177	176	175	173	173	173	173	165	148	...	...	...	...
31	187	187	187	186	185	183	183	183	179	165	158	...	...	...	...
32	138	138	138	138	138	138	138	138	138	138	135	...	...	...	...
33	140	140	140	140	140	140	140	140	140	139	123	101	83.8	67.0	51.0
34	140	140	140	140	140	140	140	140	140	139	123	101	83.8	67.0	51.0
35	146	146	146	146	146	146	146	146	146	146	133	107	88.1	67.6	...
36	149	149	149	149	149	149	149	149	149	149	133	107	88.1	67.6	...
37	151	151	151	151	151	151	151	151	151	151	133	107	88.1	67.6	...
38	151	151	151	151	151	151	151	151	151	151	133	107	88.1	67.6	...
39	158	158	158	158	158	158	158	158	158	155	135	...	...	...	...
40	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
41	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
42	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
43	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
44	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...
45	158	158	158	158	158	158	158	158	158	158	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	34.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	33.6	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...	≤20
2	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...	≤20
3	C-Mn-Ti	Plate, sheet	SA-562	...	K11224	...	...
4	C-Si-Ti	Forgings	SA-836	...	...	1	...
5	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...	40 < t ≤ 60
6	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...	16 < t ≤ 40
7	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...	t ≤ 16
8	C- $\frac{1}{2}$ Mo	Smls. & wld. fittings	SA-234	WP1	K12821	...	...
9	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1b	K11422	...	...
10	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1b	K11422	...	...
(25) 11	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1b	K11422	...	...
12	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1	K11522	...	...
13	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1	K11522	...	...
(25) 14	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1	K11522	...	...
15	C- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P1	K11522	...	...
16	C- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP1	K11522	...	...
17	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1a	K12023	...	...
18	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1a	K12023	...	...
(25) 19	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1a	K12023	...	...
20	C- $\frac{1}{2}$ Mo	Castings	SA-217	WC1	J12524	...	...
21	C- $\frac{1}{2}$ Mo	Castings	SA-352	LC1	J12522	...	...
22	C- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP1	J12521	...	...
23	C- $\frac{1}{2}$ Mo	Plate	SA-204	A	K11820	...	...
24	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L65	K11820	...	...
25	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-65	K11820	...	...
26	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-65	K11820	...	...
27	C- $\frac{1}{2}$ Mo	Forgings	SA-182	F1	K12822	...	...
28	C- $\frac{1}{2}$ Mo	Plate	SA-204	B	K12020	...	...
29	C- $\frac{1}{2}$ Mo	Forgings	SA-336	F1	K12520	...	...
30	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L70	K12020	...	...
31	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-70	K12020	...	...
32	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-70	K12020	...	...
33	C- $\frac{1}{2}$ Mo	Plate	SA-204	C	K12320	...	...
34	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L75	K12320	...	...
35	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-75	K12320	...	...
36	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-75	K12320	...	...
37	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	55	...
38	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	55	...
39	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	65	...
40	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	65	...
41	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	70	...
42	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	70	...
43	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo-V	Plate	SA-517	B	K11630	...	≤32
44	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Plate	SA-517	A	K11856	...	≤32
45	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Forgings	SA-592	A	K11856	...	≤65

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	1	4	621	552	NP	NP	NP	343	...	...
2	1	4	621	552	NP	NP	NP	343	...	...
3	1	1	380	205	NP	NP	343	NP	CS-6	G7
4	1	1	380	170	NP	NP	343	343	CS-1	...
5	3	1	450	260	538	NP	538	NP	CS-2	G11, S2, T3
6	3	1	450	270	538	NP	538	NP	CS-2	G11, S2, T3
7	3	1	450	280	538	NP	538	NP	CS-2	G11, S2, T3
8	3	1	380	205	538	371	538	343	CS-2	G11, T4, W14
9	3	1	365	195	538	NP	538	343	CS-1	G11, S3, T5
10	3	1	365	195	538	NP	NP	NP	CS-1	G11, S2, T5, W13
11	3	1	365	195	538	NP	538	343	CS-1	G11, G24, S2, T5
12	3	1	380	205	538	NP	538	343	CS-2	G11, S3, T4
13	3	1	380	205	538	NP	NP	NP	CS-2	G11, S2, T4, W13
14	3	1	380	205	538	NP	538	343	CS-2	G11, G24, S2, T4
15	3	1	380	205	538	371	538	343	CS-2	G11, S2, T4
16	3	1	380	205	538	371	538	343	CS-2	G11, S2, T4
17	3	1	415	220	538	NP	538	343	CS-2	G11, S3, T4
18	3	1	415	220	538	NP	NP	NP	CS-2	G11, S2, T4, W13
19	3	1	415	220	538	NP	538	343	CS-2	G11, G24, S2, T4
20	3	1	450	240	538	371	538	343	CS-2	G1, G11, G17, S2, T4
21	3	1	450	240	NP	371	343	343	CS-2	G1, G17
22	3	1	450	240	NP	371	NP	NP	CS-2	G17
23	3	1	450	255	538	371	538	343	CS-2	G11, S2, T4
24	3	1	450	255	NP	371	NP	NP	CS-2	G26, W10, W12
25	3	1	450	255	NP	371	NP	NP	CS-2	G26, W10, W12
26	3	1	450	255	NP	149 (Cl. 3 only)	NP	NP	CS-2	G27, W10, W12
27	3	2	485	275	538	371	538	343	CS-2	G11, S2, T4
28	3	2	485	275	538	371	538	343	CS-2	G11, S2, T4
29	3	2	485	275	538	371	538	343	CS-2	G11, S2, T4
30	3	2	485	275	NP	371	NP	NP	CS-2	G26, W10, W12
31	3	2	485	275	NP	371	NP	NP	CS-2	G26, W10, W12
32	3	2	485	275	NP	149 (Cl. 3 only)	NP	NP	CS-2	G27, W10, W12
33	3	2	515	295	538	371	538	343	CS-2	G11, S2, T4, W12
34	3	2	515	295	NP	371	NP	NP	CS-2	G26, W10, W12
35	3	2	515	295	NP	371	NP	NP	CS-2	G26, W10, W12
36	3	2	515	295	NP	149 (Cl. 3 only)	NP	NP	CS-2	G27, W10, W12
37	...	...	585	380	NP	NP	315	315	CS-3	W11
38	...	...	585	380	NP	NP	315	315	CS-3	W11
39	...	...	725	450	NP	NP	315	315	CS-3	W11
40	...	...	725	450	NP	NP	315	315	CS-3	W11
41	...	...	825	485	NP	NP	93	93	CS-3	W11
42	...	...	825	485	NP	NP	93	93	CS-3	W11
43	11B	4	795	690	NP	343 (SPT)	343	343	HT-1	...
44	11B	1	795	690	NP	343 (SPT)	343	343	HT-1	...
45	11B	1	795	690	NP	343 (SPT)	343	343	HT-1	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
2	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
3	88.9	84.0	78.3	75.1	73.0	71.7	71.7	71.7	71.7	71.7	...	...	...	...	...
4	108	103	97.6	94.1	91.6	89.7	89.6	89.4	88.5	87.2	...	...	...	...	...
5	129	129	129	129	129	129	129	129	129	129	129	129	129	126	105
6	129	129	129	129	129	129	129	129	129	129	129	129	129	126	105
7	129	129	129	129	129	129	129	129	129	129	129	129	129	126	105
8	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
9	104	104	104	104	104	104	104	104	104	103	101	98.5	96.7	93.6	90.7
10	104	104	104	104	104	104	104	104	104	103	101	98.5	96.7	93.6	90.7
11	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
12	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
13	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
14	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
15	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
16	108	108	108	108	108	108	108	108	108	108	108	106	103	101	96.1
17	118	118	118	118	118	118	118	118	118	118	115	113	110	107	100
18	118	118	118	118	118	118	118	118	118	118	115	113	110	107	100
19	101	101	101	101	101	101	101	101	101	100	98.2	95.8	93.9	90.9	84.9
20	128	128	128	128	128	128	128	128	128	128	126	123	120	117	103
21	128	128	128	128	128	128	128	128	128	128	126	...	...	...	...
22	128	128	128	128	128	128	128	128	128	128	126	...	...	...	...
23	128	128	128	128	128	128	128	128	128	128	128	128	127	124	105
24	128	128	128	128	128	128	128	128	128	128	128	...	...	...	...
25	128	128	128	128	128	128	128	128	128	128	128	...	...	...	...
26	128	128	128	128	128	...	...	...	...	...	...	...	...	...	...
27	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
28	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
29	138	138	138	138	138	138	138	138	138	138	138	138	137	134	107
30	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
31	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
32	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...
33	148	148	148	148	148	148	148	148	148	148	148	148	148	144	109
34	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
35	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
36	148	148	148	148	148	...	...	...	...	...	...	...	...	...	...
37	167	167	167	167	167	167	167	167	167	...	...	...	...	...	...
38	167	167	167	167	167	167	167	167	167	...	...	...	...	...	...
39	207	207	207	207	207	207	207	207	207	...	...	...	...	...	...
40	207	207	207	207	207	207	207	207	207	...	...	...	...	...	...
41	236	236	236	...	...	...	...	...	...	...	...	...	...	...	...
42	236	236	236	...	...	...	...	...	...	...	...	...	...	...	...
43	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
44	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
45	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	68.9	42.8	23.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	68.9	42.8	23.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	68.9	42.8	23.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	72.1	41.7	23.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	70.4	42.2	23.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	70.4	42.2	23.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	60.2	36.0	20.0	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	72.1	41.7	23.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	72.1	41.7	23.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	61.3	35.7	20.1	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	72.1	41.7	23.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	72.1	41.7	23.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	70.4	42.3	23.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	70.4	42.3	23.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	59.9	36.2	19.9	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	69.5	42.6	23.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	68.9	42.8	23.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	68.1	43.1	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	68.1	43.1	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	68.1	43.1	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	67.2	43.3	23.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P2	K11547	...	...
2	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP2	K11547	...	...
3	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2	K12143	1	...
4	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$	K12143	...	...
5	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$	K12143	...	...
(25) 6	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T2	K11547	...	...
7	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. tube	SA-250	T2	K11547	...	...
8	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. tube	SA-250	T2S1	K11547	...	...
9	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP2	J11547	...	...
10	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F2	K12122	...	...
11	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2	K12143	2	...
12	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$	K12143	...	...
(25) 13	$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	Smls. & wld. tube	SA-423	1	K11535	...	...
14	$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	Wld. tube	SA-423	1	K11535	...	...
15	$\frac{3}{4}\text{Cr}-\frac{3}{4}\text{Ni}-\text{Cu}-\text{Al}$	Pipe	SA-333	4	K11267	...	...
16	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	55	...
17	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	55	...
18	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	55	...
19	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	65	...
20	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	65	...
21	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	65	...
22	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	70	...
23	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	70	...
24	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	70	...
25	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	G41370	110	...
26	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	12	K11757	1	...
27	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	1CR	K11757	...	...
28	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP12	J11562	...	...
29	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F12	K11562	1	...
30	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T12	K11562	...	...
(25) 31	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. & wld. fittings	SA-234	WP12	K12062	1	...
32	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. tube	SA-250	T12	K11562	...	...
33	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. tube	SA-250	T12S1	K11562	...	...
34	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P12	K11562	...	...
35	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP12	K11562	...	...
36	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$250 < t \leq 500$
37	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$150 < t \leq 250$
38	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$100 < t \leq 150$
39	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/GB 713	15CrMoR	...	NT	$100 < t \leq 200$
40	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$100 < t \leq 250$
41	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$60 < t \leq 100$
42	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$70 < t \leq 100$
43	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA/EN 10216-2	13CrMo4-5	...	...	$40 < t \leq 60$
(25) 44	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$35 < t \leq 70$
45	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA/EN 10216-2	13CrMo4-5	...	...	$t \leq 40$

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	3	1	380	205	538	371	538	343	CS-2	T5
2	3	1	380	205	538	371	538	343	CS-2	T5
3	3	1	380	230	538	371	538	343	CS-2	T5
4	3	1	380	230	NP	371	NP	NP	CS-2	G26, W10, W12
5	3	1	380	230	NP	149 (Cl. 3 only)	NP	NP	CS-2	G27, W10, W12
6	3	1	415	205	538	371	538	343	CS-2	T5
7	3	1	415	205	538	NP	NP	NP	CS-2	G24, T5
8	3	1	415	205	538	NP	NP	NP	CS-2	T5, W13
9	3	1	415	205	NP	371	NP	NP	CS-2	G17
10	3	2	485	275	538	NP	538	343	CS-2	T5
11	3	2	485	310	NP	371	538	343	CS-3	T5
12	3	2	485	310	NP	371	NP	NP	CS-3	G26, W10, W12
13	4	2	415	255	371	NP	343	NP	CS-2	W13, W14
14	4	2	415	255	371	NP	343	NP	CS-2	G24
15	4	2	415	240	NP	371	343	NP	CS-2	...
16	...	...	585	380	NP	NP	315	315	CS-3	W11
17	...	...	585	380	NP	NP	315	315	CS-3	W11
18	...	...	585	380	NP	NP	315	315	CS-3	W11
19	...	...	725	450	NP	NP	343	343	CS-2	W11
20	...	...	725	450	NP	NP	315	315	CS-3	W11
21	...	...	725	450	NP	NP	343	343	CS-2	W11
22	...	...	825	485	NP	NP	343	343	CS-5	W11
23	...	...	825	485	NP	NP	343	343	CS-5	W11
24	...	...	825	485	NP	NP	343	343	CS-5	W11
25	...	...	930	760	NP	NP	343	343	HT-1	W11
26	4	1	380	230	649	371	649	NP	CS-2	S4, T5
27	4	1	380	230	NP	371	NP	NP	CS-2	G26, W10, W12
28	4	1	415	205	NP	371	NP	NP	CS-2	G17
29	4	1	415	220	649	NP	649	NP	CS-2	T5
30	4	1	415	220	649	371	649	NP	CS-2	S4, T5
31	4	1	415	220	649	371	649	NP	CS-2	S4, T5, W14
32	4	1	415	220	649	NP	NP	NP	CS-2	G24, S4, T5
33	4	1	415	220	649	NP	NP	NP	CS-2	S4, T5, W13
34	4	1	415	220	649	371	649	NP	CS-2	S4, T5
35	4	1	415	220	649	371	649	NP	CS-2	S4, T5
36	4	1	420	240	649	NP	649	NP	CS-2	S4, T4
37	4	1	420	245	649	NP	649	NP	CS-2	S4, T4
38	4	1	430	255	649	NP	649	NP	CS-2	S4, T4
39	4	1	440	255	649	NP	NP	NP	CS-2	S4, T4
40	4	1	440	265	649	NP	649	NP	CS-2	S4, T4
41	4	1	440	270	649	NP	649	NP	CS-2	S4, T4
42	4	1	440	275	649	NP	649	NP	CS-2	S4, T4
43	4	1	440	280	649	NP	649	NP	CS-2	T4
44	4	1	440	285	649	NP	649	NP	CS-2	S4, T4
45	4	1	440	290	649	NP	649	NP	CS-2	T4

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	108	108	108	108	108	108	108	108	108	108	108	106	103	100	97.1
2	108	108	108	108	108	108	108	108	108	108	108	106	103	100	97.1
3	108	108	108	108	108	108	108	108	108	108	108	108	108	106	103
4	108	108	108	108	108	108	108	108	108	108	108	...	...	...	...
5	108	108	108	108	108	...	...	...	...	...	...	...	...	...	...
6	118	118	118	118	118	118	117	114	112	110	108	106	103	100	97.1
7	100	100	100	100	100	100	99.6	96.7	95.5	93.8	91.5	90.2	87.7	85.3	82.4
8	118	118	118	118	118	118	117	114	112	110	108	106	103	100	97.1
9	118	118	118	118	118	118	117	114	112	110	108	...	...	...	...
10	138	138	138	138	138	138	138	138	138	138	138	138	137	134	130
11	138	138	138	138	138	138	138	138	138	138	138	138	138	135	130
12	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
13	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
14	101	101	101	101	101	101	101	101	101	101	101	...	...	...	...
15	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
16	167	167	167	167	167	167	167	167	167	...	...	...	...	...	...
17	167	167	167	167	167	167	167	167	167	...	...	...	...	...	...
18	167	167	167	167	167	167	167	167	167	...	...	...	...	...	...
19	207	207	207	207	207	207	207	207	207	205	...	...	...	...	...
20	207	207	207	207	207	207	207	207	207	...	...	...	...	...	...
21	207	207	207	207	207	207	207	207	207	205	...	...	...	...	...
22	236	236	236	236	236	236	236	236	236	235	...	...	...	...	...
23	236	236	236	236	236	236	236	236	236	235	...	...	...	...	...
24	236	236	236	236	236	236	236	236	236	235	...	...	...	...	...
25	265	260	254	254	253	252	249	248	245	234	...	...	...	...	...
26	108	107	106	105	104	104	104	104	104	104	104	104	104	104	102
27	108	107	106	105	104	104	104	104	104	104	104	...	...	...	...
28	118	117	116	115	114	112	109	106	104	103	102	...	...	...	...
29	118	118	115	114	114	114	114	113	112	110	109	107	106	103	101
30	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
31	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
32	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
33	118	118	115	114	114	114	114	113	112	110	109	107	106	103	101
34	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
35	118	117	116	114	114	114	114	113	112	110	109	107	106	103	101
36	120	120	118	116	115	114	114	114	114	114	114	114	114	113	110
37	120	120	117	116	116	116	115	115	115	115	115	115	115	115	112
38	123	123	120	119	118	118	118	118	118	118	118	118	118	118	116
39	126	126	123	122	121	121	118	115	114	112	111	109	107	105	103
40	126	126	124	122	121	120	120	120	120	120	120	120	120	120	117
41	126	126	123	122	121	121	121	121	121	121	121	121	121	120	119
42	126	126	124	122	121	120	120	120	120	120	120	120	120	120	117
43	126	126	126	126	126	126	126	126	126	126	126	126	126	123	118
44	126	126	124	122	121	120	120	120	120	120	120	120	120	120	117
45	126	126	126	126	126	126	126	126	126	126	126	126	126	123	118

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	77.0	49.5	31.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	77.0	49.5	31.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	76.7	49.6	31.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	77.0	49.5	31.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	65.3	42.0	26.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	77.0	49.5	31.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	89.1	46.0	32.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	88.9	46.0	32.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	88.8	61.7	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
30	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
31	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
32	72.9	53.2	33.7	22.5	14.8	9.71	6.34	...	...	...	...	...	...	...	...	...	...
33	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
34	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
35	88.3	61.9	40.3	26.4	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
36	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
37	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
38	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
39	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
40	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
41	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
42	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
43	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
44	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
45	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25)	1 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$t \leq 35$
	2 1Cr- $\frac{1}{2}$ Mo	Plate	SA-387	12	K11757	2	...
	3 1Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	1CR	K11757	...	...
	4 1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR	...	NT	$60 < t \leq 100$
	5 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$16 < t \leq 60$
	6 1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR	...	NT	$6 \leq t \leq 60$
	7 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$t \leq 16$
	8 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12	K11564	2	...
	9 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F12	K11564	...	...
	10 1Cr-V	Smls. tube	SA-213	T17	K12047	...	...
	11 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC6	J12072	...	...
	12 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP11	J12072	...	...
	13 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Bar	SA-739	B11	K11797	...	...
	14 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11597	1	...
	15 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T11	K11597	...	...
(25)	16 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. & wld. fittings	SA-234	WP11	...	1	...
	17 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. tube	SA-250	T11	K11597	...	...
	18 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. tube	SA-250	T11S1	K11597	...	...
	19 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P11	K11597	...	...
	20 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11597	1	...
	21 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forged pipe	SA-369	FP11	K11597	...	...
	22 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	1	...
	23 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	$\frac{1}{4}$ CR	K11789	...	...
	24 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	$\frac{1}{4}$ CR	K11789	...	...
	25 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11572	2	...
	26 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	2	...
	27 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	3	...
	28 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	2	...
	29 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	$\frac{1}{4}$ CR	K11789	...	...
	30 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	$65 < t \leq 100$
(25)	31 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	≤ 65
	32 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	$65 < t \leq 150$
	33 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	≤ 65
	34 $\frac{2}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	1	...
	35 $\frac{2}{4}$ Cr-1Mo	Smls. tube	SA-213	T22	K21590	...	...
	36 $\frac{2}{4}$ Cr-1Mo	Smls. & wld. fittings	SA-234	WP22	K21590	1	...
	37 $\frac{2}{4}$ Cr-1Mo	Wld. tube	SA-250	T22	K21590	...	...
	38 $\frac{2}{4}$ Cr-1Mo	Wld. tube	SA-250	T22S1	K21590	...	...
	39 $\frac{2}{4}$ Cr-1Mo	Smls. pipe	SA-335	P22	K21590	...	...
	40 $\frac{2}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	1	...
	41 $\frac{2}{4}$ Cr-1Mo	Forged pipe	SA-369	FP22	K21590	...	...
	42 $\frac{2}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	1	...
	43 $\frac{2}{4}$ Cr-1Mo	Wld. pipe	SA-691	$\frac{2}{4}$ CR	K21590	...	...
	44 $\frac{2}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	$150 < t \leq 250$
	45 $\frac{2}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	$200 < t \leq 500$

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	4	1	440	295	649	NP	649	NP	CS-2	S4, T4
2	4	1	450	275	649	371	649	NP	CS-2	S4, T5
3	4	1	450	275	NP	371	NP	NP	CS-2	G26, W10, W12
4	4	1	450	275	649	NP	NP	NP	CS-2	S4, T4
5	4	1	450	290	649	NP	649	NP	CS-2	S4, T4
6	4	1	450	295	649	NP	NP	NP	CS-2	S4, T4
7	4	1	450	300	649	NP	649	NP	CS-2	S4, T4
8	4	1	485	275	649	371	649	NP	CS-2	S4, T4
9	4	1	485	275	649	371	649	NP	CS-2	S4, T4
10	10B	1	415	205	NP	NP	343	343	CS-2	...
11	4	1	485	275	593	371	593	NP	CS-2	G1, G17, T4
12	4	1	485	275	NP	371	NP	NP	CS-2	G17
13	4	1	485	310	NP	371	649	NP	CS-3	T4
14	4	1	415	205	649	NP	649	NP	CS-2	S4, T5
15	4	1	415	205	649	371	649	NP	CS-2	S4, T5
16	4	1	415	205	649	371	649	NP	CS-2	S4, T5, W14
17	4	1	415	205	649	NP	NP	NP	CS-2	G24, S4, T5
18	4	1	415	205	649	NP	NP	NP	CS-2	S4, T5, W13
19	4	1	415	205	649	371	649	NP	CS-2	S4, T5
20	4	1	415	205	649	NP	NP	NP	CS-2	S4, T5
21	4	1	415	205	649	371	649	NP	CS-2	S4, T5
22	4	1	415	240	649	371	649	NP	CS-2	S4, T4
23	4	1	415	240	NP	149 (Cl. 3 only)	NP	NP	CS-2	G27, W10, W12
24	4	1	415	240	NP		NP	NP	CS-2	G26, W10, W12
25	4	1	485	275	649	371	649	NP	CS-2	S4, T4
26	4	1	485	275	649	NP	649	NP	CS-2	S4, T4
27	4	1	515	310	NP	NP	649	NP	CS-3	T3
28	4	1	515	310	649	371	649	NP	CS-3	S4, T3
29	4	1	515	310	NP	371	NP	NP	CS-3	G26, W10, W12
30	11B	2	725	620	NP	343 (SPT)	343	343	CS-5	S7
31	11B	2	795	690	NP	NP	343	343	HT-1	...
32	11B	2	725	620	NP	371 (Cl. MC & SPT)	343	343	CS-5	...
33	11B	2	795	690	NP	371 (Cl. MC & SPT)	343	343	HT-1	...
34	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
35	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
36	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9, W14
37	5A	1	415	205	649	NP	NP	NP	CS-2	G24, S4, T4, W9
38	5A	1	415	205	649	NP	NP	NP	CS-2	S4, T4, W9, W13
39	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
40	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
41	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
42	5A	1	415	205	649	371	649	NP	CS-2	S4, T4, W7, W9
43	5A	1	415	205	NP	371	NP	NP	CS-2	G26, W10, W12
44	5A	1	450	250	593	NP	593	NP	CS-3	S4, T4, W7, W9
45	5A	1	450	265	649	NP	649	NP	CS-3	S4, T4, W7, W9

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	126	126	124	122	121	120	120	120	120	120	120	120	120	120	117
2	128	128	125	124	123	123	123	123	123	123	123	123	123	123	123
3	128	127	125	124	123	123	123	123	123	123	123	...	...	...	...
4	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
5	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
6	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
7	129	129	126	125	124	124	124	123	123	123	123	123	123	123	121
8	138	137	135	133	132	132	132	132	132	132	132	132	132	129	125
9	138	138	134	133	132	132	132	132	132	132	132	132	132	129	125
10	118	118	118	118	118	116	112	109	108	106	...	...	...	...	...
11	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
12	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...
13	138	138	138	138	138	138	138	138	138	138	138	138	138	135	107
14	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
15	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
16	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
17	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
18	118	118	118	118	118	116	112	109	108	106	104	102	99.5	96.9	94.7
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	118	118	118	118	118	118	118	118	118	118	118	118	116	114	101
23	118	118	118	118	118	...	...	...	...	...	...	...	...	...	...
24	118	118	118	118	118	118	118	118	118	118	118	...	...	...	...
25	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
26	138	138	138	138	138	138	138	138	138	138	138	136	133	130	105
27	148	148	148	148	148	148	148	148	148	148	148	148	148	143	107
28	148	148	148	148	148	148	148	148	148	148	148	148	148	143	107
29	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
30	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
31	227	227	227	227	227	227	227	227	227	227	...	...	...	...	...
32	207	207	207	207	207	207	207	207	207	207	206	...	...	...	...
33	227	227	227	227	227	227	227	227	227	227	221	...	...	...	...
34	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
35	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
36	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
37	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
38	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
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
42	118	118	118	116	114	114	114	114	114	114	114	114	114	114	100
43	118	118	118	116	114	114	114	114	114	114	114	...	...	...	...
44	129	129	128	126	125	124	123	123	122	121	120	118	116	113	109
45	129	129	129	128	126	124	124	123	123	122	121	119	116	113	109

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
2	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
5	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
6	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
7	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
8	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
9	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	73.3	52.1	36.4	25.2	17.6	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	72.9	52.3	36.3	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
14	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
15	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
16	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
17	62.8	43.5	31.5	21.5	15.0	10.4	6.73	...	...	...	...	...	...	...	...	...	...
18	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
19	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
20	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
21	72.9	51.0	36.7	25.1	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
22	72.9	51.7	36.5	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	72.9	52.1	36.4	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
26	72.9	52.1	36.4	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
27	72.9	52.3	36.3	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
28	72.9	52.3	36.3	25.2	17.6	12.4	8.08	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	80.9	64.0	47.7	34.5	23.5	15.5	9.39	...	...	...	...	...	...	...	...	...	...
35	80.9	64.0	47.7	34.5	23.5	15.5	9.39	...	...	...	...	...	...	...	...	...	...
36	80.9	64.0	47.7	34.5	23.5	15.5	9.39	...	...	...	...	...	...	...	...	...	...
37	69.0	54.5	40.4	29.1	19.8	12.9	8.06	...	...	...	...	...	...	...	...	...	...
38	80.9	64.0	47.7	34.5	23.5	15.5	9.39	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...
42	80.9	64.0	47.7	34.5	23.5	15.5	9.39	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...	...	...	...
45	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	100 < t ≤ 150
2	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	60 < t ≤ 100
3	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA/EN 10216-2	10CrMo9-10	...	...	40 < t ≤ 60
4	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA/EN 10216-2	10CrMo9-10	...	...	t ≤ 40
5	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	t ≤ 60
6	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9	J21890	...	...
7	2 $\frac{1}{4}$ Cr-1Mo	Cast pipe	SA-426	CP22	J21890	...	...
8	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	3	...
9	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	3	...
10	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	2	...
11	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR	K21590	...	...
12	2 $\frac{1}{4}$ Cr-1Mo	Bar	SA-739	B22	K21390	...	...
(25) 13	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	t ≤ 200
14	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-487	8	J22091	A	...
15	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-508	22	K21590	3	...
16	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	3	...
17	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-542	B	K21590	4	...
18	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-182	F22V	K31835	...	...
19	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-336	F22V	K31835	...	...
20	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-541	22V	K31835	...	...
21	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-542	D	K31835	4a	...
22	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-832	22V	K31835	...	...
23	3Cr-1Mo	Smls. tube	SA-213	T21	K31545	...	...
24	3Cr-1Mo	Smls. pipe	SA-335	P21	K31545	...	...
25	3Cr-1Mo	Forgings	SA-336	F21	K31545	1	...
26	3Cr-1Mo	Forged pipe	SA-369	FP21	K31545	...	...
27	3Cr-1Mo	Plate	SA-387	21	K31545	1	...
28	3Cr-1Mo	Cast pipe	SA-426	CP21	J31545	...	...
29	3Cr-1Mo	Forgings	SA-182	F21	K31545	...	...
30	3Cr-1Mo	Forgings	SA-336	F21	K31545	3	...
31	3Cr-1Mo	Plate	SA-387	21	K31545	2	...
32	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-182	F3V	K31830	...	...
33	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-336	F3V	K31830	...	...
34	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-508	3V	K31830	...	...
35	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-541	3V	K31830	...	...
36	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-542	C	K31830	4a	...
37	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-832	21V	K31830	...	...
38	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-182	F3VCb	...	...	...
39	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-336	F3VCb	...	...	...
40	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-508	3VCb	...	...	...
41	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-541	3VCb	...	...	...
42	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-542	E	...	4a	...
43	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-832	23V	...	...	...
44	5Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T5	K41545	...	...
45	5Cr- $\frac{1}{2}$ Mo	Smls. & wld. fittings	SA-234	WP5	K41545	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	5A	1	460	260	593	NP	593	NP	CS-3	S4, T4, W7, W9
2	5A	1	470	280	593	NP	593	NP	CS-3	S4, T4, W7, W9
3	5A	1	480	270	649	NP	649	NP	CS-2	T4, W7, W9
4	5A	1	480	280	649	NP	649	NP	CS-2	T4, W7, W9
5	5A	1	480	...	593	NP	593	NP	CS-3	G18, S4, T4, W7, W9
6	5A	1	485	275	649	371	649	NP	CS-2	G1, G17, S4, T4, W7, W9
7	5A	1	485	275	NP	371	NP	NP	CS-2	G17
8	5A	1	515	310	649	371	649	NP	CS-3	S4, T4, W7, W9
9	5A	1	515	310	649	371	649	NP	CS-3	S4, T4, W7, W9
10	5A	1	515	310	649	371	649	NP	CS-3	S4, T4, W7, W9
11	5A	1	515	310	NP	371	NP	NP	CS-3	G26, W10, W12
12	5A	1	515	310	NP	371	649	NP	CS-3	T4, W7
13	5A	1	520	310	649	NP	649	NP	CS-3	S4, T3, W7, W9
14	5C	1	585	380	NP	NP	538	NP	CS-3	G1, T4, W7
15	5C	1	585	380	NP	NP	454	NP	CS-2	...
16	5C	1	585	380	NP	NP	454	NP	CS-2	...
17	5C	1	585	380	NP	NP	454	NP	CS-2	...
18	5C	1	585	415	NP	NP	482	NP	CS-2	...
19	5C	1	585	415	NP	NP	482	NP	CS-2	...
20	5C	1	585	415	NP	NP	482	NP	CS-2	...
21	5C	1	585	415	NP	NP	482	NP	CS-2	...
22	5C	1	585	415	NP	NP	482	NP	CS-2	...
23	5A	1	415	205	649	371	649	NP	CS-2	S4, T3
24	5A	1	415	205	649	371	649	NP	CS-2	S4, T3
25	5A	1	415	205	649	371	649	NP	CS-2	S4, T3
26	5A	1	415	205	649	371	649	NP	CS-2	S4, T3
27	5A	1	415	205	649	371	649	NP	CS-2	S4, T3
28	5A	1	415	205	NP	371	NP	NP	CS-2	G17
29	5A	1	515	310	649	371	649	NP	CS-3	S4, T3
30	5A	1	515	310	649	371	649	NP	CS-3	S4, T3
31	5A	1	515	310	649	371	649	NP	CS-3	S4, T3
32	5C	1	585	415	NP	NP	482	NP	CS-3	...
33	5C	1	585	415	NP	NP	482	NP	CS-3	...
34	5C	1	585	415	NP	NP	482	NP	CS-3	...
35	5C	1	585	415	NP	NP	482	NP	CS-3	...
36	5C	1	585	415	NP	NP	482	NP	CS-3	...
37	5C	1	585	415	NP	NP	482	NP	CS-3	...
38	5C	1	585	415	NP	NP	482	NP	CS-3	...
39	5C	1	585	415	NP	NP	482	NP	CS-3	...
40	5C	1	585	415	NP	NP	482	NP	CS-3	...
41	5C	1	585	415	NP	NP	482	NP	CS-3	...
42	5C	1	585	415	NP	NP	482	NP	CS-3	...
43	5C	1	585	415	NP	NP	482	NP	CS-3	...
44	5B	1	415	205	649	371	649	NP	CS-2	T4
45	5B	1	415	205	649	371	649	NP	CS-2	T4, W14

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	131	131	131	129	128	127	126	125	125	124	123	121	119	116	112
2	134	134	134	132	131	129	129	128	127	127	125	123	121	118	114
3	137	137	137	137	135	133	132	132	132	131	129	126	123	119	113
4	137	137	137	137	135	133	132	132	132	131	129	126	123	119	113
5	137	137	137	135	133	132	132	131	130	129	128	126	124	121	117
6	138	138	138	137	136	134	133	133	132	131	129	127	124	119	113
7	138	138	138	137	136	134	133	133	132	131	129	...	...	...	...
8	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
9	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
10	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
11	148	148	147	146	144	142	141	141	140	139	138	...	...	...	...
12	148	148	147	146	144	142	141	141	140	139	138	136	133	130	116
13	149	149	149	148	146	143	143	142	142	141	139	137	135	131	116
14	168	168	167	165	163	162	162	161	160	160	157	154	150	145	120
15	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
16	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
17	168	168	168	168	168	168	165	161	160	159	158	156	151	142	133
18	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
19	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
20	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
21	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
22	168	168	168	168	168	168	168	165	162	159	157	153	149	145	141
23	118	118	118	116	114	114	114	114	114	114	114	114	114	113	90.5
24	118	118	118	116	114	114	114	114	114	114	114	114	114	113	90.5
25	118	118	118	116	114	114	114	114	114	114	114	114	114	113	90.5
26	118	118	118	116	114	114	114	114	114	114	114	114	114	113	90.5
27	118	118	118	116	114	114	114	114	114	114	114	114	114	113	90.5
28	118	118	118	116	114	114	114	114	114	114	114	...	...	...	...
29	148	148	147	146	144	142	141	141	140	139	138	136	133	127	100
30	148	148	147	146	144	142	141	141	140	139	138	136	133	127	100
31	148	148	147	146	144	142	141	141	140	139	138	136	133	127	100
32	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
33	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
34	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
35	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
36	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
37	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
38	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
39	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
40	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
41	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
42	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
43	168	168	167	164	161	156	154	151	150	149	147	145	144	141	139
44	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
45	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...	...	...	...
2	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...	...	...	...
3	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
4	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
5	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...	...	...	...
6	90.4	64.0	45.0	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
9	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
10	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
13	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...	...	...	...
14	88.1	65.1	42.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	137	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	68.2	54.1	43.5	34.4	25.3	17.4	10.0	...	...	...	...	...	...	...	...	...	...
24	68.2	54.1	43.5	34.4	25.3	17.4	10.0	...	...	...	...	...	...	...	...	...	...
25	68.2	54.1	43.5	34.4	25.3	17.4	10.0	...	...	...	...	...	...	...	...	...	...
26	68.2	54.1	43.5	34.4	25.3	17.4	10.0	...	...	...	...	...	...	...	...	...	...
27	68.2	54.1	43.5	34.4	25.3	17.4	10.0	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	72.8	54.9	40.7	29.4	20.4	15.7	8.64	...	...	...	...	...	...	...	...	...	...
30	72.8	54.9	40.7	29.4	20.4	15.7	8.64	...	...	...	...	...	...	...	...	...	...
31	72.8	54.9	40.7	29.4	20.4	15.7	8.64	...	...	...	...	...	...	...	...	...	...
32	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	136	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
45	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...

(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	5Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P5	K41545	...	...
2	5Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP5	K41545	...	...
3	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	1	...
4	5Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	5CR	K41545	...	...
5	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5	K41545	...	...
6	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5	K41545	...	...
7	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	2	...
8	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5A	K42544	...	...
9	5Cr- $\frac{1}{2}$ Mo	Castings	SA-217	C5	J42045	...	...
10	5Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP5	J42045	...	...
11	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5a	K42544	...	...
12	5Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T5b	K51545	...	...
13	5Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P5b	K51545	...	...
14	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. tube	SA-213	T5c	K41245	...	...
15	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. pipe	SA-335	P5c	K41245	...	...
16	9Cr-1Mo	Smls. tube	SA-213	T9	K90941	...	...
17	9Cr-1Mo	Fittings	SA-234	WP9	K90941	...	...
18	9Cr-1Mo	Smls. pipe	SA-335	P9	K90941	...	...
19	9Cr-1Mo	Forged pipe	SA-369	FP9	K90941	...	...
20	9Cr-1Mo	Forgings	SA-182	F9	K90941	...	...
21	9Cr-1Mo	Forgings	SA-336	F9	K90941	...	...
22	9Cr-1Mo	Castings	SA-217	C12	J82090	...	...
23	9Cr-1Mo	Cast pipe	SA-426	CP9	J82090	...	...
24	9Cr-1Mo-V	Smls. tube	SA-213	T91 Type 1	K90901	...	...
25	9Cr-1Mo-V	Fittings	SA-234	WP91 Type 1	K90901	...	...
26	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Type 1	K90901	...	$t \leq 75$
27	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Type 1	K90901	...	$t > 75$
28	9Cr-1Mo-V	Forged pipe	SA-369	FP91 Type 1	K90901	...	...
29	9Cr-1Mo-V	Plate	SA-387	91 Type 1	K90901	2	$t \leq 75$
30	9Cr-1Mo-V	Plate	SA-387	91 Type 1	K90901	2	$t > 75$
31	9Cr-1Mo-V	Forgings	SA-182	F91 Type 1	K90901	...	$t \leq 75$
32	9Cr-1Mo-V	Forgings	SA-182	F91 Type 1	K90901	...	$t > 75$
33	9Cr-1Mo-V	Forgings	SA-336	F91 Type 1	K90901	...	...
34	9Cr-1Mo-V	Smls. tube	SA-213	T91 Type 2	K90901	...	...
35	9Cr-1Mo-V	Fittings	SA-234	WP91 Type 2	K90901	...	...
36	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Type 2	K90901	...	...
37	9Cr-1Mo-V	Forged pipe	SA-369	FP91 Type 2	K90901	...	...
38	9Cr-1Mo-V	Plate	SA-387	91 Type 2	K90901	2	...
39	9Cr-1Mo-V	Forgings	SA-182	F91 Type 2	K90901	...	...
40	9Cr-1Mo-V	Forgings	SA-336	F91 Type 2	K90901	...	...
41	11Cr-Ti	Plate	SA-240	...	S40910	...	...
42	11Cr-Ti	Plate	SA-240	...	S40920	...	...
43	11Cr-Ti	Plate	SA-240	...	S40930	...	...
44	11Cr-Ti	Wld. tube	SA-268	TP409	S40900	...	...
45	11Cr-Ti	Smls. tube	SA-268	TP409	S40900	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	5B	1	415	205	649	371	649	NP	CS-2	T4
2	5B	1	415	205	649	371	649	NP	CS-2	T4
3	5B	1	415	205	649	371	649	NP	CS-2	T4
4	5B	1	415	205	NP	371	NP	NP	CS-2	G26, W10, W12
5	5B	1	415	250	649	NP	649	NP	CS-2	T4
6	5B	1	485	275	649	371	649	NP	CS-2	T3
7	5B	1	515	310	NP	371	649	NP	CS-3	T3
8	5B	1	550	345	649	NP	649	NP	CS-3	T3
9	5B	1	620	415	649	371	649	NP	CS-3	G1, G17, T3
10	5B	1	620	415	NP	371	NP	NP	CS-3	G17
11	5B	1	620	450	649	NP	649	NP	CS-5	T3
12	5B	1	415	205	649	NP	649	NP	CS-2	T4
13	5B	1	415	205	649	NP	649	NP	CS-2	T4
14	5B	1	415	205	649	NP	649	NP	CS-2	T4
15	5B	1	415	205	649	NP	649	NP	CS-2	T4
16	5B	1	415	205	649	371	649	NP	CS-2	T5
17	5B	1	415	205	649	NP	649	NP	CS-2	T5
18	5B	1	415	205	649	371	649	NP	CS-2	T5
19	5B	1	415	205	649	371	649	NP	CS-2	T5
20	5B	1	585	380	649	NP	649	NP	CS-3	T4
21	5B	1	585	380	NP	NP	649	NP	CS-3	T4
22	5B	1	620	415	649	371 (SPT)	649	NP	CS-3	G1, T4
23	5B	1	620	415	NP	371	NP	NP	CS-3	G17
24	15E	1	585	415	649	371	649	NP	CS-3	T6
25	15E	1	620	415	649	NP	NP	NP	CS-3	T6
26	15E	1	585	415	649	371	649	NP	CS-3	T6
27	15E	1	585	415	649	NP	649	NP	CS-3	T6
28	15E	1	585	415	649	NP	NP	NP	CS-3	T6
29	15E	1	585	415	649	371	649	NP	CS-3	T6
30	15E	1	585	415	649	NP	649	NP	CS-3	T6
31	15E	1	620	415	649	371	649	NP	CS-3	T6
32	15E	1	620	415	649	NP	649	NP	CS-3	T6
33	15E	1	620	415	649	NP	649	NP	CS-3	T6
34	15E	1	585	415	649	NP	NP	NP	CS-3	T6
35	15E	1	620	415	649	NP	NP	NP	CS-3	T6
36	15E	1	585	415	649	NP	NP	NP	CS-3	T6
37	15E	1	585	415	649	NP	NP	NP	CS-3	T6
38	15E	1	585	415	649	NP	NP	NP	CS-3	T6
39	15E	1	620	415	649	NP	NP	NP	CS-3	T6
40	15E	1	620	415	649	NP	NP	NP	CS-3	T6
41	7	1	380	170	NP	NP	427	NP	CS-1	...
42	7	1	380	170	NP	NP	427	NP	CS-1	...
43	7	1	380	170	NP	NP	427	NP	CS-1	...
44	7	1	380	170	NP	NP	427	343	CS-1	G24
45	7	1	380	170	NP	NP	427	343	CS-1	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
2	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
3	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
4	118	118	118	116	114	114	113	112	111	109	107	...	...	...	...
5	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
6	138	138	138	136	134	132	132	131	130	128	125	121	118	102	81.1
7	148	148	147	146	143	142	142	140	139	137	134	130	126	104	80.5
8	158	158	157	154	152	152	151	150	148	146	143	139	133	104	80.3
9	177	177	177	174	172	170	170	169	167	164	161	156	134	103	80.6
10	177	177	177	174	172	170	170	169	167	164	161	...	...	...	...
11	177	177	177	174	172	170	170	169	167	164	161	156	134	103	80.6
12	118	118	118	116	114	114	113	112	111	109	107	104	100	96.1	81.4
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	95.8	91.8
17	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
18	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
19	118	118	118	116	114	114	113	112	111	109	107	104	100	95.8	91.8
20	168	167	166	164	162	161	161	159	157	155	152	147	142	137	121
21	168	167	166	164	162	161	161	159	157	155	152	147	142	137	121
22	177	177	177	174	172	170	170	169	167	164	161	156	151	145	123
23	177	177	177	174	172	170	170	169	167	164	161	...	...	...	...
24	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
25	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
26	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
27	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
28	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
29	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
30	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
31	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
32	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
33	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
34	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
35	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
36	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
37	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
38	168	168	168	168	168	167	166	164	163	161	157	153	147	141	134
39	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
40	177	177	177	177	177	177	176	175	172	170	166	162	156	149	142
41	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	...
42	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	...
43	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	...
44	92.4	88.4	84.0	80.2	76.6	71.2	68.4	66.5	66.2	66.2	66.2	65.6	65.1	64.6	...
45	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	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
2	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
3	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
6	61.8	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
7	62.0	46.3	34.8	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
8	62.1	46.3	34.8	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
9	62.0	46.3	34.8	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	62.0	46.3	34.8	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
12	61.7	46.4	34.7	25.8	18.0	11.5	6.68	...	...	...	...	...	...	...	...	...	...
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	80.3	61.0	42.9	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
17	80.3	61.0	42.9	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
18	80.3	61.0	42.9	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
19	80.3	61.0	42.9	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
20	89.0	60.7	43.1	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
21	89.0	60.7	43.1	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
22	88.2	61.0	43.0	30.0	20.6	14.4	10.2	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
25	133	124	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
26	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
27	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
28	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
29	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
30	126	117	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
31	133	124	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
32	133	124	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
33	133	124	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...	...	...	...
34	126	117	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
35	133	124	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
36	126	117	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
37	126	117	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
38	126	117	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
39	133	124	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
40	133	124	102	78.2	57.6	39.2	25.1	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	12Cr	Plate	SA-1010	40	S41003	...	$t \leq 19$
2	12Cr	Bar	SA-479	403	S40300	A	...
3	12Cr	Bar	SA-479	403	S40300	1	...
4	12Cr	Plate	SA-1010	50	S41003	...	$t \leq 19$
5	12Cr-Al	Bar	SA/JIS G4303	SUS405	...	...	...
6	12Cr-Al	Plate	SA-240	405	S40500	...	...
7	12Cr-Al	Plate	SA-240	405	S40500	...	...
8	12Cr-Al	Bar	SA-479	405	S40500	...	...
9	12Cr-Al	Smls. & wld. tube	SA-268	TP405	S40500	...	...
(25) 10	12Cr-Al	Wld. tube	SA-268	TP405	S40500	...	...
11	12Cr-Ti	Wld. tube	SA-268	...	S40800	...	...
12	12Cr-Ti	Smls. tube	SA-268	...	S40800	...	...
13	13Cr	Plate	SA-240	410S	S41008	...	...
14	13Cr	Smls. & wld. tube	SA-268	TP410	S41000	...	...
(25) 15	13Cr	Wld. tube	SA-268	TP410	S41000	...	...
16	13Cr	Plate	SA-240	410	S41000	...	...
17	13Cr	Forgings	SA-182	F6a	S41000	1	...
18	13Cr	Bar	SA-479	410	S41000	...	...
19	13Cr	Bar	SA-479	410	S41000	A	...
20	13Cr	Bar	SA-479	410	S41000	1	...
21	13Cr	Forgings	SA-182	F6a	S41000	2	...
22	13Cr	Castings	SA-217	CA15	J91150	...	...
23	13Cr	Cast pipe	SA-426	CPCA15	J91150	...	...
(25) 24	13Cr	Bar	SA/EN 10088-3	X12Cr13	...	QT650	$t \leq 160$
25	13Cr-4Ni	Castings	SA-487	CA6NM	J91540	A	...
26	13Cr-4Ni	Forgings	SA-182	F6NM	S41500	...	...
(25) 27	15Cr	Wld. tube	SA-268	TP429	S42900	...	...
28	15Cr	Smls. & wld. tube	SA-268	TP429	S42900	...	...
29	15Cr	Plate	SA-240	429	S42900	...	...
(25) 30	17Cr	Wld. tube	SA-268	TP430	S43000	...	...
31	17Cr	Smls. & wld. tube	SA-268	TP430	S43000	...	...
32	17Cr	Plate	SA-240	430	S43000	...	...
33	17Cr	Bar	SA-479	430	S43000	...	...
34	17Cr-4Ni-3Cu	Castings	SA-747	CB7Cu-1	J92180	...	...
35	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1150	...
(25) 36	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1150	...
(25) 37	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1150	...
38	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1100	...
(25) 39	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1100	...
(25) 40	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1100	...
41	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1075	...
(25) 42	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1075	...
(25) 43	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1075	...
44	18Cr-2Mo	Plate	SA-240	...	S44400	...	...
45	18Cr-2Mo	Wld. tube	SA-268	...	S44400	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	7	1	455	275	NP	NP	316	316	CS-2	...
2	6	1	485	275	NP	371	NP	NP	...	...
3	6	1	485	275	NP	371	NP	NP	...	...
4	7	1	485	345	NP	NP	316	316	CS-3	...
5	7	1	410	174	NP	371	538	NP	CS-1	G19, T5
6	7	1	415	170	371	NP	538	343	CS-1	G19, T5
7	7	1	415	170	NP	371	NP	NP	CS-1	G19
8	7	1	415	170	NP	371	538	343	CS-1	G19, T5
9	7	1	415	205	371	NP	538	343	CS-2	G19, T5, W13, W14
10	7	1	415	205	371	NP	538	343	CS-2	G19, G24, T5
11	7	1	380	205	NP	NP	427	343	CS-2	G19, W14
12	7	1	380	205	NP	NP	427	343	CS-2	G19
13	7	1	415	205	NP	371	649	343	CS-2	T4
14	6	1	415	205	371	NP	649	343	CS-2	T4, W13, W14
15	6	1	415	205	371	NP	649	343	CS-2	G24, T4
16	6	1	450	205	NP	NP	649	343	CS-2	T4
17	6	1	485	275	NP	371	538	343	CS-2	T4
18	6	1	485	275	NP	NP	538	343	CS-2	G22, T4
19	6	1	485	275	NP	371	NP	NP	CS-2	...
20	6	1	485	275	371	371	NP	NP	CS-2	...
21	6	3	585	380	NP	371	649	343	CS-3	T3
22	6	3	620	450	NP	371	649	343	CS-5	G1, G17, T3
23	6	3	620	450	NP	371	NP	NP	CS-5	G17
24	...	...	650	450	NP	371 (SPT)	NP	NP	...	W1
25	6	4	760	550	NP	371	427	343	CS-5	G1, G17
26	6	4	795	620	NP	371	NP	NP	CS-3	G17
27	6	2	415	240	371	NP	371	343	CS-2	G19, G24, W14
28	6	2	415	240	371	NP	649	343	CS-2	G19, T4, W13, W14
29	6	2	450	205	NP	NP	649	343	CS-2	G19, T4
30	7	2	415	240	371	NP	649	343	CS-2	G19, G24, T4
31	7	2	415	240	371	371	649	343	CS-2	G19, T4, W12, W13, W14
32	7	2	450	205	NP	NP	649	343	CS-2	G19, T4
33	7	2	485	275	371	371	538	343	CS-2	G19, G22, T4
34	...	...	1035	965	NP	NP	93	NP	HT-1	G1, G28, W1
35	...	...	930	725	NP	343	343	NP	HT-1	G8, G19, W1
36	...	...	930	725	NP	343	343	NP	HT-1	G19, W2
37	...	...	930	725	NP	343	343	NP	HT-1	G19, W2
38	...	...	965	795	NP	343	343	NP	HT-1	G8, G19, W1
39	...	...	965	795	NP	343	343	NP	HT-1	G19, W2
40	...	...	965	795	NP	343	343	NP	HT-1	G19, W2
41	...	...	1000	860	NP	343	NP	NP	HT-1	G19, W1
42	...	...	1000	860	NP	343	343	NP	HT-1	G19, W2
43	...	...	1000	860	NP	343	343	NP	HT-1	G19, W2
44	7	2	415	275	NP	NP	343	343	CS-2	G19
45	7	2	415	275	NP	NP	343	343	CS-2	G19, G24

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	130	130	130	130	130	127	123	119	117	...	...	...	...	...	...
2	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
3	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
4	138	138	138	138	138	135	131	126	124	...	...	...	...	...	...
5	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
6	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
7	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...
8	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	79.2
9	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.2	88.4
10	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
11	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	...
12	108	108	108	107	106	104	103	101	99.6	98.0	95.5	92.9	89.2	85.5	...
13	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.0	88.3
14	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.0	88.3
15	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
16	128	128	126	125	123	120	119	117	115	114	111	108	104	100	89.9
17	138	138	138	137	135	133	131	129	127	124	122	118	113	109	92.1
18	138	138	138	137	135	133	131	129	127	124	122	118	113	109	92.1
19	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
20	138	138	138	137	135	133	131	129	127	124	122	...	...	...	...
21	168	168	167	166	164	162	159	157	154	151	148	143	138	123	93.5
22	177	177	177	176	174	171	169	166	163	160	156	151	146	117	83.3
23	177	177	177	176	174	171	169	166	163	160	156	...	...	...	...
24	186	186	186	184	182	179	177	173	171	168	164	...	...	...	...
25	216	216	216	215	212	208	204	200	198	195	192	189	184	180	...
26	227	227	227	227	227	225	217	209	205	202	197	...	...	...	...
27	101	101	101	99.7	98.5	96.7	95.4	93.9	92.4	90.5	88.6	...	...	...	...
28	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.3	86.2
29	128	128	126	125	123	120	119	117	115	114	111	108	104	101	87.8
30	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
31	118	118	118	117	116	114	113	111	109	107	104	101	97.5	93.3	86.2
32	128	128	126	125	123	120	119	117	115	114	111	108	104	101	87.8
33	138	138	138	137	135	133	131	129	127	124	122	118	113	109	90.1
34	221	221	221	...	...	...	...	...	...	...	...	...	...	...	...
35	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
36	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
37	266	266	266	266	266	259	254	251	249	247	...	...	...	...	...
38	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
39	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
40	276	276	276	276	276	269	263	260	258	256	...	...	...	...	...
41	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
42	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
43	285	285	285	285	285	279	273	270	267	265	...	...	...	...	...
44	118	118	118	116	114	112	110	107	105	104	...	...	...	...	...
45	101	101	101	99.0	97.1	95.3	93.5	91.3	89.7	87.7	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	67.3	41.9	14.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	67.3	41.9	14.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	67.3	41.9	14.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	70.6	40.9	14.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	59.8	34.6	12.4	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	69.7	50.7	37.9	26.4	18.0	11.6	6.68	...	...	...	...	...	...	...	...	...	...
14	69.7	50.7	37.9	26.4	18.0	11.6	6.68	...	...	...	...	...	...	...	...	...	...
15	60.0	42.8	31.9	22.4	15.5	9.59	5.69	...	...	...	...	...	...	...	...	...	(25)
16	69.2	50.9	37.8	26.4	18.0	11.6	6.68	...	...	...	...	...	...	...	...	...	...
17	68.4	51.3	37.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	68.4	51.3	37.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	68.0	51.3	37.7	26.4	17.9	11.6	6.68	...	...	...	...	...	...	...	...	...	...
22	60.1	42.0	28.6	19.8	13.8	9.81	6.76	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
28	70.9	52.8	38.1	27.5	20.5	15.9	12.2	...	...	...	...	...	...	...	...	...	...
29	70.4	53.0	38.1	27.5	20.5	15.9	12.2	...	...	...	...	...	...	...	...	...	...
30	60.2	44.8	32.2	23.2	17.3	13.3	10.2	...	...	...	...	...	...	...	...	...	(25)
31	70.9	52.8	38.1	27.5	20.5	15.9	12.2	...	...	...	...	...	...	...	...	...	...
32	70.4	53.0	38.1	27.5	20.5	15.9	12.2	...	...	...	...	...	...	...	...	...	...
33	69.5	53.6	36.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-2Mo	Smls. tube	SA-268	...	S44400	...	...
2	18Cr-Ti	Plate	SA-240	...	S43932	...	...
3	18Cr-Ti	Wld. tube	SA-268	TP439	S43035	...	...
4	18Cr-Ti	Smls. tube	SA-268	TP439	S43035	...	...
(25) 5	...	...	...	...	...	...	...
(25) 6	...	...	...	...	...	...	...
7	18Cr-Ti	Wld. tube	SA-803	TP439	S43035	...	...
8	18Cr-Ti	Smls. tube	SA-268	TP430 Ti	S43036	...	...
9	18Cr-Ti	Wld. tube	SA-268	TP430 Ti	S43036	...	...
10	18Cr-Ti	Bar	SA-479	439	S43035	...	...
11	26Cr-3Ni-3Mo	Plate	SA-240	26-3-3	S44660	...	≤5
12	26Cr-3Ni-3Mo	Smls. tube	SA-268	26-3-3	S44660	...	≤5
13	26Cr-3Ni-3Mo	Wld. tube	SA-268	26-3-3	S44660	...	≤5
14	26Cr-3Ni-3Mo	Wld. tube	SA-268	26-3-3	S44660	...	≤5
15	26Cr-3Ni-3Mo	Wld. tube	SA-803	26-3-3	S44660	...	≤5
16	27Cr	Smls. tube	SA-268	TP446-1	S44600	...	...
17	27Cr-1Mo	Forgings	SA-182	FXM-27Cb	S44627	...	...
18	27Cr-1Mo	Plate	SA-240	XM-27	S44627	...	...
19	27Cr-1Mo	Wld. tube	SA-268	TPXM-27	S44627	...	...
20	27Cr-1Mo	Smls. tube	SA-268	TPXM-27	S44627	...	...
21	27Cr-1Mo	Bar	SA-479	XM-27	S44627	...	...
(25) 22	...	...	...	...	...	...	...
(25) 23	...	...	...	...	...	...	...
(25) 24	...	...	...	...	...	...	...
(25) 25	...	...	...	...	...	...	...
26	27Cr-1Mo-Ti	Plate	SA-240	XM-33	S44626	...	...
27	27Cr-1Mo-Ti	Smls. tube	SA-268	TPXM-33	S44626	...	...
28	27Cr-1Mo-Ti	Wld. tube	SA-268	TPXM-33	S44626	...	...
29	29Cr-4Mo	Bar	SA-479	...	S44700	...	...
30	29Cr-4Mo	Plate	SA-240	...	S44700	...	...
31	29Cr-4Mo	Smls. tube	SA-268	29-4	S44700	...	...
32	29Cr-4Mo	Wld. tube	SA-268	29-4	S44700	...	...
33	29Cr-4Mo-2Ni	Bar	SA-479	...	S44800	...	...
34	29Cr-4Mo-2Ni	Plate	SA-240	...	S44800	...	...
35	29Cr-4Mo-2Ni	Smls. tube	SA-268	29-4-2	S44800	...	...
36	29Cr-4Mo-2Ni	Wld. tube	SA-268	29-4-2	S44800	...	...
37	29Cr-4Mo-Ti	Smls. tube	SA-268	...	S44735	...	...
38	29Cr-4Mo-Ti	Wld. tube	SA-268	...	S44735	...	...
39	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	...	...
40	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2	J13005	A	...
41	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2	J13005	B	...
42	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	A	K12021	...	...
43	Mn- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	H75	K12021	...	...
44	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	B	K12022	...	...
45	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	1	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	7	2	415	275	NP	NP	343	343	CS-2	G19
2	7	2	415	205	NP	NP	316	316	CS-2	G19
3	7	2	415	205	427	NP	427	343	CS-2	G19, G24
4	7	2	415	205	427	NP	427	343	CS-2	G19
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	7	2	415	205	NP	NP	316	316	CS-2	G19, G24
8	7	2	415	240	NP	NP	427	NP	CS-2	G19
9	7	2	415	240	NP	NP	427	NP	CS-2	G19, G24
10	7	2	485	275	NP	NP	538	343	CS-2	G19, G22, T4
11	10K	1	585	450	NP	NP	371	343	HA-5	G19
12	10K	1	585	450	NP	371	371	343	HA-5	G19, H5
13	10K	1	585	450	NP	371	NP	NP	HA-5	G19, H5, W12
14	10K	1	585	450	NP	NP	371	343	HA-5	G19, G24
15	10K	1	585	450	NP	NP	316	316	HA-5	G19, G24
16	10I	1	485	275	371	NP	343	343	CS-2	G19
17	10I	1	415	240	NP	NP	343	343	HA-2	G19
18	10I	1	450	275	NP	343	343	343	HA-2	G19
19	10I	1	450	275	NP	NP	343	343	HA-2	G19, G24
20	10I	1	450	275	NP	343	343	343	HA-2	G19
21	10I	1	450	275	NP	371	343	343	HA-2	G19, G22
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	10I	1	470	310	NP	NP	343	343	HA-6	G19
27	10I	1	470	310	NP	NP	343	343	HA-6	G19
28	10I	1	470	310	NP	NP	343	343	HA-6	G19, G24
29	10J	1	485	380	NP	NP	316	316	HA-6	G19, G22
30	10J	1	550	415	NP	NP	316	316	HA-6	G19
31	10J	1	550	415	NP	NP	316	316	HA-6	G19
32	10J	1	550	415	NP	NP	316	316	HA-6	G19, G24
33	10K	1	485	380	NP	NP	316	316	HA-6	G19, G22
34	10K	1	550	415	NP	NP	316	316	HA-6	G19
35	10K	1	550	415	NP	NP	316	316	HA-6	G19
36	10K	1	550	415	NP	NP	316	316	HA-6	G19, G24
37	10J	1	515	415	NP	NP	316	316	HA-6	G19
38	10J	1	515	415	NP	NP	316	316	HA-6	G19, G24
39	...	...	725	450	NP	343	343	343	CS-5	G25, W2, W11
40	3	3	585	365	NP	371 (SPT)	343	343	CS-3	G1
41	3	3	620	450	NP	NP	343	343	CS-5	G1
42	3	2	515	310	538	371	538	343	CS-3	G11, S2, T3
43	3	2	515	310	NP	371	NP	NP	CS-3	S6, W10, W12
44	3	3	550	345	538	371	538	343	CS-3	G11, S2, T3
45	3	3	550	345	NP	371	538	NP	CS-5	G23, T4

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	118	118	118	116	114	112	110	107	105	104	...	...	...	...	...
2	118	118	118	113	108	101	96.6	94.0	93.8	...	...	...	...	...	...
3	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	...
4	118	118	118	113	108	101	96.6	94.0	93.8	93.7	93.0	92.3	91.1	89.8	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	101	101	100	96.5	91.5	85.9	81.9	80.3	79.7	...	...	...	...	...	...
8	118	118	118	116	114	111	109	107	105	104	102	99.7	97.0	93.8	...
9	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	...
10	138	138	138	136	133	130	127	124	123	121	119	116	113	110	91.7
11	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
12	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
13	168	168	168	167	167	165	164	163	162	162	161	...	...	...	...
14	142	142	142	142	142	140	139	139	138	138	137	...	...	...	...
15	142	142	142	142	142	140	139	139	138	...	...	...	...	...	...
16	138	138	138	136	133	130	127	124	123	121	119	...	...	...	...
17	118	118	118	116	114	111	111	111	111	111	...	...	...	...	...
18	128	128	128	127	126	125	125	125	125	125	...	...	...	...	...
19	109	109	109	108	107	106	106	106	106	106	...	...	...	...	...
20	128	128	128	127	126	125	125	125	125	125	...	...	...	...	...
21	128	128	128	127	126	125	125	125	125	125	125	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	134	134	134	134	133	131	130	128	126	124	...	...	...	...	...
27	134	134	134	134	133	131	130	128	126	124	...	...	...	...	...
28	114	114	114	113	113	112	111	109	108	106	...	...	...	...	...
29	138	138	138	135	133	132	132	132	132	...	...	...	...	...	...
30	158	158	157	155	152	151	151	151	151	...	...	...	...	...	...
31	158	158	157	155	152	151	151	151	151	...	...	...	...	...	...
32	134	134	134	132	130	128	128	128	128	...	...	...	...	...	...
33	138	137	135	134	133	132	131	129	128	...	...	...	...	...	...
34	158	156	154	153	152	151	149	147	147	...	...	...	...	...	...
35	158	156	154	153	152	151	149	147	147	...	...	...	...	...	...
36	134	133	131	130	130	128	127	125	124	...	...	...	...	...	...
37	148	146	144	144	143	141	140	139	138	...	...	...	...	...	...
38	125	125	123	122	121	121	119	118	117	...	...	...	...	...	...
39	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
40	168	168	168	168	168	167	167	167	167	166	166	...	...	...	...
41	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
42	148	148	148	148	148	148	148	148	148	148	148	148	148	142	107
43	148	148	148	148	148	148	148	148	148	148	148	...	...	...	...
44	158	158	158	158	158	158	158	158	158	158	158	158	158	143	106
45	158	158	158	158	158	158	158	158	158	158	158	158	158	154	106

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	69.9	53.5	36.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	68.1	43.1	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	68.4	43.0	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	77.2	55.6	32.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	2	...
2	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	3	...
3	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	1	...
4	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	2	...
5	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	3	...
6	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-302	C	K12039	...	...
7	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	1	...
8	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	H80	K12039	...	...
9	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J80	K12539	...	...
10	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	2	...
11	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J90	K12539	...	...
12	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	3	...
13	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J100	K12539	...	...
14	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-302	D	K12054	...	...
15	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	1	...
16	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	1	...
17	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	2	...
18	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	2	...
19	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	3	...
20	Mn- $\frac{1}{2}$ Ni-V	Plate	SA-225	C	K12524	...	...
21	Mn-V	Castings	SA-487	1	J13002	A	...
22	Mn-V	Castings	SA-487	1	J13002	A	...
23	Mn-V	Castings	SA-487	1	J13002	B	...
24	$1\frac{1}{2}$ Si- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P15	K11578	...	...
25	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	A	...
26	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	B	...
27	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	E	...
28	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	1	...
29	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	2	...
30	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	$65 < t \leq 100$
31	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Plate	SA-517	F	K11576	...	≤ 65
32	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	≤ 65
33	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Smls. & wld. tube	SA-423	2	K11540	...	...
34	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Wld. tube	SA-423	2	K11540	...	...
35	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	1	...
36	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	1	...
37	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	2	...
38	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	2	...
39	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	1	...
40	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	2	...
41	$\frac{3}{4}$ Ni-1Mo- $\frac{3}{4}$ Cr	Castings	SA-217	WC5	J22000	...	...
42	1Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC4	J12082	...	...
43	$1\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...	$65 < t \leq 100$
44	$1\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...	≤ 65
45	$1\frac{1}{2}$ Ni	Forgings	SA-350	LF5	K13050	1	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	3	3	620	485	NP	371	427	NP	CS-5	...
2	11A	4	690	570	NP	371	NP	NP	CS-5	...
3	3	3	550	345	NP	371	NP	NP	CS-5	...
4	3	3	620	485	NP	371	427	NP	CS-5	...
5	11A	4	690	570	NP	371	399	343	CS-5	...
6	3	3	550	345	538	371	538	343	CS-3	G11, S2, T3
7	3	3	550	345	NP	371	427	NP	CS-5	G23
8	3	3	550	345	NP	371	NP	NP	CS-3	G26, W10, W12
9	3	3	550	345	NP	371	NP	NP	CS-5	G26, W10, W12
10	3	3	620	485	NP	371	427	NP	CS-5	...
11	3	3	620	485	NP	371	NP	NP	CS-5	G26, W10, W12
12	11A	4	690	570	NP	371	399	343	CS-5	...
13	11A	4	690	570	NP	371	NP	NP	CS-5	G26, W10, W12
14	3	3	550	345	538	371	538	343	CS-3	G11, S2, T3
15	3	3	550	345	NP	371	427	NP	CS-5	G23
16	3	3	550	345	NP	NP	427	NP	CS-5	G23
17	3	3	620	485	NP	371	427	NP	CS-5	...
18	3	3	620	485	NP	NP	427	NP	CS-5	...
19	11A	4	690	570	NP	371	NP	NP	CS-5	...
20	10A	1	725	485	NP	NP	371	343	CS-5	...
21	10A	1	585	380	NP	371 (SPT)	NP	NP	CS-3	...
22	10A	1	585	380	NP	NP	343	343	CS-3	G1
23	10A	1	620	450	NP	NP	343	343	CS-5	G1
24	3	1	415	205	NP	NP	538	343	CS-2	T3
25	3	3	620	415	NP	343	343	343	CS-3	G1
26	11A	3	725	585	NP	NP	371	343	CS-5	G1
27	11A	3	795	655	NP	NP	371	343	CS-5	G1
28	3	3	550	345	NP	371	427	343	CS-5	G23
29	3	3	620	450	NP	371	371	NP	CS-5	...
30	11B	3	725	620	NP	343 (SPT)	343	343	CS-5	S7
31	11B	3	795	690	NP	343 (SPT)	343	343	HT-1	...
32	11B	3	795	690	NP	NP	343	343	HT-1	...
33	4	2	415	255	343	NP	343	NP	CS-2	W13, W14
34	4	2	415	255	343	NP	343	NP	CS-2	G24
35	3	3	550	345	NP	371	427	343	CS-5	G23
36	3	3	550	345	NP	371	427	343	CS-5	G23
37	3	3	620	450	NP	371	371	NP	CS-5	...
38	3	3	620	450	NP	371	371	NP	CS-5	...
39	3	3	550	345	NP	371	427	343	CS-5	G23
40	3	3	620	450	NP	371	371	NP	CS-5	...
41	4	1	485	275	593	371	593	NP	CS-2	G1, G17, T4
42	4	1	485	275	538	371	538	NP	CS-2	G1, G17, T4
43	11B	8	725	620	NP	371 (SPT)	343	343	CS-5	...
44	11B	8	795	690	NP	343 (SPT)	343	343	HT-1	...
45	9A	1	415	205	NP	NP	260	260	CS-2	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
2	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...
3	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
4	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
5	197	197	197	197	197	197	197	197	197	197	197	197	...	...	...
6	158	158	158	158	158	158	158	158	158	158	158	158	158	143	106
7	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
8	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
9	158	158	158	158	158	158	158	158	158	158	158	...	...	...	...
10	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
11	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
12	197	197	197	197	197	197	197	197	197	197	197	197	...	...	...
13	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...
14	158	158	158	158	158	158	158	158	158	158	158	158	158	143	106
15	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
16	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
17	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
18	177	177	177	177	177	177	177	177	177	177	177	177	177	177	...
19	197	197	197	197	197	197	197	197	197	197	197	...	...	...	...
20	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...
21	168	163	158	155	154	154	154	152	150	147	143	...	...	...	...
22	168	163	158	156	155	155	155	153	150	148	...	...	...	...	...
23	177	173	169	168	167	166	166	166	164	160	...	...	...	...	...
24	118	118	118	118	118	118	118	117	115	114	112	110	107	96.9	88.8
25	177	177	177	177	177	177	177	177	177	177	...	...	...	...	...
26	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...
27	227	227	227	227	227	227	227	227	227	227	227	...	...	...	...
28	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
29	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
30	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
31	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
32	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
33	118	118	118	118	118	118	118	118	118	118	...	...	...	...	...
34	101	101	101	101	101	101	101	101	101	101	...	...	...	...	...
35	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
36	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
37	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
38	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
39	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
40	177	177	177	177	177	177	177	177	177	177	177	...	...	...	...
41	138	138	138	138	138	138	138	138	138	138	138	138	138	135	120
42	138	138	138	138	138	138	138	138	138	138	138	138	138	135	113
43	207	207	207	207	207	207	207	207	207	206	202	...	...	...	...
44	227	227	227	227	227	227	227	227	227	226	...	...	...	...	...
45	118	116	113	111	108	106	105	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	68.4	43.0	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	68.4	43.0	23.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	76.4	55.6	32.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	89.3	58.8	39.6	27.4	16.3	...	...	...	...	...	...	...	...	...	...	...	...
42	76.6	49.7	31.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	1½Ni	Forgings	SA-350	LF5	K13050	2	...
2	1¾Ni-¾Cr-Mo	Forgings	SA-372	L	K24055	...	...
3	2Ni-1Cu	Forgings	SA-182	FR	K22035	...	...
4	2Ni-1Cu	Fittings	SA-234	WPR	K22035	...	...
5	2Ni-1Cu	Pipe	SA-333	9	K22035	...	...
6	2Ni-1Cu	Smls. pipe	SA-333	9	K22035	...	...
7	2Ni-1Cu	Wld. pipe	SA-333	9	K22035	...	...
8	2Ni-1Cu	Tube	SA-334	9	K22035	...	...
9	2Ni-1Cu	Forgings	SA-350	LF9	K22036	...	...
10	2Ni-1Cu	Smls. & wld. fittings	SA-420	WPL9	K22035	...	...
(25) 11	2Ni-1½Cr-¼Mo-V	Forgings	SA-372	N	K23550	100	...
12	2Ni-1½Cr-¼Mo-V	Forgings	SA-723	1	K23550	1	...
(25) 13	2Ni-1½Cr-¼Mo-V	Forgings	SA-372	N	K23550	120	...
14	2Ni-1½Cr-¼Mo-V	Forgings	SA-723	1	K23550	2	...
15	2Ni-1½Cr-¼Mo-V	Forgings	SA-723	1	K23550	3	...
16	2Ni-1½Cr-¼Mo-V	Forgings	SA-723	1	K23550	4	...
17	2Ni-1½Cr-¼Mo-V	Forgings	SA-723	1	K23550	5	...
18	2½Ni	Pipe	SA-333	7	K21903	...	...
19	2½Ni	Wld. pipe	SA-333	7	K21903	...	...
20	2½Ni	Tube	SA-334	7	K21903	...	...
21	2½Ni	Wld. tube	SA-334	7	K21903	...	...
22	2½Ni	Plate	SA-203	A	K21703	...	...
23	2½Ni	Plate	SA-203	B	K22103	...	...
24	2½Ni	Castings	SA-352	LC2	J22500	...	...
25	2¾Ni-1½Cr-½Mo	Plate	SA-543	C	...	3	...
26	2¾Ni-1½Cr-½Mo	Plate	SA-543	C	...	1	...
27	2¾Ni-1½Cr-½Mo	Plate	SA-543	C	...	2	...
(25) 28	2¾Ni-1½Cr-½Mo-V	Forgings	SA-372	P	K34035	100	...
29	2¾Ni-1½Cr-½Mo-V	Forgings	SA-723	2	K34035	1	...
(25) 30	2¾Ni-1½Cr-½Mo-V	Forgings	SA-372	P	K34035	120	...
31	2¾Ni-1½Cr-½Mo-V	Forgings	SA-723	2	K34035	2	...
32	2¾Ni-1½Cr-½Mo-V	Forgings	SA-723	2	K34035	3	...
33	2¾Ni-1½Cr-½Mo-V	Forgings	SA-723	2	K34035	4	...
34	2¾Ni-1½Cr-½Mo-V	Forgings	SA-723	2	K34035	5	...
35	3Ni-1¾Cr-½Mo	Plate	SA-543	B	K42339	3	...
36	3Ni-1¾Cr-½Mo	Forgings	SA-372	M	K42365	85	...
37	3Ni-1¾Cr-½Mo	Plate	SA-543	B	K42339	1	...
38	3Ni-1¾Cr-½Mo	Plate	SA-543	B	K42339	2	...
39	3Ni-1¾Cr-½Mo	Forgings	SA-372	M	K42365	100	...
40	3½Ni	Pipe	SA-333	3	K31918	...	...
41	3½Ni	Wld. pipe	SA-333	3	K31918	...	...
42	3½Ni	Tube	SA-334	3	K31918	...	...
43	3½Ni	Wld. tube	SA-334	3	K31918	...	...
44	3½Ni	Fittings	SA-420	WPL3	...	...	...
45	3½Ni	Plate	SA-203	D	K31718	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Applicability and Max. Temperature							External Pressure Chart No.	Notes
			Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits						
					(NP = Not Permitted) (SPT = Supports Only)						
					I	III	VIII-1	XII			
1	9A	1	485	260	NP	NP	260	260	CS-2	...	
2	...	...	1070	930	NP	NP	343	343	...	W11	
3	9A	1	435	315	NP	NP	38	38	CS-3	...	
4	9A	1	435	315	NP	NP	38	NP	CS-3	...	
5	9A	1	435	315	NP	NP	38	38	CS-3	...	
6	9A	1	435	315	NP	38	NP	NP	CS-3	...	
7	9A	1	435	315	NP	NP	38	38	CS-3	G24	
8	9A	1	435	315	NP	NP	38	38	CS-3	...	
9	9A	1	435	315	NP	NP	38	38	CS-3	...	
10	9A	1	435	315	NP	38	38	38	CS-3	W14	
11	...	...	795	690	NP	NP	343	NP	HT-1	W1	
12	...	...	795	690	NP	371 (SPT)	NP	NP	HT-1	W1	
13	...	...	930	825	NP	NP	343	NP	HT-1	W1	
14	...	...	930	825	NP	371 (SPT)	NP	NP	HT-1	W1	
15	...	...	1070	965	NP	371 (SPT)	NP	NP	HT-1	W1	
16	...	...	1205	1105	NP	371 (SPT)	NP	NP	HT-1	W1	
17	...	...	1310	1240	NP	371 (SPT)	NP	NP	HT-1	W1	
18	9A	1	450	240	NP	NP	343	343	CS-2	...	
19	9A	1	450	240	NP	NP	343	343	CS-2	G24	
20	9A	1	450	240	NP	NP	343	343	CS-2	...	
21	9A	1	450	240	NP	NP	343	343	CS-2	G24	
22	9A	1	450	255	NP	371	538	343	CS-2	T2	
23	9A	1	485	275	NP	343	538	343	CS-2	T2	
24	9A	1	485	275	NP	38	343	343	CS-2	G1	
25	3	3	620	485	NP	NP	343	NP	CS-5	...	
26	11A	5	725	585	NP	NP	343	NP	CS-5	...	
27	11B	10	795	690	NP	NP	343	NP	HT-1	...	
28	...	...	795	690	NP	NP	343	NP	HT-1	W1	
29	...	...	795	690	NP	371 (SPT)	NP	NP	HT-1	W1	
30	...	...	930	825	NP	NP	343	NP	HT-1	W1	
31	...	...	930	825	NP	371 (SPT)	NP	NP	HT-1	W1	
32	...	...	1070	965	NP	371 (SPT)	NP	NP	HT-1	W1	
33	...	...	1205	1105	NP	371 (SPT)	NP	NP	HT-1	W1	
34	...	...	1310	1240	NP	371 (SPT)	NP	NP	HT-1	W1	
35	3	3	620	485	NP	NP	343	NP	CS-5	...	
36	...	...	725	585	NP	NP	343	343	...	W11	
37	11A	5	725	585	NP	NP	343	NP	CS-5	...	
38	11B	10	795	690	NP	NP	343	NP	HT-1	...	
39	...	...	825	690	NP	NP	343	343	...	W11	
40	9B	1	450	240	NP	NP	343	343	CS-2	...	
41	9B	1	450	240	NP	NP	343	343	CS-2	G24	
42	9B	1	450	240	NP	NP	343	343	CS-2	...	
43	9B	1	450	240	NP	NP	343	343	CS-2	G24	
44	9B	1	450	240	NP	NP	343	343	CS-2	...	
45	9B	1	450	255	NP	371	538	343	CS-2	T2	

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	135	132	129	126	123	123	...	...	...	...	...	...	...	...
2	305	305	305	305	305	305	305	305	302	294	...	...	...	...	...
3	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	123	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	105	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	227	227	227	227	227	227	227	227	226	222	...	...	...	...	...
12	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
13	266	266	266	266	266	266	266	266	265	261	...	...	...	...	...
14	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
15	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
16	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
17	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...
18	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
19	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
20	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
21	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
22	128	128	128	128	128	128	128	128	126	120	112	95.1	79.6	64.8	49.1
23	138	138	138	138	138	138	138	138	136	129	122	101	83.8	67.3	49.4
24	138	138	138	138	138	138	138	138	136	129	...	...	...	...	...
25	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
26	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
27	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
28	227	227	227	227	227	227	227	227	226	222	...	...	...	...	...
29	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
30	266	266	266	266	266	266	266	266	265	261	...	...	...	...	...
31	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
32	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
33	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
34	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...
35	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
36	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
37	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
38	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
39	236	236	236	236	236	234	233	231	229	226	...	...	...	...	...
40	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
41	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
42	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
43	109	109	109	109	109	109	109	105	101	96.7	...	...	...	...	...
44	128	128	128	128	128	128	128	124	119	114	...	...	...	...	...
45	128	128	128	128	128	128	128	128	126	120	112	95.1	79.6	64.8	49.1

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	35.8	23.7	11.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	35.6	23.7	11.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	35.8	23.7	11.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	3½Ni	Forgings	SA-350	LF3	K32025	1	...
2	3½Ni	Forgings	SA-350	LF3	K32025	2	...
3	3½Ni	Forgings	SA-765	III	K32026	...	...
4	3½Ni	Plate	SA-203	E	K32018	...	...
5	3½Ni	Plate	SA-203	E	K32018	...	...
6	3½Ni	Castings	SA-352	LC3	J31550	...	...
7	3½Ni	Plate	SA-203	F	...	...	>50
8	3½Ni	Plate	SA-203	F	...	...	≤50
9	3½Ni-1¾Cr-½Mo-V	Forgings	SA-508	4N	K22375	3	...
10	3½Ni-1¾Cr-½Mo-V	Forgings	SA-508	4N	K22375	1	...
11	3½Ni-1¾Cr-½Mo-V	Forgings	SA-508	4N	K22375	2	...
12	4Ni-1½Cr-½Mo-V	Forgings	SA-723	3	K44045	1	...
13	4Ni-1½Cr-½Mo-V	Forgings	SA-723	3	K44045	2	...
14	4Ni-1½Cr-½Mo-V	Forgings	SA-723	3	K44045	3	...
15	4Ni-1½Cr-½Mo-V	Forgings	SA-723	3	K44045	4	...
16	4Ni-1½Cr-½Mo-V	Forgings	SA-723	3	K44045	5	...
17	5Ni-¼Mo	Plate	SA-645	A	K41583	...	...
18	7Ni	Plate	SA-553	III	K61365	...	≤50
19	7Ni	Plate	SA-553	III	K61365	...	≤50
20	8Ni	Forgings	SA-522	II	K71340	...	...
21	8Ni	Plate	SA-553	II	K71340	...	...
22	8Ni	Plate	SA-553	II	K71340	...	...
23	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	NNT640	≤50
24	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	QT640	≤50
25	9Ni	Plate	SA/EN 10028-4	X7Ni9	...	QT	≤50
26	9Ni	Plate	SA/EN 10028-4	X7Ni9	...	QT	≤50
27	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	QT680	≤50
28	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	QT680	≤50
29	9Ni	Smls. & wld. pipe	SA-333	8	K81340	...	...
30	9Ni	Smls. & wld. pipe	SA-333	8	K81340	...	...
31	9Ni	Smls. pipe	SA-333	8	K81340	...	...
32	9Ni	Smls. pipe	SA-333	8	K81340	...	...
33	9Ni	Wld. pipe	SA-333	8	K81340	...	...
34	9Ni	Wld. tube	SA-334	8	K81340	...	...
35	9Ni	Smls. & wld. tube	SA-334	8	K81340	...	...
36	9Ni	Smls. tube	SA-334	8	K81340	...	...
37	9Ni	Smls. tube	SA-334	8	K81340	...	...
38	9Ni	Wld. tube	SA-334	8	K81340	...	...
39	9Ni	Plate	SA-353	...	K81340	...	...
40	9Ni	Plate	SA-353	...	K81340	...	...
41	9Ni	Plate	SA-353	...	K81340	...	...
42	9Ni	Smls. & wld. fittings	SA-420	WPL8	K81340	...	...
43	9Ni	Smls. & wld. fittings	SA-420	WPL8	K81340	...	...
44	9Ni	Forgings	SA-522	I	K81340	...	...
45	9Ni	Forgings	SA-522	I	K81340	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	9B	1	485	260	NP	343	343	343	CS-2	...
2	9B	1	485	260	NP	343	343	343	CS-2	...
3	9B	1	485	260	NP	NP	343	343	CS-2	...
4	9B	1	485	275	NP	149 (SPT)	NP	NP	CS-2	...
5	9B	1	485	275	NP	343	538	343	CS-2	T2
6	9B	1	485	275	NP	38	343	343	CS-2	G1
7	9B	1	515	345	NP	NP	343	343	CS-3	...
8	9B	1	550	380	NP	NP	343	343	CS-3	...
9	3	3	620	485	NP	NP	343	343	CS-5	...
10	11A	5	725	585	NP	316 (SPT)	343	NP	CS-5	...
11	11B	10	795	690	NP	NP	343	NP	HT-1	...
12	...	...	795	690	NP	371 (SPT)	NP	NP	HT-1	W1
13	...	...	930	825	NP	371 (SPT)	NP	NP	HT-1	W1
14	...	...	1070	965	NP	371 (SPT)	NP	NP	HT-1	W1
15	...	...	1205	1105	NP	371 (SPT)	NP	NP	HT-1	W1
16	...	...	1310	1240	NP	371 (SPT)	NP	NP	HT-1	W1
17	11A	2	655	450	NP	NP	121	121	CS-3	...
18	11A	1	690	585	NP	NP	66	NP	CS-3	G20, G33, W4
19	11A	1	690	585	NP	NP	66	NP	CS-3	G20, G33, W5
20	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W5
21	11A	1	690	585	NP	93 (Cl. 3 only)	121	121	CS-3	G20, W5
22	11A	1	690	585	NP	93 (Cl. 3 only)	121	121	CS-3	G20, W4
23	11A	1	640	480	NP	NP	121	121	CS-3	G20
24	11A	1	640	480	NP	NP	121	121	CS-3	G20
25	11A	1	680	575	NP	NP	121	121	CS-3	G20, W4
26	11A	1	680	575	NP	NP	121	121	CS-3	G20, W5
27	11A	1	680	575	NP	NP	121	121	CS-3	G20, W4
28	11A	1	680	575	NP	NP	121	121	CS-3	G20, W5
29	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W12
30	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W5, W12
31	11A	1	690	515	NP	NP	121	121	CS-3	G20, W4
32	11A	1	690	515	NP	NP	121	121	CS-3	G20, W5
33	11A	1	690	515	NP	NP	121	121	CS-3	G20, G24, W3
34	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W12
35	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W5, W12
36	11A	1	690	515	NP	NP	121	121	CS-3	G20, W4
37	11A	1	690	515	NP	NP	121	121	CS-3	G20, W5
38	11A	1	690	515	NP	NP	121	121	CS-3	G20, G24, W3
39	11A	1	690	515	NP	93 (Cl. 3 only)	121	121	CS-3	G20, W4
40	11A	1	690	515	NP	NP	121	121	CS-3	G20, W5
41	11A	1	690	515	NP	93 (Cl. 3 only)	NP	NP	CS-3	G20, W5
42	11A	1	690	515	NP	NP	121	121	CS-3	G20, W4
43	11A	1	690	515	NP	NP	121	121	CS-3	G20, W3
44	11A	1	690	515	NP	93 (Cl. 3 only)	121	121	CS-3	G20, S8, W4
45	11A	1	690	515	NP	NP	121	121	CS-3	G20, S8, W5

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
2	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
3	138	138	138	138	138	138	138	133	128	122	...	...	...	...	...
4	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...
5	138	138	138	138	138	138	138	138	136	129	122	101	83.8	67.3	49.4
6	138	138	138	138	138	138	138	138	136	129	...	...	...	...	...
7	148	148	148	148	148	148	148	148	146	140	...	...	...	...	...
8	158	158	158	158	158	158	158	158	152	137	...	...	...	...	...
9	177	177	177	177	177	176	175	173	172	169	...	...	...	...	...
10	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...
11	227	227	227	227	227	224	223	221	219	217	...	...	...	...	...
12	227	227	227	227	227	227	227	227	226	222	217	...	...	...	...
13	266	266	266	266	266	266	266	266	265	261	255	...	...	...	...
14	305	305	305	305	305	305	305	305	305	299	293	...	...	...	...
15	345	345	345	345	345	345	345	345	343	337	330	...	...	...	...
16	374	374	374	374	374	374	374	374	373	367	359	...	...	...	...
17	187	187	186	183	...	...	...	...	...	...	...	...	...	...	...
18	197	197	...	...	...	...	...	...	...	...	...	...	...	...	...
19	187	187	...	...	...	...	...	...	...	...	...	...	...	...	...
20	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
21	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
22	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
23	183	183	183	183	...	...	...	...	...	...	...	...	...	...	...
24	183	183	183	183	...	...	...	...	...	...	...	...	...	...	...
25	194	194	194	194	...	...	...	...	...	...	...	...	...	...	...
26	187	187	187	187	...	...	...	...	...	...	...	...	...	...	...
27	194	194	194	194	...	...	...	...	...	...	...	...	...	...	...
28	187	187	187	187	...	...	...	...	...	...	...	...	...	...	...
29	197	197	182	...	...	...	...	...	...	...	...	...	...	...	...
30	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
31	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
32	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
33	168	168	155	152	...	...	...	...	...	...	...	...	...	...	...
34	197	197	182	...	...	...	...	...	...	...	...	...	...	...	...
35	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
36	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
37	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
38	168	168	155	152	...	...	...	...	...	...	...	...	...	...	...
39	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
40	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
41	187	187	173	...	...	...	...	...	...	...	...	...	...	...	...
42	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
43	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
44	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
45	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	35.6	23.7	11.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	9Ni	Plate	SA-553	I	K81340	...	...
2	9Ni	Plate	SA-553	I	K81340	...	...
(25) 3	46Fe-24Ni-21Cr-6Mo-N	Smls. & wld. fittings	SA-403	...	N08367	...	...
(25) 4	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-182	F62	N08367	...	...
(25) 5	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-182	F62	N08367	...	...
(25) 6	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-965	F62	N08367	...	...
(25) 7	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-965	F62	N08367	...	...
(25) 8	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...	>5
(25) 9	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...	>5
(25) 10	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe	SA-312	...	N08367	...	>5
(25) 11	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe	SA-312	...	N08367	...	>5
(25) 12	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...	>5
(25) 13	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...	>5
(25) 14	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...	>5
(25) 15	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...	>5
(25) 16	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-688	...	N08367	...	>5
(25) 17	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-688	...	N08367	...	>5
(25) 18	46Fe-24Ni-21Cr-6Mo-N	Plate	SA-240	...	N08367	...	≥5
(25) 19	46Fe-24Ni-21Cr-6Mo-N	Plate	SA-240	...	N08367	...	≥5
(25) 20	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...	>5
(25) 21	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...	>5
(25) 22	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-276	...	N08367	...	...
(25) 23	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-276	...	N08367	...	...
(25) 24	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-479	...	N08367	...	...
(25) 25	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-479	...	N08367	...	...
(25) 26	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...	≤5
(25) 27	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...	≤5
(25) 28	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe	SA-312	...	N08367	...	≤5
(25) 29	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe	SA-312	...	N08367	...	≤5
(25) 30	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...	≤5
(25) 31	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...	≤5
(25) 32	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...	≤5
(25) 33	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...	≤5
(25) 34	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-688	...	N08367	...	≤5
(25) 35	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-688	...	N08367	...	≤5
(25) 36	46Fe-24Ni-21Cr-6Mo-N	Sheet, strip	SA-240	...	N08367	...	<5
(25) 37	46Fe-24Ni-21Cr-6Mo-N	Sheet, strip	SA-240	...	N08367	...	<5
(25) 38	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...	≤5
(25) 39	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...	≤5
(25) 40	25Ni-47Fe-21Cr-5Mo	Forgings	SA-182	F700	N08700	...	...
(25) 41	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SA-240	...	N08700	...	...
(25) 42	25Ni-47Fe-21Cr-5Mo	Bar	SA-276	...	N08700	...	...
(25) 43	25Ni-47Fe-21Cr-5Mo	Wld. pipe	SA-358	...	N08700	...	...
(25) 44	25Ni-47Fe-21Cr-5Mo	Fittings	SA-403	700	N08700	...	...
(25) 45	25Ni-47Fe-21Cr-5Mo	Bar	SA-479	...	N08700	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	11A	1	690	585	NP	93 (Cl. 3 only)	121	121	CS-3	G20, W4
2	11A	1	690	585	NP	93 (Cl. 3 only)	121	121	CS-3	G20, W5
3	45	...	655	310	NP	427	427	NP	NFN-12	G5, W12, W14
4	45	...	655	310	NP	427	427	343	NFN-12	...
5	45	...	655	310	NP	427	427	343	NFN-12	G5
6	45	...	655	310	NP	427	427	343	NFN-12	...
7	45	...	655	310	NP	427	427	343	NFN-12	G5
8	45	...	655	310	NP	427	427	343	NFN-12	G24
9	45	...	655	310	NP	427	427	343	NFN-12	G5, G24
10	45	...	655	310	NP	427	427	343	NFN-12	...
11	45	...	655	310	NP	427	427	343	NFN-12	G5
12	45	...	655	310	NP	427	427	343	NFN-12	G24
13	45	...	655	310	NP	427	427	343	NFN-12	G5, G24
14	45	...	655	310	NP	427	427	343	NFN-12	G24
15	45	...	655	310	NP	427	427	343	NFN-12	G5, G24
16	45	...	655	310	NP	427	427	343	NFN-12	...
17	45	...	655	310	NP	427	427	343	NFN-12	G5
18	45	...	655	310	NP	427	427	343	NFN-12	...
19	45	...	655	310	NP	427	427	343	NFN-12	G5
20	45	...	655	310	NP	427	427	343	NFN-12	...
21	45	...	655	310	NP	427	427	343	NFN-12	G5
22	45	...	655	310	NP	427	427	343	NFN-12	...
23	45	...	655	310	NP	427	427	343	NFN-12	G5
24	45	...	655	310	NP	427	427	343	NFN-12	...
25	45	...	655	310	NP	427	427	343	NFN-12	G5
26	45	...	690	310	NP	427	427	343	NFN-12	G24
27	45	...	690	310	NP	427	427	343	NFN-12	G5, G24
28	45	...	690	310	NP	427	427	343	NFN-12	...
29	45	...	690	310	NP	427	427	343	NFN-12	G5
30	45	...	690	310	NP	427	427	343	NFN-12	G24
31	45	...	690	310	NP	427	427	343	NFN-12	G5, G24
32	45	...	690	310	NP	427	427	343	NFN-12	G24
33	45	...	690	310	NP	427	427	343	NFN-12	G5, G24
34	45	...	690	310	NP	427	427	343	NFN-12	...
35	45	...	690	310	NP	427	427	343	NFN-12	G5
36	45	...	690	310	NP	427	427	343	NFN-12	...
37	45	...	690	310	NP	427	427	343	NFN-12	G5
38	45	...	690	310	NP	427	427	343	NFN-12	...
39	45	...	690	310	NP	427	427	343	NFN-12	G5
40	45	...	550	240	NP	NP	343	343	NFN-8	...
41	45	...	550	240	NP	NP	343	343	NFN-8	...
42	45	...	550	240	NP	NP	343	343	NFN-8	...
43	45	...	550	240	NP	NP	343	343	NFN-8	W14
44	45	...	550	240	NP	NP	343	343	NFN-8	W14
45	45	...	550	240	NP	NP	343	343	NFN-8	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	197	197	182	178	...	...	...	...	...	...	...	...	...	...	...
2	187	187	173	169	...	...	...	...	...	...	...	...	...	...	...
3	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
4	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
5	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
6	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
7	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
8	159	157	152	145	139	130	121	115	113	110	109	107	106	104	...
9	159	159	159	155	150	144	140	137	136	135	134	134	132	131	...
10	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
11	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
12	159	157	152	145	139	130	121	115	113	110	109	107	106	104	...
13	159	159	159	155	150	144	140	137	136	135	134	134	132	131	...
14	159	157	152	145	139	130	121	115	113	110	109	107	106	104	...
15	159	159	159	155	150	144	140	137	136	135	134	134	132	131	...
16	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
17	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
18	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
19	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
20	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
21	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
22	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
23	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
24	187	185	179	172	164	152	143	136	133	130	128	126	124	122	...
25	187	187	186	182	177	170	165	161	160	159	158	157	156	155	...
26	168	160	151	145	139	130	121	115	113	110	109	107	106	104	...
27	168	168	167	163	158	152	148	144	143	142	141	141	139	138	...
28	197	189	179	171	164	152	143	136	133	130	128	126	124	122	...
29	197	197	197	192	186	178	173	170	168	167	166	166	164	163	...
30	168	160	151	145	139	130	121	115	113	110	109	107	106	104	...
31	168	168	167	163	158	152	148	144	143	142	141	141	139	138	...
32	168	160	151	145	139	130	121	115	113	110	109	107	106	104	...
33	168	168	167	163	158	152	148	144	143	142	141	141	139	138	...
34	197	189	179	171	164	152	143	136	133	130	128	126	124	122	...
35	197	197	197	192	186	178	173	170	168	167	166	166	164	163	...
36	197	189	179	171	164	152	143	136	133	130	128	126	124	122	...
37	197	197	197	192	186	178	173	170	168	167	166	166	164	163	...
38	197	189	179	171	164	152	143	136	133	130	128	126	124	122	...
39	197	197	197	192	186	178	173	170	168	167	166	166	164	163	...
40	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
41	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
42	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
43	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
44	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
45	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25)	1	25Ni-47Fe-21Cr-5Mo	Forgings	SA-965	F700	N08700	...
	2	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660	S66286	...
(25)	3	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SA-240	...	N08925	...
(25)	4	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SA-240	...	N08925	...
(25)	5	25Ni-20Cr-6Mo-Cu-N	Bar	SA-276	...	N08925	...
(25)	6	25Ni-20Cr-6Mo-Cu-N	Bar	SA-276	...	N08925	...
(25)	7	25Ni-20Cr-6Mo-Cu-N	Bar	SA-479	...	N08925	...
(25)	8	25Ni-20Cr-6Mo-Cu-N	Bar	SA-479	...	N08925	...
(25)	9	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SA-312	...	N08925	...
(25)	10	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SA-312	...	N08925	...
(25)	11	25Ni-20Cr-6Mo-Cu-N	Smls. pipe	SA-312	...	N08925	...
(25)	12	25Ni-20Cr-6Mo-Cu-N	Smls. pipe	SA-312	...	N08925	...
(25)	13	25Ni-20Cr-6Mo-Cu-N	Smls. tube	SA-213	...	N08925	...
(25)	14	25Ni-20Cr-6Mo-Cu-N	Smls. tube	SA-213	...	N08925	...
(25)	15	44Fe-25Ni-21Cr-Mo	Forgings	SA-182	F904L	N08904	...
(25)	16	44Fe-25Ni-21Cr-Mo	Smls. tube	SA-213	...	N08904	...
(25)	17	44Fe-25Ni-21Cr-Mo	Plate, sheet, strip	SA-240	904L	N08904	...
(25)	18	44Fe-25Ni-21Cr-Mo	Wld. tube	SA-249	...	N08904	...
(25)	19	44Fe-25Ni-21Cr-Mo	Smls. pipe	SA-312	...	N08904	...
(25)	20	44Fe-25Ni-21Cr-Mo	Wld. pipe	SA-312	...	N08904	...
(25)	21	44Fe-25Ni-21Cr-Mo	Fittings	SA-403	WP904L/CR904L	N08904	...
(25)	22	44Fe-25Ni-21Cr-Mo	Bar	SA-479	904L	N08904	...
	23	27Ni-22Cr-7Mo-Mn-Cu-N	Smls. tube	SA-213	...	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	Plate	SA-240	...	S31277	...
(25)	27	27Ni-22Cr-7Mo-Mn-Cu-N	Wld. tube	SA-249	...	S31277	...
	28	27Ni-22Cr-7Mo-Mn-Cu-N	Wld. tube	SA-249	...	S31277	...
	29	29Ni-20Cr-3Cu-2Mo	Castings	SA-351	CN7M	J95150	...
	30	29Ni-20Cr-3Cu-2Mo	Castings	SA-351	CN7M	J95150	...
(25)	31	35Ni-35Fe-20Cr-Cb	Forgings	SA-182	F20	N08020	...
(25)	32	35Ni-35Fe-20Cr-Cb	Forgings	SA-182	F20	N08020	...
(25)	33	35Ni-35Fe-20Cr-Cb	Forgings	SA-965	F20	N08020	...
(25)	34	35Ni-35Fe-20Cr-Cb	Forgings	SA-965	F20	N08020	...
(25)	35	35Ni-35Fe-20Cr-Cb	Plate	SA-240	...	N08020	...
(25)	36	35Ni-35Fe-20Cr-Cb	Plate	SA-240	...	N08020	...
(25)	37	35Ni-35Fe-20Cr-Cb	Bar	SA-276	Alloy 20	N08020	...
(25)	38	35Ni-35Fe-20Cr-Cb	Bar	SA-276	Alloy 20	N08020	...
(25)	39	35Ni-35Fe-20Cr-Cb	Bar	SA-479	Alloy 20	N08020	...
(25)	40	35Ni-35Fe-20Cr-Cb	Bar	SA-479	Alloy 20	N08020	...
(25)	41	35Ni-35Fe-20Cr-Cb	Smls. pipe	SA-312	Alloy 20	N08020	...
(25)	42	35Ni-35Fe-20Cr-Cb	Smls. pipe	SA-312	Alloy 20	N08020	...
(25)	43	35Ni-35Fe-20Cr-Cb	Wld. pipe	SA-312	Alloy 20	N08020	...
(25)	44	35Ni-35Fe-20Cr-Cb	Wld. pipe	SA-312	Alloy 20	N08020	...
(25)	45	35Ni-35Fe-20Cr-Cb	Wld. pipe	SA-312	Alloy 20	N08020	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	45	...	550	240	NP	NP	343	343	NFN-8	...
2	...	...	895	585	NP	371	371	NP	HA-5	W1
3	45	...	600	295	NP	NP	427	343	NFN-12	...
4	45	...	600	295	NP	NP	427	343	NFN-12	G5
5	45	...	600	295	NP	NP	427	343	NFN-12	...
6	45	...	600	295	NP	NP	427	343	NFN-12	G5
7	45	...	600	295	NP	NP	427	343	NFN-12	...
8	45	...	600	295	NP	NP	427	343	NFN-12	G5
9	45	...	600	295	NP	NP	427	343	NFN-12	G24
10	45	...	600	295	NP	NP	427	343	NFN-12	G5, G24
11	45	...	600	295	NP	NP	427	343	NFN-12	...
12	45	...	600	295	NP	NP	427	343	NFN-12	G5
13	45	...	600	295	NP	NP	427	343	NFN-12	...
14	45	...	600	295	NP	NP	427	343	NFN-12	G5
15	45	...	490	215	NP	371	371	343	NFN-9	W14
16	45	...	490	215	NP	371	371	343	NFN-9	...
17	45	...	490	215	NP	371	371	343	NFN-9	...
18	45	...	490	215	NP	371	371	343	NFN-9	G24
19	45	...	490	215	NP	371	371	343	NFN-9	...
20	45	...	490	215	NP	371	371	343	NFN-9	G24
21	45	...	490	215	NP	371	371	343	NFN-9	W14
22	45	...	490	215	NP	371	371	343	NFN-9	...
23	45	...	772	359	NP	NP	427	NP	NFN-26	G5
24	45	...	772	359	NP	NP	427	NP	NFN-26	...
25	45	...	772	359	NP	NP	427	NP	NFN-26	G5
26	45	...	772	359	NP	NP	427	NP	NFN-26	...
27	45	...	772	359	NP	NP	427	NP	NFN-26	G5, G24
28	45	...	772	359	NP	NP	427	NP	NFN-26	...
29	45	...	425	170	316	316 (Cl. 3 only)	316	NP	NFN-9	G1, G5
30	45	...	425	170	316		NP	316	NP	NFN-9
31	45	...	550	240	NP	427	427	343	NFN-12	G5
32	45	...	550	240	NP	NP	427	343	NFN-12	...
33	45	...	550	240	NP	427	427	343	NFN-12	G5
34	45	...	550	240	NP	NP	427	343	NFN-12	...
35	45	...	550	240	NP	NP	427	343	NFN-12	...
36	45	...	550	240	NP	427	427	343	NFN-12	G5
37	45	...	550	240	NP	427	427	343	NFN-12	G5
38	45	...	550	240	NP	NP	427	343	NFN-12	...
39	45	...	550	240	NP	427	427	343	NFN-12	G5
40	45	...	550	240	NP	NP	427	343	NFN-12	...
41	45	...	550	240	NP	NP	427	343	NFN-12	...
42	45	...	550	240	NP	NP	427	343	NFN-12	G5
43	45	...	550	240	NP	427	NP	NP	NFN-12	G5, W12
44	45	...	550	240	NP	NP	427	343	NFN-12	G24
45	45	...	550	240	NP	NP	427	343	NFN-12	G5, G24

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	158	152	143	137	131	123	118	116	112	108	...	...	...	...	...
2	256	256	256	256	256	256	253	248	246	243	241	...	...	...	...
3	172	166	158	152	147	137	128	121	118	117	117	117	117	117	...
4	172	172	171	168	165	159	153	149	147	145	143	141	139	137	...
5	172	166	158	152	147	137	128	121	118	117	117	117	117	117	...
6	172	172	171	168	165	159	153	149	147	145	143	141	139	137	...
7	172	166	158	152	147	137	128	121	118	117	117	117	117	117	...
8	172	172	171	168	165	159	153	149	147	145	143	141	139	137	...
9	145	141	135	129	125	117	109	103	101	99.3	99.3	99.3	99.3	99.3	...
10	145	145	145	143	141	135	130	127	125	123	122	120	117	115	...
11	172	166	158	152	147	137	128	121	118	117	117	117	117	117	...
12	172	172	171	168	165	159	153	149	147	145	143	141	139	137	...
13	172	166	158	152	147	137	128	121	118	117	117	117	117	117	...
14	172	172	171	168	165	159	153	149	147	145	143	141	139	137	...
15	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
16	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
17	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
18	119	107	96.3	91.9	88.8	82.0	75.6	70.7	69.1	67.9	66.7	...	...	...	...
19	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
20	119	107	96.3	91.9	88.8	82.0	75.6	70.7	69.1	67.9	66.7	...	...	...	...
21	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
22	140	126	113	108	104	95.8	88.8	83.4	81.3	79.6	78.4	...	...	...	...
23	221	221	220	...	212	203	197	191	189	186	185	183	181	181	...
24	221	221	219	...	198	184	177	175	175	175	175	173	172	172	...
25	221	221	220	...	212	203	197	191	189	186	185	183	181	181	...
26	221	221	219	...	198	184	177	175	175	175	175	173	172	172	...
27	188	188	187	...	180	173	167	162	160	158	157	155	154	154	...
28	188	188	186	...	169	156	150	149	149	149	149	147	146	146	...
29	115	114	109	101	93.5	88.5	84.3	80.9	79.4	...	...	...	...	...	...
30	115	107	97.7	92.8	88.8	81.9	75.6	70.4	68.0	...	...	...	...	...	...
31	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
32	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
33	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
34	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
35	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
36	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
37	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
38	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
39	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
40	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
41	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
42	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
43	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
44	134	127	120	117	115	111	108	104	103	103	102	101	98.7	96.9	...
45	134	134	134	133	132	130	130	130	129	129	128	128	128	128	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	35Ni-35Fe-20Cr-Cb	Smls. tube	SA-213	Alloy 20	N08020	...	...
(25) 2	35Ni-35Fe-20Cr-Cb	Smls. tube	SA-213	Alloy 20	N08020	...	...
(25) 3	35Ni-35Fe-20Cr-Cb	Wld. tube	SA-249	Alloy 20	N08020	...	...
(25) 4	35Ni-35Fe-20Cr-Cb	Wld. tube	SA-249	Alloy 20	N08020	...	...
(25) 5	35Ni-35Fe-20Cr-Cb	Wld. tube	SA-249	Alloy 20	N08020	...	...
(25) 6	35Ni-35Fe-20Cr-Cb	Smls. & wld. fittings	SA-403	...	N08020	...	...
(25) 7	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10	N08810	...	...
(25) 8	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10	N08810	...	...
(25) 9	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H	N08810	...	...
(25) 10	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H	N08810	...	...
(25) 11	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...	...
(25) 12	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...	...
(25) 13	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H	N08810	...	...
(25) 14	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H	N08810	...	...
(25) 15	42Fe-33Ni-21Cr	Bar	SA-276	800H	N08810	...	...
(25) 16	42Fe-33Ni-21Cr	Bar	SA-276	800H	N08810	...	...
(25) 17	42Fe-33Ni-21Cr	Smls. & wld. pipe	SA-312	800H	N08810	...	...
(25) 18	42Fe-33Ni-21Cr	Smls. & wld. pipe	SA-312	800H	N08810	...	...
(25) 19	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H	N08810	...	...
(25) 20	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H	N08810	...	...
(25) 21	42Fe-33Ni-21Cr	Bar	SA-479	800H	N08810	...	...
(25) 22	42Fe-33Ni-21Cr	Bar	SA-479	800H	N08810	...	...
(25) 23	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H	N08810	...	...
(25) 24	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H	N08810	...	...
(25) 25	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10	N08810	...	...
(25) 26	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10	N08810	...	...
(25) 27	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11	N08811	...	...
(25) 28	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11	N08811	...	...
(25) 29	42Fe-33Ni-21Cr	Smls. tube	SA-213	...	N08811	...	...
(25) 30	42Fe-33Ni-21Cr	Smls. tube	SA-213	...	N08811	...	...
(25) 31	42Fe-33Ni-21Cr	Plate	SA-240	...	N08811	...	...
(25) 32	42Fe-33Ni-21Cr	Plate	SA-240	...	N08811	...	...
(25) 33	42Fe-33Ni-21Cr	Wld. tube	SA-249	...	N08811	...	...
(25) 34	42Fe-33Ni-21Cr	Wld. tube	SA-249	...	N08811	...	...
(25) 35	42Fe-33Ni-21Cr	Bar	SA-276	...	N08811	...	...
(25) 36	42Fe-33Ni-21Cr	Bar	SA-276	...	N08811	...	...
(25) 37	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...	N08811	...	...
(25) 38	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...	N08811	...	...
(25) 39	42Fe-33Ni-21Cr	Bar	SA-479	...	N08811	...	...
(25) 40	42Fe-33Ni-21Cr	Bar	SA-479	...	N08811	...	...
(25) 41	42Fe-33Ni-21Cr	Wld. tube	SA-688	...	N08811	...	...
(25) 42	42Fe-33Ni-21Cr	Wld. tube	SA-688	...	N08811	...	...
(25) 43	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11	N08811	...	...
(25) 44	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11	N08811	...	...
(25) 45	14Cr-16Ni-6Si-Cu-Mo	Smls. tube	SA-213	...	S38815	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	45	...	550	240	NP	NP	427	343	NFN-12	...
2	45	...	550	240	NP	NP	427	343	NFN-12	G5
3	45	...	550	240	NP	427	NP	NP	NFN-12	G5, W12
4	45	...	550	240	NP	NP	427	343	NFN-12	G24
5	45	...	550	240	NP	NP	427	343	NFN-12	G5, G24
6	45	...	585	275	NP	427	427	343	NFN-12	G5, W12, W14
7	45	...	450	170	816	NP	899	NP	NFN-9	G6, T9
8	45	...	450	170	816	427	899	NP	NFN-9	G5, G6, T8
9	45	...	450	170	NP	NP	899	NP	NFN-9	G6, T9
10	45	...	450	170	NP	427	899	NP	NFN-9	G5, G6, T8
11	45	...	450	170	816	NP	899	NP	NFN-9	G6, T9
12	45	...	450	170	816	427	899	NP	NFN-9	G5, G6, T8
13	45	...	450	170	816	NP	899	NP	NFN-9	G6, G24, T9
14	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, G24, T8
15	45	...	450	170	816	NP	899	NP	NFN-9	G6, T9
16	45	...	450	170	816	427	899	NP	NFN-9	G5, G6, T8
17	45	...	450	170	816	NP	982	NP	NFN-9	G6, T9, W5, W12
18	45	...	450	170	816	427	982	NP	NFN-9	G5, G6, T8, W5, W12
19	45	...	450	170	NP	NP	899	NP	NFN-9	G6, G24, T9
20	45	...	450	170	NP	NP	899	NP	NFN-9	G5, G6, G24, T8
21	45	...	450	170	816	NP	899	NP	NFN-9	G6, T9
22	45	...	450	170	816	427	899	NP	NFN-9	G5, G6, T8
23	45	...	450	170	816	NP	899	NP	NFN-9	G6, G24, T9
24	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, G24, T8
25	45	...	450	170	816	NP	899	NP	NFN-9	G6, T9
26	45	...	450	170	816	427	899	NP	NFN-9	G5, G6, T8
27	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
28	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
29	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
30	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
31	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
32	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
33	45	...	450	170	816	NP	899	NP	NFN-9	G6, G24, T12
34	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, G24, T9
35	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
36	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
37	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
38	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
39	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
40	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
41	45	...	450	170	816	NP	899	NP	NFN-9	G6, G24, T12
42	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, G24, T9
43	45	...	450	170	816	NP	899	NP	NFN-9	G6, T12
44	45	...	450	170	816	NP	899	NP	NFN-9	G5, G6, T8
45	8	1	540	255	NP	NP	427	NP	HA-2	G5

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	158	149	141	138	136	131	126	123	122	120	120	119	116	114	...
2	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
3	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
4	134	127	120	117	115	111	108	104	103	103	102	101	98.7	96.9	...
5	134	134	134	133	132	130	130	130	129	129	128	128	128	128	...
6	158	158	158	157	156	153	152	152	152	152	151	150	150	150	...
7	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
9	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
11	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
13	97.9	94.0	89.6	87.0	84.7	80.4	75.9	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
14	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
15	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
17	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
19	97.9	94.0	89.6	87.0	84.7	80.4	75.9	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	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
21	115	111	105	102	99.2	94.2	89.8	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
22	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
23	97.9	94.0	89.6	87.0	84.7	80.4	75.9	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
24	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
25	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
27	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
29	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
31	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
33	97.9	94.0	89.6	87.0	84.7	80.4	75.9	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	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
35	115	111	105	102	99.2	94.2	89.8	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	113	110	108	105	104	102	100
37	115	111	105	102	99.2	94.2	89.8	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
38	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
39	115	111	105	102	99.2	94.2	89.8	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
40	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
41	97.9	94.0	89.6	87.0	84.7	80.4	75.9	72.7	71.0	69.2	68.1	66.8	65.6	64.4	63.0
42	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.2	95.9	93.8	91.3	89.6	88.4	86.5	85.1
43	115	111	105	102	99.2	94.2	89.8	85.4	83.4	81.5	79.8	78.5	76.6	75.3	74.2
44	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
45	154	154	154	154	153	149	145	143	142	142	142	142	142	141	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
7	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 (25)
8	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)
9	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 (25)
10	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)
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 (25)
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 (25)
13	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 (25)
14	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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
21	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 (25)
22	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)
23	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 (25)
24	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 (25)
25	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 (25)
26	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)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
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 (25)
37	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 (25)
38	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 (25)
39	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 (25)
40	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 (25)
41	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 (25)
42	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 (25)
43	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 (25)
44	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 (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	14Cr-16Ni-6Si-Cu-Mo	Smls. tube	SA-213	...	S38815	...	...
2	14Cr-16Ni-6Si-Cu-Mo	Plate	SA-240	...	S38815	...	...
3	14Cr-16Ni-6Si-Cu-Mo	Plate	SA-240	...	S38815	...	...
4	14Cr-16Ni-6Si-Cu-Mo	Wld. tube	SA-249	...	S38815	...	...
5	14Cr-16Ni-6Si-Cu-Mo	Wld. tube	SA-249	...	S38815	...	...
6	14Cr-16Ni-6Si-Cu-Mo	Wld. pipe	SA-312	...	S38815	...	...
7	14Cr-16Ni-6Si-Cu-Mo	Wld. pipe	SA-312	...	S38815	...	...
8	14Cr-16Ni-6Si-Cu-Mo	Smls. & wld. fittings	SA-403	...	S38815	...	...
9	14Cr-16Ni-6Si-Cu-Mo	Smls. & wld. fittings	SA-403	...	S38815	...	...
10	14Cr-16Ni-6Si-Cu-Mo	Bar	SA-479	...	S38815	...	...
11	14Cr-16Ni-6Si-Cu-Mo	Bar	SA-479	...	S38815	...	...
12	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	...
13	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	...
14	16Cr-9Mn-2Ni-N	Plate	SA-240	204	S20400	...	...
15	16Cr-9Mn-2Ni-N	Plate	SA-240	204	S20400	...	...
16	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	>130
17	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	>130
18	16Cr-12Ni-2Mo	Forgings	SA-965	F316L	S31603	...	...
19	16Cr-12Ni-2Mo	Forgings	SA-965	F316L	S31603	...	...
20	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316L	...	...	...
21	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	≤130
22	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	≤130
23	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	...	...
24	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	...	...
25	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	...	...
26	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	...	...
27	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...
28	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...
29	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...
30	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316L	S31603	...	...
31	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316L	S31603	...	...
32	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	...
33	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	...
34	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	1	...
35	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316L	S31603	...	...
36	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316L	S31603	...	...
37	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	...	...
38	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	...	...
39	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L	S31603	...	...
40	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L	S31603	...	...
41	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L	S31603	...	...
42	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316L	S31603	...	...
43	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316L	S31603	...	...
44	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	>130
45	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	>130

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	1	540	255	NP	NP	427	NP	HA-2	...
2	8	1	540	255	NP	NP	427	NP	HA-2	G5
3	8	1	540	255	NP	NP	427	NP	HA-2	...
4	8	1	540	255	NP	NP	427	NP	HA-2	G5
5	8	1	540	255	NP	NP	427	NP	HA-2	...
6	8	1	540	255	NP	NP	427	NP	HA-2	G5
7	8	1	540	255	NP	NP	427	NP	HA-2	...
8	8	1	540	255	NP	NP	427	NP	HA-2	G5, W14
9	8	1	540	255	NP	NP	427	NP	HA-2	W14
10	8	1	540	255	NP	NP	427	NP	HA-2	G5
11	8	1	540	255	NP	NP	427	NP	HA-2	...
12	8	3	655	310	NP	NP	427	343	HA-6	G5
13	8	3	655	310	NP	NP	427	343	HA-6	...
14	8	3	655	330	NP	NP	482	343	HA-6	G5
15	8	3	655	330	NP	NP	482	343	HA-6	...
16	8	1	450	170	454	427	649	343	HA-4	G5, T12
17	8	1	450	170	454	NP	649	343	HA-4	G21, T12
18	8	1	450	170	454	427	649	343	HA-4	G5, T12
19	8	1	450	170	454	NP	649	343	HA-4	G21, T12
20	8	1	480	175	454	427	454	NP	HA-4	G5, G21, G22
21	8	1	485	170	454	427	649	343	HA-4	G5, T12
22	8	1	485	170	454	NP	649	343	HA-4	G21, T12
23	8	1	485	170	454	427	649	NP	HA-4	G5, T12
24	8	1	485	170	454	NP	649	NP	HA-4	G21, T12
25	8	1	485	170	454	427	649	343	HA-4	G5, T12
26	8	1	485	170	454	NP	649	343	HA-4	G21, T12
27	8	1	485	170	NP	427	NP	NP	HA-4	G5, W12
28	8	1	485	170	454	NP	649	343	HA-4	G5, G21, G24, T12
29	8	1	485	170	454	NP	649	343	HA-4	G21, G24, T12
30	8	1	485	170	454	427	649	343	HA-4	G5, G21, T12, W12, W14
31	8	1	485	170	454	NP	649	343	HA-4	G21, T12
32	8	1	485	170	454	NP	649	343	HA-4	G5, G21, G24, T12
33	8	1	485	170	454	NP	649	343	HA-4	G21, G24, T12
34	8	1	485	170	NP	427	NP	NP	HA-4	G5
35	8	1	485	170	NP	427	649	343	HA-4	G5, T12, W12, W14
36	8	1	485	170	NP	427	NP	NP	HA-4	G5
37	8	1	485	170	454	427	649	343	HA-4	G5, G21, G22, T12
38	8	1	485	170	454	NP	649	343	HA-4	G21, G22, T12
39	8	1	485	170	NP	427	NP	NP	HA-4	G5, W12
40	8	1	485	170	NP	NP	454	343	HA-4	G5, G24
41	8	1	485	170	NP	NP	454	343	HA-4	G24
42	8	1	485	170	NP	427	NP	NP	HA-4	G5, W12
43	8	1	485	170	NP	427	NP	NP	HA-4	G5, W12
44	8	1	485	205	816	427	816	343	HA-2	G5, G12, T8
45	8	1	485	205	816	NP	816	343	HA-2	G12, T9

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	154	153	141	134	127	118	113	111	110	110	110	110	110	110	...
2	154	154	154	154	153	149	145	143	142	142	142	142	142	141	...
3	154	153	141	134	127	118	113	111	110	110	110	110	110	110	...
4	131	131	131	131	130	126	124	122	121	121	121	121	120	120	...
5	131	130	120	114	108	100	96.0	94.1	93.8	93.8	93.8	93.8	93.8	93.8	...
6	131	131	131	131	130	126	124	122	121	121	121	121	120	120	...
7	131	130	120	114	108	100	96.0	94.1	93.8	93.8	93.8	93.8	93.8	93.8	...
8	154	154	154	154	153	149	145	143	142	142	142	142	142	141	...
9	154	153	141	134	127	118	113	111	110	110	110	110	110	110	...
10	154	154	154	154	153	149	145	143	142	142	142	142	142	141	...
11	154	153	141	134	127	118	113	111	110	110	110	110	110	110	...
12	187	177	164	152	146	139	136	136	135	135	134	132	130	128	...
13	187	177	161	152	146	139	136	134	131	127	124	120	115	112	...
14	187	175	160	150	142	131	125	124	123	123	123	123	122	120	117
15	187	175	160	149	140	124	115	110	108	107	107	105	104	102	99.5
16	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
17	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
18	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
19	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
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	86.6
22	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
23	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
24	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
25	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
26	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
27	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
28	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
29	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
30	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	86.6
31	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
32	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
33	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
34	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
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	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
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	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
40	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
41	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
42	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
43	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...
44	138	138	138	136	134	133	126	119	116	114	112	111	110	108	108
45	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, Division 1, 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	114	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	96.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
17	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
18	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
19	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
22	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
23	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
24	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
25	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
26	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	71.7	70.2	68.8	67.5	65.0	49.7	36.9	...	...	...	...	...	...	...	...	...	...
29	53.4	52.0	50.9	50.0	49.1	48.5	36.9	...	...	...	...	...	...	...	...	...	...
30	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
31	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
32	71.7	70.2	68.8	67.5	65.0	49.7	36.9	...	...	...	...	...	...	...	...	...	...
33	53.4	52.0	50.9	50.0	49.1	48.5	36.9	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	84.4	82.6	80.9	79.4	76.5	58.5	43.4	...	...	...	...	...	...	...	...	...	...
38	62.8	61.2	59.9	58.8	57.8	57.0	43.4	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	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	...	...	...
45	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, Division 1, 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
1	16Cr-12Ni-2Mo	Forgings	SA-965	F316	S31600	...	...
2	16Cr-12Ni-2Mo	Forgings	SA-965	F316	S31600	...	...
3	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	>130
4	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	>130
5	16Cr-12Ni-2Mo	Forgings	SA-965	F316H	S31609	...	...
6	16Cr-12Ni-2Mo	Forgings	SA-965	F316H	S31609	...	...
7	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	≤130
8	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	≤130
9	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...	...
10	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...	...
11	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...	...
12	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...	...
13	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...
14	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...
(25) 15	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...
(25) 16	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...
17	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316	S31600	...	...
18	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316	S31600	...	...
(25) 19	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	...
(25) 20	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	...
21	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	1	...
(25) 22	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316	S31600	...	...
(25) 23	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316	S31600	...	...
24	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316	S31600	...	...
25	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316	S31600	...	...
(25) 26	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	...	...
(25) 27	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	...	...
28	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	...
29	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	...
30	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	...
31	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316	S31600	...	...
32	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316	S31600	...	...
33	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	≤130
34	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	≤130
35	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316H	S31609	...	...
36	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316H	S31609	...	...
37	16Cr-12Ni-2Mo	Plate	SA-240	316H	S31609	...	...
38	16Cr-12Ni-2Mo	Plate	SA-240	316H	S31609	...	...
(25) 39	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...
(25) 40	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...
41	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...
42	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...
43	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316H	S31609	...	...
44	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316H	S31609	...	...
(25) 45	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316H	S31609	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	485	205	816	427	816	343	HA-2	G5, G12, T8
2	8	1	485	205	816	NP	816	343	HA-2	G12, T9
3	8	1	485	205	816	427	816	NP	HA-2	G5, G12, T8
4	8	1	485	205	816	NP	816	NP	HA-2	T9
5	8	1	485	205	NP	427	816	NP	HA-2	G5, T8
6	8	1	485	205	NP	NP	816	NP	HA-2	T9
7	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T8
8	8	1	515	205	816	NP	816	NP	HA-2	G12, T9
9	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T8
10	8	1	515	205	816	NP	816	NP	HA-2	G12, T9
11	8	1	515	205	816	427	816	343	HA-2	G5, G12, T8
12	8	1	515	205	816	NP	816	343	HA-2	G12, T9
13	8	1	515	205	816	NP	NP	NP	HA-2	G12, T9, W13
14	8	1	515	205	816	427	NP	NP	HA-2	G5, G12, T8, W12, W13
15	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T7
16	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T9
17	8	1	515	205	816	427	816	343	HA-2	G5, G12, T8, W12, W13, W14
18	8	1	515	205	816	NP	816	343	HA-2	G12, T9, W13, W14
19	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T7
20	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T9
21	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
22	8	1	515	205	816	427	816	343	HA-2	G5, G12, T8, W12
23	8	1	515	205	816	NP	816	343	HA-2	G12, T9
24	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T8, W12, W14
25	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
26	8	1	515	205	816	427	816	343	HA-2	G5, G12, G22, T8
27	8	1	515	205	816	NP	816	343	HA-2	G12, G22, T9
28	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
29	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T7
30	8	1	515	205	NP	NP	816	343	HA-2	G12, G24, T9
31	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
32	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
33	8	1	515	205	816	427	816	NP	HA-2	G5, T8
34	8	1	515	205	816	NP	816	NP	HA-2	T9
35	8	1	515	205	816	427	816	NP	HA-2	G5, T8
36	8	1	515	205	816	NP	816	NP	HA-2	T9
37	8	1	515	205	816	427	816	NP	HA-2	G5, T8
38	8	1	515	205	816	NP	816	NP	HA-2	T9
39	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T7
40	8	1	515	205	816	NP	816	NP	HA-2	G24, T9
41	8	1	515	205	816	NP	NP	NP	HA-2	T9, W13
42	8	1	515	205	816	427	NP	NP	HA-2	G5, T8, W12, W13
43	8	1	515	205	816	427	816	NP	HA-2	G5, T8, W12, W13
44	8	1	515	205	816	NP	816	NP	HA-2	T9, W13
45	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T7

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	136	134	133	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	136	134	133	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	136	134	133	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	108
8	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
9	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
10	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
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	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
14	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
15	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
16	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
17	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
18	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
19	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
20	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
21	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
22	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
23	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
24	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
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	108
27	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
28	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
29	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
30	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
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	108
34	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
35	138	138	138	138	138	134	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	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
41	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
42	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
43	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
44	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
45	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
8	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	...	...	...
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	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	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	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	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	...	...	... (25)
16	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)
17	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	...	...	...
18	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	...	...	...
19	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	...	...	... (25)
20	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)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	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	...	...	... (25)
23	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	...	...	... (25)
24	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	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	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	...	...	... (25)
27	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	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	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	...	...	...
30	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	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	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	...	...	...
34	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	...	...	...
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	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	...	...	... (25)
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	...	...	... (25)
41	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	...	...	...
42	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	...	...	...
43	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	...	...	...
44	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	...	...	...
45	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	...	...	... (25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316H	S31609	...	...
2	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	1	...
(25) 3	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H	S31609	...	...
(25) 4	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H	S31609	...	...
5	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316H	S31609	...	...
(25) 6	16Cr-12Ni-2Mo	Bar	SA-479	316H	S31609	...	...
(25) 7	16Cr-12Ni-2Mo	Bar	SA-479	316H	S31609	...	...
8	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316H	S31609	...	...
9	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316H	S31609	...	...
10	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316	...	...	...
11	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2	...	...	≤75
12	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2	...	...	≤75
13	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...	≤75
14	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...	≤75
15	16Cr-12Ni-2Mo-Cb	Plate	SA-240	316Cb	S31640	...	...
16	16Cr-12Ni-2Mo-Cb	Plate	SA-240	316Cb	S31640	...	...
17	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...	>130
18	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316LN	S31653	...	...
19	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...	≤130
20	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316LN	S31653	...	...
21	16Cr-12Ni-2Mo-N	Plate	SA-240	316LN	S31653	...	...
22	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316LN	S31653	...	...
23	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316LN	S31653	...	...
24	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	1	...
25	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316LN	S31653	...	...
26	16Cr-12Ni-2Mo-N	Fittings	SA-403	316LN	S31653	...	...
27	16Cr-12Ni-2Mo-N	Bar	SA-479	316LN	S31653	...	...
28	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316LN	S31653	...	...
29	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316N	S31651	...	...
30	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N	S31651	...	...
31	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N	S31651	...	...
32	16Cr-12Ni-2Mo-N	Plate	SA-240	316N	S31651	...	...
33	16Cr-12Ni-2Mo-N	Plate	SA-240	316N	S31651	...	...
34	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	...
35	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	...
(25) 36	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	...
(25) 37	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	...
38	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316N	S31651	...	...
39	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316N	S31651	...	...
(25) 40	16Cr-12Ni-2Mo-N	Wld. pipe	SA-312	TP316N	S31651	...	...
(25) 41	16Cr-12Ni-2Mo-N	Wld. pipe	SA-312	TP316N	S31651	...	...
42	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	1	...
(25) 43	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N	S31651	...	...
(25) 44	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N	S31651	...	...
45	16Cr-12Ni-2Mo-N	Smls. & wld. fittings	SA-403	316N	S31651	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	515	205	816	NP	816	NP	HA-2	G24, T9
2	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
3	8	1	515	205	816	427	816	NP	HA-2	G5, T8
4	8	1	515	205	816	NP	816	NP	HA-2	T9
5	8	1	515	205	NP	427	816	NP	HA-2	G5, G12, T8, W12, W14
6	8	1	515	205	816	427	NP	NP	HA-2	G5, T8
7	8	1	515	205	816	NP	NP	NP	HA-2	T9
8	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
9	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
10	8	1	520	205	816	427	816	NP	HA-2	G5, G12, G22, H1, T8
11	8	1	520	220	NP	NP	454	343	HA-4	G5, G30
12	8	1	520	220	NP	NP	454	343	HA-4	G30
13	8	1	520	220	NP	NP	550	343	HA-2	G5, G12, G30
14	8	1	520	220	NP	NP	550	343	HA-2	G12, G30
15	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, T8
16	8	1	515	205	NP	NP	816	343	HA-2	G12, T9
17	8	1	485	205	NP	427	NP	NP	HA-2	G5
18	8	1	485	205	NP	427	NP	NP	HA-2	G5
19	8	1	515	205	NP	427	NP	NP	HA-2	G5
20	8	1	515	205	NP	427	NP	NP	HA-2	G5
21	8	1	515	205	NP	427	NP	NP	HA-2	G5
22	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
23	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
24	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
25	8	1	515	205	NP	427	NP	NP	HA-2	G5
26	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
27	8	1	515	205	NP	427	NP	NP	HA-2	G5
28	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
29	8	1	550	240	NP	427	NP	NP	HA-2	G5
30	8	1	550	240	649	427	649	NP	HA-2	G5, G12, T7
31	8	1	550	240	649	NP	649	NP	HA-2	G12, T8
32	8	1	550	240	NP	427	649	343	HA-2	G5, G12, T7
33	8	1	550	240	NP	NP	649	343	HA-2	G12, T8
34	8	1	550	240	649	NP	NP	NP	HA-2	G5, G12, T7, W13
35	8	1	550	240	649	NP	NP	NP	HA-2	G12, T8, W13
36	8	1	550	240	649	NP	649	343	HA-2	G12, G24, T8
37	8	1	550	240	649	NP	649	343	HA-2	G5, G12, G24, T7
38	8	1	550	240	649	427	649	343	HA-2	G5, G12, T7, W12, W13, W14
39	8	1	550	240	649	NP	649	343	HA-2	G12, T8, W13, W14
40	8	1	550	240	649	NP	649	343	HA-2	G12, G24, T8
41	8	1	550	240	649	NP	649	343	HA-2	G5, G12, G24, T7
42	8	1	550	240	NP	427	NP	NP	HA-2	G5, W12
43	8	1	550	240	649	427	649	343	HA-2	G5, G12, T7
44	8	1	550	240	649	NP	649	343	HA-2	G12, T8
45	8	1	550	240	NP	427	649	343	HA-2	G5, G12, T7, W12, W14

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	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
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	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	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	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	108
11	147	147	147	147	147	139	131	125	123	121	119	116	114	112	110
12	147	133	123	117	112	103	97.0	93.0	91.0	89.0	88.0	86.0	85.0	83.0	81.0
13	147	147	147	147	147	142	133	127	124	122	120	118	117	116	114
14	147	134	125	119	114	105	98.7	93.7	91.8	90.1	88.7	87.5	86.5	85.6	84.8
15	138	138	138	138	138	134	125	117	116	114	112	111	110	109	108
16	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
17	138	138	138	134	130	124	119	115	113	110	107	105	102	99.7	...
18	138	138	138	134	130	124	119	115	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	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	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
30	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
31	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
32	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
33	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
34	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
35	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
36	134	128	120	115	111	104	97.6	93.1	90.7	88.4	86.6	84.7	83.5	82.3	80.5
37	134	134	133	131	129	126	125	124	122	119	117	115	113	111	109
38	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
39	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
40	134	128	120	115	111	104	97.6	93.1	90.7	88.4	86.6	84.7	83.5	82.3	80.5
41	134	134	133	131	129	126	125	124	122	119	117	115	113	111	109
42	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
43	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128
44	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
45	158	158	158	155	152	148	146	145	144	140	137	135	133	130	128

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	67.1	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)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	... (25)
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	...	...	... (25)
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	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	...	...	... (25)
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	...	...	... (25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	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	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	113	113	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	84.0	83.4	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	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	...	...	...
16	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	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
31	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
32	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
33	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
34	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
35	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
36	79.1	77.8	76.8	74.7	70.0	55.3	42.9	...	...	...	...	...	...	...	...	...	... (25)
37	107	105	101	85.7	70.0	55.3	42.9	...	...	...	...	...	...	...	...	...	... (25)
38	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
39	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
40	79.1	77.8	76.8	74.7	70.0	55.3	42.9	...	...	...	...	...	...	...	...	...	... (25)
41	107	105	101	85.7	70.0	55.3	42.9	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	... (25)
44	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	... (25)
45	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	16Cr-12Ni-2Mo-N	Bar	SA-479	316N	S31651	...	...
(25) 2	16Cr-12Ni-2Mo-N	Bar	SA-479	316N	S31651	...	...
3	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316N	S31651	...	...
4	16Cr-12Ni-2Mo-N	Wld. pipe	SA-813	TP316N	S31651	...	...
5	16Cr-12Ni-2Mo-N	Wld. pipe	SA-814	TP316N	S31651	...	...
6	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N	S31651	...	...
7	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N	S31651	...	...
8	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-11-2	...	...	≤75
9	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-13-3	...	...	≤75
10	16Cr-12Ni-2Mo-Ti	Plate	SA-240	316Ti	S31635	...	...
11	16Cr-12Ni-2Mo-Ti	Plate	SA-240	316Ti	S31635	...	...
12	17Cr-4Ni-6Mn	Plate	SA-240	201-1	S20100	...	...
13	17Cr-4Ni-6Mn	Plate	SA-240	201-1	S20100	...	...
14	17Cr-4Ni-6Mn	Plate	SA-666	201-1	S20100	...	...
15	17Cr-4Ni-6Mn	Plate	SA-666	201-1	S20100	...	...
16	17Cr-4Ni-6Mn	Plate	SA-240	201-2	S20100	...	...
17	17Cr-4Ni-6Mn	Plate	SA-666	201-2	S20100	...	...
18	17Cr-7Ni	Plate, sheet, strip	SA-240	301	S30100	...	...
19	17Cr-7Ni	Plate, sheet, strip	SA-240	301	S30100	...	...
20	17.5Cr-17.5Ni-5.3Si	Plate	SA-240	...	S30601	Sol. ann.	...
21	17.5Cr-17.5Ni-5.3Si	Plate	SA-240	...	S30601	Sol. ann.	...
22	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	...
23	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	...
24	18Cr-3Ni-12Mn	Wld. tube	SA-249	XM-29	S24000	...	...
25	18Cr-3Ni-12Mn	Wld. tube	SA-249	XM-29	S24000	...	...
26	18Cr-3Ni-12Mn	Wld. pipe	SA-312	XM-29	S24000	...	...
27	18Cr-3Ni-12Mn	Wld. pipe	SA-312	XM-29	S24000	...	...
28	18Cr-3Ni-12Mn	Bar	SA-479	XM-29	S24000	...	...
29	18Cr-3Ni-12Mn	Bar	SA-479	XM-29	S24000	...	...
30	18Cr-3Ni-12Mn	Wld. tube	SA-688	TPXM-29	S24000	...	...
31	18Cr-3Ni-12Mn	Wld. tube	SA-688	TPXM-29	S24000	...	...
32	18Cr-5Ni-3Mo	Smls. tube	SA-789	...	S31500	...	...
33	18Cr-5Ni-3Mo	Wld. tube	SA-789	...	S31500	...	...
34	18Cr-5Ni-3Mo	Smls. pipe	SA-790	...	S31500	...	...
35	18Cr-5Ni-3Mo	Wld. pipe	SA-790	...	S31500	...	...
36	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	>130
37	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	>130
38	18Cr-8Ni	Forgings	SA-965	F304L	S30403	...	...
39	18Cr-8Ni	Forgings	SA-965	F304L	S30403	...	...
40	18Cr-8Ni	Bar	SA/JIS G4303	SUS304L	...	...	...
41	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	≤130
42	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	≤130
43	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	...	...
44	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	...	...
45	18Cr-8Ni	Plate	SA-240	304L	S30403	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	1	550	240	649	427	NP	NP	HA-2	G5, G12, T7
2	8	1	550	240	649	NP	NP	NP	HA-2	G12, T8
3	8	1	550	240	NP	427	NP	NP	HA-2	G5, W12
4	8	1	550	240	NP	427	NP	NP	HA-2	G5, W12
5	8	1	550	240	NP	427	NP	NP	HA-2	G5, W12
6	8	1	550	240	NP	427	649	343	HA-2	G5, G12, T7
7	8	1	550	240	NP	NP	649	343	HA-2	G12, T8
8	8	1	580	280	NP	NP	427	343	HA-2	G5, G30
9	8	1	580	280	NP	NP	427	343	HA-2	G5, G30
10	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, T8
11	8	1	515	205	NP	NP	816	343	HA-2	G12, T9
12	8	3	515	260	NP	NP	149	149	HA-2	...
13	8	3	515	260	NP	NP	149	149	HA-2	G5
14	8	3	515	260	NP	NP	149	149	HA-2	...
15	8	3	515	260	NP	NP	149	149	HA-2	G5
16	8	3	655	310	NP	NP	149	149	HA-6	...
17	8	3	655	310	NP	NP	149	149	HA-6	...
18	8	1	515	205	NP	NP	427	NP	HA-1	G5
19	8	1	515	205	NP	NP	427	NP	HA-1	...
20	8	1	540	255	NP	NP	260	NP	HA-1	G5, G31, H6
21	8	1	540	255	NP	NP	260	NP	HA-1	G31, H6
22	8	3	690	380	NP	NP	427	343	HA-6	G5
23	8	3	690	380	NP	NP	427	343	HA-6	...
24	8	3	690	380	NP	NP	427	343	HA-6	G5, G24
25	8	3	690	380	NP	NP	427	343	HA-6	G24
26	8	3	690	380	NP	NP	427	343	HA-6	G5, G24
27	8	3	690	380	NP	NP	427	343	HA-6	G24
28	8	3	690	380	NP	NP	427	343	HA-6	G5, G22
29	8	3	690	380	NP	NP	427	343	HA-6	G22
30	8	3	690	380	NP	NP	427	343	HA-6	G5, G24
31	8	3	690	380	NP	NP	427	343	HA-6	G24
32	10H	1	635	440	NP	NP	399	343	HA-5	G19
33	10H	1	635	440	NP	NP	399	343	HA-5	G19, G24
34	10H	1	635	440	NP	NP	399	343	HA-5	G19
35	10H	1	635	440	NP	NP	399	343	HA-5	G19, G24
36	8	1	450	170	427	427	649	343	HA-3	G5, G21, T4
37	8	1	450	170	427	NP	649	343	HA-3	G21, T5
38	8	1	450	170	427	427	649	343	HA-3	G5, G21, T4
39	8	1	450	170	427	NP	649	343	HA-3	G21, T5
40	8	1	480	175	427	427	649	NP	HA-3	G5, G21, G22, T4
41	8	1	485	170	427	427	649	343	HA-3	G5, G21, T4
42	8	1	485	170	427	NP	649	343	HA-3	G21, T5
43	8	1	485	170	427	427	649	NP	HA-3	G5, G21, T4
44	8	1	485	170	427	NP	649	NP	HA-3	G21, T5
45	8	1	485	170	427	427	649	343	HA-3	G5, G21, T4

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
3	158	158	158	155	152	148	146	145	144	140	137	135	133	130	...
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	128
7	158	150	141	136	131	122	115	109	107	104	102	99.9	98.0	96.1	94.9
8	166	166	166	166	166	164	158	154	152	149	145	142	139	136	...
9	166	166	166	166	166	164	158	154	152	149	145	142	139	136	...
10	138	138	138	138	138	134	125	117	116	114	112	111	110	109	108
11	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
12	147	147	130	121	114	...	...	...	...	...	...	...	...	...	...
13	147	147	140	134	130	...	...	...	...	...	...	...	...	...	...
14	147	147	130	121	114	...	...	...	...	...	...	...	...	...	...
15	147	147	140	134	130	...	...	...	...	...	...	...	...	...	...
16	187	171	154	145	135	...	...	...	...	...	...	...	...	...	...
17	187	171	154	145	135	...	...	...	...	...	...	...	...	...	...
18	138	133	118	112	108	106	106	106	106	106	105	103	101	98.7	...
19	138	120	109	104	99.3	93.4	90.0	87.2	85.6	83.8	81.7	79.3	76.9	74.7	...
20	154	...	154	...	145	138	130	...	...	...	...	...	...	...	...
21	154	...	140	...	121	113	104	...	...	...	...	...	...	...	...
22	197	196	191	185	179	172	168	165	163	161	158	154	151	147	...
23	197	196	191	182	172	152	140	134	131	129	127	125	123	120	...
24	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
25	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
26	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
27	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
28	197	196	191	185	179	172	168	165	163	161	158	154	151	147	...
29	197	196	191	182	172	152	140	134	131	129	127	125	123	120	...
30	168	166	162	157	152	146	143	140	139	137	134	132	128	124	...
31	168	167	162	155	146	130	119	114	112	110	108	106	104	102	...
32	181	178	174	171	168	167	167	167	167	167	167	167	...	...	...
33	154	152	148	145	143	142	142	142	142	142	142	142	...	...	...
34	181	178	174	171	168	167	167	167	167	167	167	167	...	...	...
35	154	152	148	145	143	142	142	142	142	142	142	142	...	...	...
36	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
37	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
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	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
42	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
43	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
44	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
45	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
2	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	126	124	119	101	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
7	93.1	91.7	90.1	88.5	81.6	65.3	50.4	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	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	...	...	...
11	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	...	...	...
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	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
37	63.4	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	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
42	63.4	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
43	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
44	63.4	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
45	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-8Ni	Plate	SA-240	304L	S30403	...	...
2	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...
3	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...
4	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...
5	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304L	S30403	...	...
6	18Cr-8Ni	Smls. pipe	SA-312	TP304L	S30403	...	...
7	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...
8	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...
9	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	1	...
10	18Cr-8Ni	Smls. & wld. fittings	SA-403	304L	S30403	...	...
11	18Cr-8Ni	Wld. pipe	SA-409	TP304L	S30403	...	...
12	18Cr-8Ni	Bar	SA-479	304L	S30403	...	...
13	18Cr-8Ni	Bar	SA-479	304L	S30403	...	...
14	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...
15	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...
16	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...
17	18Cr-8Ni	Wld. pipe	SA-813	TP304L	S30403	...	...
18	18Cr-8Ni	Wld. pipe	SA-814	TP304L	S30403	...	...
19	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	>130
20	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	>130
21	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	>130
22	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	>130
23	18Cr-8Ni	Castings	SA-351	CF3	J92500	...	...
24	18Cr-8Ni	Castings	SA-351	CF3	J92500	...	...
(25) 25	18Cr-8Ni	Castings	SA-351	CF8	J92600	...	...
(25) 26	18Cr-8Ni	Castings	SA-351	CF8	J92600	...	...
27	18Cr-8Ni	Castings	SA-351	CF8	J92600	...	...
28	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	≥200
29	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	≥200
30	18Cr-8Ni	Cast pipe	SA-451	CPF3	J92500	...	...
31	18Cr-8Ni	Cast pipe	SA-451	CPF8	J92600	...	...
32	18Cr-8Ni	Forgings	SA-965	F304	S30400	...	...
33	18Cr-8Ni	Forgings	SA-965	F304	S30400	...	...
34	18Cr-8Ni	Forgings	SA-965	F304H	S30409	...	...
35	18Cr-8Ni	Forgings	SA-965	F304H	S30409	...	...
36	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9	...	...	≤75
37	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9	...	...	≤75
38	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	≤130
39	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	≤130
40	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	≤130
41	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	≤130
42	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...	...
43	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...	...
44	18Cr-8Ni	Smls. tube	SA-213	TP304H	S30409	...	...
45	18Cr-8Ni	Smls. tube	SA-213	TP304H	S30409	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	1	485	170	427	NP	649	343	HA-3	G21, T5
2	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
3	8	1	485	170	427	NP	649	343	HA-3	G5, G21, G24, T4
4	8	1	485	170	427	NP	649	343	HA-3	G21, G24, T5
5	8	1	485	170	427	427	649	343	HA-3	G5, G21, T4, W12, W14
6	8	1	485	170	427	NP	649	343	HA-3	G21, T5
7	8	1	485	170	427	NP	649	343	HA-3	G5, G21, G24, T4
8	8	1	485	170	427	NP	649	343	HA-3	G21, G24, T5
9	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
10	8	1	485	170	NP	427	649	343	HA-3	G5, T4, W12, W14
11	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
12	8	1	485	170	427	427	649	343	HA-3	G5, G21, G22, T4
13	8	1	485	170	427	NP	649	343	HA-3	G21, G22, T5
14	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
15	8	1	485	170	NP	NP	649	343	HA-3	G5, G24, T4
16	8	1	485	170	NP	NP	649	343	HA-3	G24, T5
17	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
18	8	1	485	170	NP	427	NP	NP	HA-3	G5, W12
19	8	1	485	205	816	427	816	343	HA-1	G5, G12, T7
20	8	1	485	205	816	NP	816	343	HA-1	G12, T8
21	8	1	485	205	816	427	816	NP	HA-1	G5, T7
22	8	1	485	205	816	NP	816	NP	HA-1	T8
23	8	1	485	205	NP	427	427	343	HA-3	G1, G5, G16, G17, G19
24	8	1	485	205	NP	NP	427	343	HA-3	G1, G19
25	8	1	485	205	816	427	NP	NP	HA-1	G1, G5, G12, G16, G17, G19, T6
26	8	1	485	205	816	NP	816	343	HA-1	G1, G12, G19, T7
27	8	1	485	205	NP	NP	816	343	HA-1	G1, G5, G12, G19, T6
28	8	1	485	205	NP	427	816	343	HA-1	G5, G12, S9, T7
29	8	1	485	205	NP	NP	816	343	HA-1	G12, S9, T8
30	8	1	485	205	NP	427	NP	NP	HA-3	G5, G16, G17, G19
31	8	1	485	205	NP	427	NP	NP	HA-1	G5, G16, G17, G19
32	8	1	485	205	816	427	816	343	HA-1	G5, G12, T7
33	8	1	485	205	816	NP	816	343	HA-1	G12, T8
34	8	1	485	205	NP	427	816	NP	HA-1	G5, T7
35	8	1	485	205	NP	NP	816	NP	HA-1	T8
36	8	1	500	200	NP	NP	550	343	HA-3	G5, G30, T4
37	8	1	500	200	NP	NP	550	343	HA-3	G30, T5
38	8	1	515	205	816	NP	816	NP	HA-1	G12, T8
39	8	1	515	205	816	427	816	NP	HA-1	G5, G12, T7
40	8	1	515	205	816	NP	816	NP	HA-1	T8
41	8	1	515	205	816	427	816	NP	HA-1	G5, T7
42	8	1	515	205	816	NP	816	NP	HA-1	G12, T8
43	8	1	515	205	816	427	816	NP	HA-1	G5, G12, T7
44	8	1	515	205	816	NP	816	NP	HA-1	T8
45	8	1	515	205	816	427	816	NP	HA-1	G5, T7

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	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
2	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
3	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
4	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
5	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
6	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
7	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
8	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
9	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
10	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
11	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
12	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	86.6
13	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
14	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
15	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
16	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
17	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
18	115	115	115	115	115	110	103	97.7	95.7	94.1	92.6	91.3	90.0	88.7	...
19	138	134	130	126	122	119	118	115	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	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
22	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
23	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
24	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	77.7	76.4	...
25	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
26	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
27	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
28	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
29	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
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	...
32	138	134	130	126	122	119	118	115	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	134	130	126	122	119	118	115	114	111	109	107	105	103	101
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	133	133	133	133	133	127	119	113	111	109	107	106	105	103	101
37	133	121	113	107	102	94.1	88.1	83.8	82.2	80.8	79.6	78.5	77.5	76.3	75.1
38	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
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
43	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
44	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
45	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	63.4	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	61.6	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
4	53.9	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
5	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
6	63.4	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
7	61.6	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
8	53.9	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	72.5	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
13	63.4	60.2	49.5	40.4	32.9	26.7	22.0	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	61.6	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
16	53.9	51.2	42.1	34.3	28.0	22.7	18.7	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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	...	...	...
22	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	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	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)
26	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	...	...	... (25)
27	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	...	...	...
28	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	...	...	...
29	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	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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	72.5	60.2	49.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	73.7	60.2	49.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	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	...	...	...
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	...	...	...
43	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	...	...	...
44	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	...	...	...
45	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, Division 1, 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
1	18Cr-8Ni	Plate	SA-240	302	S30200	...	...
2	18Cr-8Ni	Plate	SA-240	302	S30200	...	...
3	18Cr-8Ni	Plate	SA-240	304	S30400	...	...
(25) 4	18Cr-8Ni	Plate	SA-240	304	S30400	...	...
5	18Cr-8Ni	Plate	SA-240	304H	S30409	...	...
6	18Cr-8Ni	Plate	SA-240	304H	S30409	...	...
7	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...
8	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...
(25) 9	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...
(25) 10	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...
11	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...
12	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...
(25) 13	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...
(25) 14	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...
15	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304	S30400	...	...
16	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304	S30400	...	...
(25) 17	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...
(25) 18	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...
19	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304H	S30409	...	...
20	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304H	S30409	...	...
(25) 21	18Cr-8Ni	Wld. pipe	SA-312	TP304H	S30409	...	...
(25) 22	18Cr-8Ni	Wld. pipe	SA-312	TP304H	S30409	...	...
23	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	1	...
24	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	1	...
25	18Cr-8Ni	Wld. pipe	SA-358	304LN	S30453	1	...
(25) 26	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	<200
(25) 27	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	<200
(25) 28	18Cr-8Ni	Smls. pipe	SA-376	TP304H	S30409	...	...
(25) 29	18Cr-8Ni	Smls. pipe	SA-376	TP304H	S30409	...	...
30	18Cr-8Ni	Smls. & wld. fittings	SA-403	304	S30400	...	...
31	18Cr-8Ni	Smls. & wld. fittings	SA-403	304H	S30409	...	...
32	18Cr-8Ni	Wld. pipe	SA-409	TP304	S30400	...	...
33	18Cr-8Ni	Bar	SA-479	302	S30200	...	...
34	18Cr-8Ni	Bar	SA-479	302	S30200	...	...
35	18Cr-8Ni	Bar	SA-479	304	S30400	...	...
36	18Cr-8Ni	Bar	SA-479	304	S30400	...	...
37	18Cr-8Ni	Bar	SA-479	304H	S30409	...	...
38	18Cr-8Ni	Bar	SA-479	304H	S30409	...	...
39	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...
40	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...
41	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...
42	18Cr-8Ni	Wld. pipe	SA-813	TP304	S30400	...	...
43	18Cr-8Ni	Wld. pipe	SA-813	TP304H	S30409	...	...
44	18Cr-8Ni	Wld. pipe	SA-814	TP304	S30400	...	...
45	18Cr-8Ni	Wld. pipe	SA-814	TP304H	S30409	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	515	205	NP	NP	399	343	HA-1	G5
2	8	1	515	205	NP	NP	399	343	HA-1	...
3	8	1	515	205	816	NP	816	343	HA-1	G12, T8
4	8	1	515	205	816	427	816	343	HA-1	G5, G12, T7
5	8	1	515	205	816	427	816	NP	HA-1	G5, T7
6	8	1	515	205	816	NP	816	NP	HA-1	T8
7	8	1	515	205	816	NP	NP	NP	HA-1	G12, T8, W13
8	8	1	515	205	816	427	NP	NP	HA-1	G5, G12, T7, W12, W13
9	8	1	515	205	816	NP	816	343	HA-1	G5, G12, G24, T7
10	8	1	515	205	816	NP	816	343	HA-1	G12, G24, T8
11	8	1	515	205	816	NP	NP	NP	HA-1	T8, W13
12	8	1	515	205	816	427	NP	NP	HA-1	G5, T7, W12, W13
13	8	1	515	205	816	NP	816	NP	HA-1	G5, G24, T7
14	8	1	515	205	816	NP	816	NP	HA-1	G24, T8
15	8	1	515	205	816	427	816	343	HA-1	G5, G12, T7, W12, W13, W14
16	8	1	515	205	816	NP	816	343	HA-1	G12, T8, W13, W14
17	8	1	515	205	816	NP	816	343	HA-1	G5, G12, G24, T7
18	8	1	515	205	816	NP	816	343	HA-1	G12, G24, T8
19	8	1	515	205	816	427	816	NP	HA-1	G5, T7, W12, W13, W14
20	8	1	515	205	816	NP	816	NP	HA-1	T8, W13, W14
21	8	1	515	205	816	NP	816	NP	HA-1	G5, G24, T7
22	8	1	515	205	816	NP	816	NP	HA-1	G24, T8
23	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
24	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
25	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
26	8	1	515	205	816	427	816	343	HA-1	G5, G12, S11, T7
27	8	1	515	205	816	NP	816	343	HA-1	G12, S11, T8
28	8	1	515	205	816	427	816	NP	HA-1	G5, T7
29	8	1	515	205	816	NP	816	NP	HA-1	T8
30	8	1	515	205	NP	427	816	343	HA-1	G5, G12, T7, W12, W14
31	8	1	515	205	NP	427	816	NP	HA-1	G5, T7, W12, W14
32	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
33	8	1	515	205	NP	427	399	343	HA-1	G5, G24
34	8	1	515	205	NP	NP	399	343	HA-1	G22
35	8	1	515	205	816	427	816	343	HA-1	G5, G12, G22, T7
36	8	1	515	205	816	NP	816	343	HA-1	G12, G22, T8
37	8	1	515	205	816	427	816	NP	HA-1	G5, G22, T7
38	8	1	515	205	816	NP	816	NP	HA-1	G22, T8
39	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
40	8	1	515	205	NP	NP	816	343	HA-1	G5, G12, G24, T7
41	8	1	515	205	NP	NP	816	343	HA-1	G12, G24, T8
42	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
43	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
44	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12
45	8	1	515	205	NP	427	NP	NP	HA-1	G5, W12

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	...	...	...
2	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	...	...	...
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	105	103	101
6	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
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	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
10	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
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	138	137	134	130	126	122	116	114	111	109	107	105	103	101
16	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
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	...
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	101
27	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
28	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
29	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
30	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
31	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
32	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
33	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
34	138	126	113	107	103	95.7	90.0	85.6	83.9	82.3	80.5	79.2	...	...	...
35	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
36	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
37	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
38	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
39	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
40	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
41	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
42	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
43	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
44	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
45	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	... (25)
5	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	...	...	...
6	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	...	...	...
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	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	...	...	... (25)
10	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	...	...	... (25)
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	...	...	... (25)
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	...	...	... (25)
15	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	...	...	...
16	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	...	...	...
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	...	...	... (25)
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	...	...	... (25)
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	...	...	... (25)
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	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	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	...	...	... (25)
27	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)
28	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	...	...	... (25)
29	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)
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	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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	...	...	...
37	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	...	...	...
38	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	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	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	...	...	...
41	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	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-8Ni	Bar	SA/JIS G4303	SUS302	...	...	...
2	18Cr-8Ni	Bar	SA/JIS G4303	SUS304	...	...	...
3	18Cr-8Ni	Plate	SA/EN 10028-7	X5CrNi18-10	...	...	≤75
4	18Cr-8Ni	Plate	SA/EN 10028-7	X5CrNi18-10	...	...	≤75
5	18Cr-8Ni	Castings	SA-351	CF3A	J92500	...	...
6	18Cr-8Ni	Castings	SA-351	CF3A	J92500	...	...
7	18Cr-8Ni	Castings	SA-351	CF8A	J92600	...	...
8	18Cr-8Ni	Castings	SA-351	CF8A	J92600	...	...
9	18Cr-8Ni	Cast pipe	SA-451	CPF3A	J92500	...	...
10	18Cr-8Ni	Cast pipe	SA-451	CPF8A	J92600	...	...
11	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...	>130
12	18Cr-8Ni-N	Forgings	SA-965	F304LN	S30453	...	...
13	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...	≤130
14	18Cr-8Ni-N	Smls. tube	SA-213	TP304LN	S30453	...	...
15	18Cr-8Ni-N	Plate	SA-240	304LN	S30453	...	...
16	18Cr-8Ni-N	Wld. tube	SA-249	TP304LN	S30453	...	...
17	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304LN	S30453	...	...
18	18Cr-8Ni-N	Smls. pipe	SA-376	TP304LN	S30453	...	...
19	18Cr-8Ni-N	Smls. & wld. fittings	SA-403	304LN	S30453	WP	...
20	18Cr-8Ni-N	Bar	SA-479	304LN	S30453	...	...
21	18Cr-8Ni-N	Wld. tube	SA-688	TP304LN	S30453	...	...
22	18Cr-8Ni-N	Wld. pipe	SA-813	TP304LN	S30453	...	...
23	18Cr-8Ni-N	Wld. pipe	SA-814	TP304LN	S30453	...	...
24	18Cr-8Ni-N	Forgings	SA-182	F304N	S30451	...	...
25	18Cr-8Ni-N	Smls. tube	SA-213	TP304N	S30451	...	...
26	18Cr-8Ni-N	Smls. tube	SA-213	TP304N	S30451	...	...
27	18Cr-8Ni-N	Plate	SA-240	304N	S30451	...	...
28	18Cr-8Ni-N	Plate	SA-240	304N	S30451	...	...
29	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...
30	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...
(25) 31	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...
(25) 32	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...
33	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...
34	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304N	S30451	...	...
35	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304N	S30451	...	...
(25) 36	18Cr-8Ni-N	Wld. pipe	SA-312	TP304N	S30451	...	...
(25) 37	18Cr-8Ni-N	Wld. pipe	SA-312	TP304N	S30451	...	...
38	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	1	...
(25) 39	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N	S30451	...	...
(25) 40	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N	S30451	...	...
41	18Cr-8Ni-N	Smls. & wld. fittings	SA-403	304N	S30451	...	...
42	18Cr-8Ni-N	Bar	SA-479	304N	S30451	...	...
43	18Cr-8Ni-N	Bar	SA-479	304N	S30451	...	...
44	18Cr-8Ni-N	Wld. tube	SA-688	TP304N	S30451	...	...
45	18Cr-8Ni-N	Wld. tube	SA-688	TP304N	S30451	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	520	205	NP	427	399	NP	HA-1	G5, G24
2	8	1	520	205	816	427	816	NP	HA-1	G5, G12, G22, T7
3	8	1	520	210	NP	NP	550	343	HA-1	G5, G12, G30, H1
4	8	1	520	210	NP	NP	550	343	HA-1	G12, G30
5	8	1	530	240	NP	343	371	343	HA-3	G1, G5, G16, G17, G19
6	8	1	530	240	NP	NP	371	343	HA-3	G1, G19
7	8	1	530	240	NP	343	343	343	HA-1	G1, G5, G16, G17, G19
8	8	1	530	240	NP	NP	343	343	HA-1	G1, G19
9	8	1	530	240	NP	343	NP	NP	HA-3	G5, G16, G17, G19
10	8	1	530	240	NP	343	NP	NP	HA-1	G5, G16, G17, G19
11	8	1	485	205	NP	427	427	NP	HA-1	G5
12	8	1	485	205	NP	427	427	NP	HA-1	G5
13	8	1	515	205	NP	427	427	NP	HA-1	G5
14	8	1	515	205	NP	427	427	NP	HA-1	G5
15	8	1	515	205	NP	427	427	NP	HA-1	G5
16	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
17	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
18	8	1	515	205	NP	427	427	NP	HA-1	G5
19	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
20	8	1	515	205	NP	427	427	NP	HA-1	G5
21	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
22	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
23	8	1	515	205	NP	427	427	NP	HA-1	G5, W12, W14
24	8	1	550	240	NP	427	NP	NP	HA-1	G5
25	8	1	550	240	649	427	649	NP	HA-1	G5, G12, T7
26	8	1	550	240	649	NP	649	NP	HA-1	G12, T8
27	8	1	550	240	NP	427	649	343	HA-1	G5, G12, T7
28	8	1	550	240	NP	NP	649	343	HA-1	G12, T8
29	8	1	550	240	649	NP	NP	NP	HA-1	G5, G12, T7, W13
30	8	1	550	240	649	NP	NP	NP	HA-1	G12, T8, W13
31	8	1	550	240	649	NP	NP	NP	HA-1	G5, G12, G24, T5
32	8	1	550	240	649	NP	649	343	HA-1	G12, G24, T8
33	8	1	550	240	NP	NP	649	343	HA-1	G5, G12, G24, T5
34	8	1	550	240	649	427	649	343	HA-1	G5, G12, T7, W12, W13, W14
35	8	1	550	240	649	NP	649	343	HA-1	G12, T8, W13, W14
36	8	1	550	240	649	NP	649	343	HA-1	G5, G12, G24, T5
37	8	1	550	240	649	NP	649	343	HA-1	G12, G24, T8
38	8	1	550	240	NP	427	NP	NP	HA-1	G5, W12
39	8	1	550	240	649	427	649	343	HA-1	G5, G12, T7
40	8	1	550	240	649	NP	649	343	HA-1	G12, T8
41	8	1	550	240	NP	427	649	343	HA-1	G5, T7, W12, W14
42	8	1	550	240	649	NP	NP	NP	HA-1	G12, T8
43	8	1	550	240	649	427	NP	NP	HA-1	G5, G12, T7
44	8	1	550	240	NP	427	NP	NP	HA-1	G5, W12
45	8	1	550	240	NP	NP	649	343	HA-1	G5, G12, G24, T7

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
3	140	140	140	140	140	131	123	118	115	113	111	108	106	105	103
4	140	124	115	109	105	97.1	91.5	87.1	85.2	83.5	81.9	80.3	78.9	77.4	76.0
5	152	148	142	138	134	130	128	128	128	128	127	...	...	...	...
6	152	143	133	126	120	112	105	100	97.9	96.0	94.2	...	...	...	...
7	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
8	152	143	133	126	120	112	105	100	97.9	96.0	...	...	...	...	...
9	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
10	152	148	142	138	134	130	128	128	128	128	...	...	...	...	...
11	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
12	138	134	130	126	122	119	118	115	114	111	109	107	105	103	...
13	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
14	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
15	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
16	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
17	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
18	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
19	138	138	137	134	130	126	122	116	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	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
25	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
26	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
27	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
28	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
29	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
30	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
31	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
32	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
33	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
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	134	134	133	131	127	120	112	106	104	102	100	99.2	97.4	95.4	94.2
37	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
38	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
39	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
40	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
41	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
42	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
43	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
44	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
45	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, Division 1, 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	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	101	98.8	96.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	74.6	73.2	71.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
26	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
27	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
28	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
29	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
30	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
31	92.5	90.5	83.9	66.4	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	... (25)
32	68.0	66.7	65.9	63.0	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	... (25)
33	92.5	90.5	83.9	66.4	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	...
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	92.5	90.5	83.9	66.4	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	... (25)
37	68.0	66.7	65.9	63.0	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	... (25)
40	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	... (25)
41	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
42	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
43	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	92.5	90.5	83.9	66.4	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-8Ni-N	Wld. tube	SA-688	TP304N	S30451	...	...
2	18Cr-8Ni-N	Wld. pipe	SA-813	TP304N	S30451	...	...
3	18Cr-8Ni-N	Wld. pipe	SA-814	TP304N	S30451	...	...
4	18Cr-8Ni-N	Forgings	SA-965	F304N	S30451	...	...
5	18Cr-8Ni-N	Forgings	SA-965	F304N	S30451	...	...
6	18Cr-8Ni-N	Plate	SA/EN 10028-7	X2CrNiN18-10	...	...	≤75
7	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9	...	...	≤75
8	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9	...	...	≤75
9	18Cr-8Ni-4Si-N	Bar	SA-479	...	S21800	...	...
10	18Cr-9Ni-3Cu-Cb-N	Smls. tube	SA-213	...	S30432	...	...
11	18Cr-9Ni-3Cu-Cb-N	Smls. tube	SA-213	...	S30432	...	...
(25) 12	18Cr-10Ni-Cb	Forgings	SA-965	F348H	S34809	...	...
(25) 13	18Cr-10Ni-Cb	Forgings	SA-965	F348H	S34809	...	...
14	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	...
15	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	...
16	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	...
17	18Cr-10Ni-Cb	Cast pipe	SA-451	CPF8C	J92710	...	...
18	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	>130
(25) 19	18Cr-10Ni-Cb	Forgings	SA-965	F347	S34700	...	...
(25) 20	18Cr-10Ni-Cb	Forgings	SA-965	F347	S34700	...	...
(25) 21	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	>130
(25) 22	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	>130
(25) 23	18Cr-10Ni-Cb	Forgings	SA-965	F347H	S34709	...	...
(25) 24	18Cr-10Ni-Cb	Forgings	SA-965	F347H	S34709	...	...
25	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	>130
26	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	>130
(25) 27	18Cr-10Ni-Cb	Forgings	SA-965	F348	S34800	...	...
(25) 28	18Cr-10Ni-Cb	Forgings	SA-965	F348	S34800	...	...
29	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	>130
30	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	>130
(25) 31	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	≤130
(25) 32	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	≤130
(25) 33	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347	S34700	...	...
(25) 34	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347	S34700	...	...
35	18Cr-10Ni-Cb	Plate	SA-240	347	S34700	...	...
36	18Cr-10Ni-Cb	Plate	SA-240	347	S34700	...	...
37	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...
38	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...
(25) 39	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...
(25) 40	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...
41	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347	S34700	...	...
42	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347	S34700	...	...
(25) 43	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347	S34700	...	...
44	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347	S34700	...	...
(25) 45	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	1	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
I	III	VIII-1	XII							
1	8	1	550	240	NP	NP	649	343	HA-1	G12, G24, T8
2	8	1	550	240	NP	427	NP	NP	HA-1	G5, W12
3	8	1	550	240	NP	427	NP	NP	HA-1	G5, W12
4	8	1	550	240	NP	427	649	343	HA-1	G5, G12, T7
5	8	1	550	240	NP	NP	649	343	HA-1	G12, T8
6	8	1	550	270	NP	NP	427	343	HA-1	G5, G30
7	8	1	550	270	NP	NP	550	343	HA-1	G5, G12, G30
8	8	1	550	270	NP	NP	550	343	HA-1	G12, G30
9	8	3	655	345	NP	427	NP	NP	HA-6	...
10	8	1	590	235	816	NP	816	NP	HA-2	G5, T12
11	8	1	590	235	816	NP	816	NP	HA-2	T12
12	8	1	450	170	NP	NP	816	NP	HA-2	G5, T9
13	8	1	450	170	NP	NP	816	NP	HA-2	T9
14	8	1	485	205	NP	427	NP	NP	HA-2	G5, G16, G17, G19
15	8	1	485	205	NP	NP	816	343	HA-2	G1, G5, G12, G19, T7
16	8	1	485	205	NP	NP	816	343	HA-2	G1, G12, G19, T7
17	8	1	485	205	NP	427	NP	NP	HA-2	G5, G16, G17, G19
18	8	1	485	205	816	427	816	343	HA-2	G5, G12, T7
19	8	1	485	205	816	427	816	343	HA-2	G5, G12, T7
20	8	1	485	205	816	NP	816	343	HA-2	G12, T7
21	8	1	485	205	816	NP	NP	NP	HA-2	T9
22	8	1	485	205	816	427	816	NP	HA-2	G5, T8
23	8	1	485	205	NP	NP	816	NP	HA-2	T9
24	8	1	485	205	NP	427	816	NP	HA-2	G5, T8
25	8	1	485	205	816	NP	NP	NP	HA-2	T7
26	8	1	485	205	816	427	816	343	HA-2	G5, G12, T7
27	8	1	485	205	NP	NP	816	343	HA-2	G5, G12, T7
28	8	1	485	205	NP	NP	816	343	HA-2	G12, T7
29	8	1	485	205	816	NP	NP	NP	HA-2	T9
30	8	1	485	205	816	427	816	NP	HA-2	G5, T8
31	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T6
32	8	1	515	205	816	NP	816	NP	HA-2	G12, T7
33	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T6
34	8	1	515	205	816	NP	816	NP	HA-2	G12, T7
35	8	1	515	205	816	427	816	343	HA-2	G5, G12, T6
36	8	1	515	205	816	NP	816	343	HA-2	G12, T7
37	8	1	515	205	816	NP	NP	NP	HA-2	G12, T7, W13
38	8	1	515	205	816	427	NP	NP	HA-2	G5, G12, T6, W12, W13
39	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T6
40	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T7
41	8	1	515	205	816	427	816	343	HA-2	G5, G12, T6, W12, W13, W14
42	8	1	515	205	816	NP	816	343	HA-2	G12, T7, W13, W14
43	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T6
44	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T7
45	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	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
2	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
3	158	158	158	154	149	141	132	125	122	120	118	116	115	113	...
4	158	158	158	154	149	141	132	125	122	120	118	116	115	113	111
5	158	144	129	121	115	105	97.6	92.9	90.9	89.3	88.0	86.1	84.9	83.7	81.8
6	157	157	157	157	154	148	145	145	145	145	142	139	137	134	...
7	157	157	157	157	157	157	147	140	137	135	133	130	128	126	124
8	157	157	145	136	129	117	109	104	102	100	98.2	96.7	95.1	93.4	91.6
9	187	185	176	164	152	137	128	123	121	119	118	116	116	115	...
10	157	157	157	157	157	157	153	147	145	143	140	139	137	135	133
11	157	144	135	130	126	119	113	109	107	106	104	103	101	99.9	98.5
12	115	115	115	114	112	107	103	101	101	101	101	101	101	100	100
13	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
14	138	135	131	126	121	115	111	108	108	108	108	108	108	108	...
15	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
16	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
17	138	135	131	126	121	115	111	108	108	108	108	108	108	108	...
18	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
19	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
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	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
22	138	135	131	126	121	115	111	108	108	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	108
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	135	131	126	121	115	111	109	109	108	108	108	108	108	108
27	138	135	131	126	121	115	111	109	109	108	108	108	108	108	108
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	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
30	138	135	131	126	121	115	111	108	108	108	108	108	108	108	108
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	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
35	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
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	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
38	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
39	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
40	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
41	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
42	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
43	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
44	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
45	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	68.0	66.7	65.9	63.0	54.5	44.1	35.5	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	109	106	98.3	78.6	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
5	80.5	78.8	77.3	74.0	64.3	51.4	41.6	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	121	119	116	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	89.7	87.9	86.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	131	129	128	126	121	97.9	78.0	61.1	46.9	35.3	25.9	18.5	12.9	8.9	...	...	...
11	97.2	95.9	94.6	93.4	92.3	91.3	78.0	61.1	46.9	35.3	25.9	18.5	12.9	8.9	...	...	...
12	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	...	...	... (25)
13	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	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	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	...	...	...
16	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	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	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	...	...	...
19	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	...	...	... (25)
20	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	...	...	... (25)
21	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)
22	107	106	105	103	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	... (25)
23	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)
24	107	106	105	103	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	... (25)
25	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	...	...	...
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	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	...	...	... (25)
28	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	...	...	... (25)
29	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	...	...	...
30	107	106	105	103	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
31	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	...	...	... (25)
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	...	...	... (25)
33	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	...	...	... (25)
34	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	...	...	... (25)
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
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	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	...	...	... (25)
40	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	...	...	... (25)
41	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	...	...	...
42	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	...	...	...
43	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	...	...	... (25)
44	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	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347	S34700	...	...
(25) 2	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347	S34700	...	...
3	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	347	S34700	...	...
(25) 4	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP347	S34700	...	...
5	18Cr-10Ni-Cb	Bar	SA-479	347	S34700	...	...
6	18Cr-10Ni-Cb	Bar	SA-479	347	S34700	...	...
(25) 7	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347	S34700	...	...
(25) 8	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	≤130
(25) 9	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	≤130
(25) 10	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H	S34709	...	...
(25) 11	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H	S34709	...	...
(25) 12	18Cr-10Ni-Cb	Plate	SA-240	347H	S34709	...	...
(25) 13	18Cr-10Ni-Cb	Plate	SA-240	347H	S34709	...	...
14	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...	...
15	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...	...
(25) 16	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...	...
(25) 17	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...	...
(25) 18	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347H	S34709	...	...
(25) 19	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347H	S34709	...	...
(25) 20	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347H	S34709	...	...
(25) 21	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347H	S34709	...	...
(25) 22	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347H	S34709	...	...
(25) 23	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347H	S34709	...	...
(25) 24	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	347H	S34709	...	...
(25) 25	18Cr-10Ni-Cb	Bar	SA-479	347H	S34709	...	...
(25) 26	18Cr-10Ni-Cb	Bar	SA-479	347H	S34709	...	...
(25) 27	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347H	S34709	...	...
28	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP347H	S34709	...	...
29	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347LN	S34751	...	...
30	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347LN	S34751	...	...
31	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347LN	S34751	...	...
32	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347LN	S34751	...	...
33	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	≤130
34	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	≤130
35	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348	S34800	...	...
36	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348	S34800	...	...
37	18Cr-10Ni-Cb	Plate	SA-240	348	S34800	...	...
38	18Cr-10Ni-Cb	Plate	SA-240	348	S34800	...	...
39	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...
40	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...
(25) 41	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...
(25) 42	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...
43	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348	S34800	...	...
44	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348	S34800	...	...
45	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348	S34800	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	1	515	205	816	427	816	343	HA-2	G5, G12, T6
2	8	1	515	205	816	NP	816	343	HA-2	G12, T7
3	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T6, W12, W14
4	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
5	8	1	515	205	816	427	816	343	HA-2	G5, G12, G22, T6
6	8	1	515	205	816	NP	816	343	HA-2	G12, G22, T7
7	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
8	8	1	515	205	816	427	816	NP	HA-2	G5, T8
9	8	1	515	205	816	NP	816	NP	HA-2	T9
10	8	1	515	205	816	427	816	NP	HA-2	G5, T8
11	8	1	515	205	816	NP	816	NP	HA-2	T9
12	8	1	515	205	816	427	816	NP	HA-2	G5, T8
13	8	1	515	205	816	NP	816	NP	HA-2	T9
14	8	1	515	205	816	427	NP	NP	HA-2	G5, T8, W12, W13
15	8	1	515	205	816	NP	NP	NP	HA-2	T9, W13
16	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T8
17	8	1	515	205	816	NP	816	NP	HA-2	G24, T9
18	8	1	515	205	816	427	816	NP	HA-2	G5, T8, W12, W13, W14
19	8	1	515	205	816	NP	816	NP	HA-2	T9, W13, W14
20	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T8
21	8	1	515	205	816	NP	816	NP	HA-2	G24, T9
22	8	1	515	205	816	427	816	NP	HA-2	G5, T8
23	8	1	515	205	816	NP	816	NP	HA-2	T9
24	8	1	515	205	NP	427	816	NP	HA-2	G5, T8, W12, W14
25	8	1	515	205	816	427	NP	NP	HA-2	G5, T8
26	8	1	515	205	816	NP	NP	NP	HA-2	T9
27	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
28	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
29	8	1	515	205	NP	NP	593	NP	HA-2	G5, T8
30	8	1	515	205	NP	NP	593	NP	HA-2	...
31	8	1	515	205	NP	NP	593	NP	HA-2	G5, T8
32	8	1	515	205	NP	NP	593	NP	HA-2	...
33	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T6
34	8	1	515	205	816	NP	816	NP	HA-2	G12, T7
35	8	1	515	205	816	427	816	NP	HA-2	G5, G12, T6
36	8	1	515	205	816	NP	816	NP	HA-2	G12, T7
37	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T6
38	8	1	515	205	NP	NP	816	343	HA-2	G12, T7
39	8	1	515	205	816	NP	NP	NP	HA-2	G12, T7, W13
40	8	1	515	205	816	427	NP	NP	HA-2	G5, G12, T6, W12, W13
41	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T6
42	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T7
43	8	1	515	205	816	427	816	343	HA-2	G5, G12, T6, W12, W14
44	8	1	515	205	816	NP	816	343	HA-2	G12, T7
45	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	138	137	134	129	123	119	117	116	116	116	116	116	116	...
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	138	137	134	129	123	119	117	116	116	116	116	116	116	...
8	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
9	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
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	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
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	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
17	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
18	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
19	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
20	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
21	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
22	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
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	138	137	134	129	123	119	117	116	116	116	116	116	116	115
25	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
26	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
27	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
28	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
29	138	137	137	136	131	123	117	114	113	112	112	112	112	112	111
30	138	128	120	115	110	101	94.7	90.2	88.6	87.5	86.7	86.2	85.9	85.7	85.7
31	138	137	137	136	131	123	117	114	113	112	112	112	112	112	111
32	138	128	120	115	110	101	94.7	90.2	88.6	87.5	86.7	86.2	85.9	85.7	85.7
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	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
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	138	137	134	129	123	119	117	116	116	116	116	116	116	115
38	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
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	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
42	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
43	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
44	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
45	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	... (25)
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	...	...	... (25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
8	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)
9	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)
10	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)
11	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)
12	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)
13	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)
14	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
15	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	...	...	...
16	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	...	...	... (25)
17	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	...	...	... (25)
18	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)
19	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)
20	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	...	...	... (25)
21	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	...	...	... (25)
22	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)
23	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)
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)
25	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)
26	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)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	111	110	108	106	84.5	...	...	...	...	...	...	...	...	...	...	...	...
30	85.6	85.4	85.1	84.7	83.2	...	...	...	...	...	...	...	...	...	...	...	...
31	111	110	108	106	84.5	...	...	...	...	...	...	...	...	...	...	...	...
32	85.6	85.4	85.1	84.7	83.2	...	...	...	...	...	...	...	...	...	...	...	...
33	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	...	...	...
34	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	...	...	...
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
38	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	...	...	...
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	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	...	...	... (25)
42	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	...	...	... (25)
43	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	...	...	...
44	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	...	...	...
45	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	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348	S34800	...	...
2	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	1	...
3	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348	S34800	...	...
4	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348	S34800	...	...
5	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	348	S34800	...	...
6	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP348	S34800	...	...
7	18Cr-10Ni-Cb	Bar	SA-479	348	S34800	...	...
8	18Cr-10Ni-Cb	Bar	SA-479	348	S34800	...	...
9	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348	S34800	...	...
10	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348	S34800	...	...
11	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	≤130
12	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	≤130
13	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H	S34809	...	...
14	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H	S34809	...	...
15	18Cr-10Ni-Cb	Plate	SA-240	348H	S34809	...	...
16	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...
17	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...
(25) 18	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...
(25) 19	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...
20	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348H	S34809	...	...
21	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348H	S34809	...	...
22	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348H	S34809	...	...
23	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348H	S34809	...	...
24	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	348H	S34809	...	...
25	18Cr-10Ni-Cb	Bar	SA-479	348H	S34809	...	...
26	18Cr-10Ni-Cb	Bar	SA-479	348H	S34809	...	...
27	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348H	S34809	...	...
28	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348H	S34809	...	...
29	18Cr-10Ni-Cb	Bar	SA/JIS G4303	SUS347	...	...	...
30	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347HFG	S34710	...	...
31	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347HFG	S34710	...	...
32	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	>9.5
33	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	>9.5
34	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	>9.5
35	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	>9.5
(25) 36	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	>9.5
(25) 37	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	>9.5
38	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	>9.5
39	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	>9.5
40	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	>9.5
41	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	>9.5
(25) 42	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	>9.5
43	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	>130
44	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	>130
(25) 45	18Cr-10Ni-Ti	Forgings	SA-965	F321	S32100	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	515	205	NP	NP	816	343	HA-2	G12, G24, T7
2	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
3	8	1	515	205	816	427	816	343	HA-2	G5, G12, H1, T6
4	8	1	515	205	816	NP	816	343	HA-2	G12, H1, T7
5	8	1	515	205	NP	427	816	343	HA-2	G5, G12, H2, T6, W12, W14
6	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
7	8	1	515	205	816	427	816	343	HA-2	G5, G12, G22, H1, T6
8	8	1	515	205	816	NP	816	343	HA-2	G12, G22, H1, T7
9	8	1	515	205	NP	427	NP	NP	HA-2	G5, H1, W12
10	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
11	8	1	515	205	816	427	816	NP	HA-2	G5, T8
12	8	1	515	205	816	NP	816	NP	HA-2	T9
13	8	1	515	205	816	427	816	NP	HA-2	G5, H2, T8
14	8	1	515	205	816	NP	816	NP	HA-2	H2, T9
15	8	1	515	205	NP	427	NP	NP	HA-2	G5, H2
16	8	1	515	205	816	427	NP	NP	HA-2	G5, T8, W12, W13
17	8	1	515	205	816	NP	NP	NP	HA-2	T9, W13
18	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T8
19	8	1	515	205	816	NP	816	NP	HA-2	G24, T9
20	8	1	515	205	816	427	816	NP	HA-2	G5, H2, T8, W12, W14
21	8	1	515	205	816	NP	816	NP	HA-2	H2, T9
22	8	1	515	205	NP	NP	816	NP	HA-2	G5, G24, H2, T8
23	8	1	515	205	NP	NP	816	NP	HA-2	G24, H2, T9
24	8	1	515	205	NP	427	816	NP	HA-2	G5, H2, T8, W12, W14
25	8	1	515	205	816	427	NP	NP	HA-2	G5, H2, T8
26	8	1	515	205	816	NP	NP	NP	HA-2	H2, T9
27	8	1	515	205	NP	427	NP	NP	HA-2	G5, H2, W12
28	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
29	8	1	520	205	816	427	816	NP	HA-2	G5, G12, G22, T6
30	8	1	550	205	732	NP	NP	NP	HA-2	G5, T8
31	8	1	550	205	732	NP	NP	NP	HA-2	T9
32	8	1	485	170	816	427	816	NP	HA-2	G5, G12, T7
33	8	1	485	170	816	NP	816	NP	HA-2	G12, T7
34	8	1	485	170	816	427	816	NP	HA-2	G5, G12, T7, W12, W13, W14
35	8	1	485	170	816	NP	816	NP	HA-2	G12, T7, W13, W14
36	8	1	485	170	NP	427	816	343	HA-2	G5, G12, T7
37	8	1	485	170	NP	NP	816	343	HA-2	G12, T7
38	8	1	485	170	816	427	816	NP	HA-2	G5, T8
39	8	1	485	170	816	NP	816	NP	HA-2	T8
40	8	1	485	170	816	427	816	NP	HA-2	G5, T8, W12, W13, W14
41	8	1	485	170	816	NP	816	NP	HA-2	T8, W13, W14
42	8	1	485	170	NP	427	816	NP	HA-2	G5, T8
43	8	1	485	205	816	427	816	NP	HA-2	G5, G12, T6
44	8	1	485	205	816	NP	816	NP	HA-2	G12, T7
45	8	1	485	205	816	427	816	343	HA-2	G5, G12, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	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
2	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
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	138	137	134	129	123	119	117	116	116	116	116	116	116	...
7	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
8	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
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	...
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	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
14	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
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	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
19	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
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	117	117	117	114	110	104	101	98.9	98.6	98.6	98.6	98.6	98.6	98.6	98.1
23	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
24	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
25	138	138	137	134	129	123	119	117	116	116	116	116	116	116	115
26	138	132	126	122	118	111	105	99.8	97.9	96.1	95.0	94.4	93.8	93.2	92.5
27	138	138	137	134	129	123	119	117	116	116	116	116	116	116	...
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	138	138	138	138	138	134	132	131	131	130	130	128	127	125
31	138	129	123	120	116	110	105	102	100	98.5	97.2	96.0	94.9	93.9	92.9
32	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
33	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
34	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
35	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
36	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
37	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
38	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
39	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
40	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
41	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
42	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	95.4
43	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
44	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
45	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	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	...	...	...
8	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	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
12	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	...	...	...
13	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
14	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	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
17	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	...	...	...
18	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	...	...	...
19	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	...	...	...
20	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
21	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	...	...	...
22	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	...	...	...
23	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	...	...	...
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	115	114	113	109	92.3	69.3	53.9	41.4	31.8	23.9	18.8	14.6	10.8	7.83	...	...	...
26	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	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	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	...	...	...
30	124	123	122	120	107	85.4	67.0	51.7	39.3	29.4	21.7	...	...	...	...	...	...
31	92.0	91.0	90.1	89.0	88.0	85.4	67.0	51.7	39.3	29.4	21.7	...	...	...	...	...	...
32	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	...	...	...
33	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	...	...	...
34	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	...	...	...
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
38	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	...	...	...
39	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	...	...	...
40	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	...	...	...
41	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	...	...	...
42	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	...	...	...
43	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	...	...	...
44	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	...	...	...
45	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	...	...	...

(25)

(25)

(25)

(25)

(25)

(25)

(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	18Cr-10Ni-Ti	Forgings	SA-965	F321	S32100	...	...
(25) 2	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	>130
(25) 3	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	>130
(25) 4	18Cr-10Ni-Ti	Forgings	SA-965	F321H	S32109	...	...
(25) 5	18Cr-10Ni-Ti	Forgings	SA-965	F321H	S32109	...	...
6	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10	...	...	≤75
7	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10	...	...	≤75
8	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	≤130
9	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	≤130
10	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	≤130
11	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...	...
12	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...	...
13	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...	...
14	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...	...
15	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...	...
16	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...	...
17	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...
18	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...
(25) 19	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...
(25) 20	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...
21	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	≤9.5
22	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	≤9.5
23	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	≤9.5
24	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	≤9.5
25	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	1	...
(25) 26	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	≤9.5
27	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	≤9.5
28	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	≤9.5
29	18Cr-10Ni-Ti	Smls. & wld. fittings	SA-403	321	S32100	...	...
30	18Cr-10Ni-Ti	Wld. pipe	SA-409	TP321	S32100	...	...
(25) 31	18Cr-10Ni-Ti	Bar	SA-479	321	S32100	...	...
(25) 32	18Cr-10Ni-Ti	Bar	SA-479	321	S32100	...	...
(25) 33	18Cr-10Ni-Ti	Bar	SA-479	321	S32100	...	...
(25) 34	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321	S32100	...	...
35	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321	S32100	...	...
(25) 36	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	≤130
(25) 37	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	≤130
(25) 38	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321H	S32109	...	...
(25) 39	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321H	S32109	...	...
(25) 40	18Cr-10Ni-Ti	Plate	SA-240	321H	S32109	...	...
(25) 41	18Cr-10Ni-Ti	Plate	SA-240	321H	S32109	...	...
42	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...
43	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...
(25) 44	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...
(25) 45	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	485	205	816	NP	816	343	HA-2	G12, T7
2	8	1	485	205	816	427	816	NP	HA-2	G5, T8
3	8	1	485	205	816	NP	816	NP	HA-2	T8
4	8	1	485	205	NP	427	816	NP	HA-2	G5, T8
5	8	1	485	205	NP	NP	816	NP	HA-2	T8
6	8	1	500	200	NP	NP	550	343	HA-2	G12, G30
7	8	1	500	200	NP	NP	550	343	HA-2	G5, G12, G30, T6
8	8	1	515	205	816	NP	NP	NP	HA-2	G5, G12, T7
9	8	1	515	205	816	NP	816	343	HA-2	G12, T7
10	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T6
11	8	1	515	205	816	NP	NP	NP	HA-2	G5, G12, T7
12	8	1	515	205	816	NP	816	NP	HA-2	G12, T7
13	8	1	515	205	NP	427	816	NP	HA-2	G5, G12, T6
14	8	1	515	205	816	NP	NP	NP	HA-2	G5, G12, T7
15	8	1	515	205	816	NP	816	343	HA-2	G12, T7
16	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T6
17	8	1	515	205	816	NP	NP	NP	HA-2	G12, T7, W13
18	8	1	515	205	816	427	NP	NP	HA-2	G5, G12, T7, W12, W13
19	8	1	515	205	816	NP	816	343	HA-2	G5, G12, G24, T7
20	8	1	515	205	816	NP	816	343	HA-2	G12, G24, T7
21	8	1	515	205	816	427	816	343	HA-2	G5, G12, T7
22	8	1	515	205	816	NP	816	343	HA-2	G12, T7
23	8	1	515	205	816	427	816	343	HA-2	G5, G12, T7, W12, W13, W14
24	8	1	515	205	816	NP	816	343	HA-2	T7, W13, W14
25	8	1	515	205	NP	427	NP	NP	HA-2	G5, H1, W12
26	8	1	515	205	816	NP	NP	NP	HA-2	G5, G12, T7
27	8	1	515	205	816	NP	816	NP	HA-2	G12, H1, T7
28	8	1	515	205	NP	427	816	NP	HA-2	G5, G12, T6
29	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T6, W12, W14
30	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
31	8	1	515	205	816	NP	NP	NP	HA-2	G5, G12, T7
32	8	1	515	205	816	NP	816	343	HA-2	G12, G22, T7
33	8	1	515	205	NP	427	816	343	HA-2	G5, G12, G22, T6
34	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
35	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
36	8	1	515	205	816	427	816	NP	HA-2	G5, T8
37	8	1	515	205	816	NP	816	NP	HA-2	T8
38	8	1	515	205	816	427	816	NP	HA-2	G5, T8
39	8	1	515	205	816	NP	816	NP	HA-2	T8
40	8	1	515	205	816	427	816	NP	HA-2	G5, T8
41	8	1	515	205	816	NP	816	NP	HA-2	T8
42	8	1	515	205	816	NP	NP	NP	HA-2	T8, W13
43	8	1	515	205	816	427	NP	NP	HA-2	G5, T8, W12, W13
44	8	1	515	205	816	NP	816	NP	HA-2	G5, G24, T8
45	8	1	515	205	816	NP	816	NP	HA-2	G24, T8

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
2	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
3	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
4	138	135	130	126	123	121	121	121	121	121	121	119	117	115	114
5	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
6	133	125	119	114	110	103	96.5	91.5	89.4	87.6	86.1	84.8	83.7	82.8	81.9
7	133	133	133	133	133	133	130	124	121	118	116	114	113	112	111
8	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
9	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
10	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
11	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
12	138	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
13	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
14	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
15	138	130	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	130	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
18	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
19	117	117	117	114	112	110	110	108	106	104	102	101	99.4	98.1	97.5
20	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
21	138	138	138	135	132	129	129	127	125	123	120	119	117	115	114
22	138	130	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	120	119	117	115	...
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	121	119	117	115	114
30	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
31	138	138	138	135	132	129	129	127	125	123	120	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	121	119	117	115	114
34	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
35	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
36	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
37	138	131	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	121	119	117	115	114
39	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
40	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
41	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
42	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
43	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
44	117	117	117	114	112	110	110	108	106	104	102	101	99.4	98.1	97.4
45	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

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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)
2	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)
3	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	...	...	... (25)
4	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)
5	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	...	...	... (25)
6	81.2	80.4	79.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	110	109	87.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	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	...	...	...
9	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	...	...	...
10	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	...	...	...
11	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	...	...	...
12	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	...	...	...
13	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	...	...	...
14	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	...	...	...
15	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	...	...	...
16	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	...	...	...
17	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	...	...	...
18	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	...	...	...
19	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	...	...	... (25)
20	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	...	...	... (25)
21	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	...	...	...
22	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	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	... (25)
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	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	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	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	...	...	... (25)
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	...	...	... (25)
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	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	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)
37	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	...	...	... (25)
38	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)
39	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	...	...	... (25)
40	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)
41	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	...	...	... (25)
42	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	...	...	...
43	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	...	...	...
44	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	...	...	... (25)
45	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	...	...	... (25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	≤9.5
2	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	≤9.5
3	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	≤9.5
4	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	≤9.5
(25) 5	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	≤9.5
(25) 6	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	≤9.5
(25) 7	18Cr-10Ni-Ti	Smls. & wld. fittings	SA-403	321H	S32109	...	...
(25) 8	18Cr-10Ni-Ti	Bar	SA-479	321H	S32109	...	...
(25) 9	18Cr-10Ni-Ti	Bar	SA-479	321H	S32109	...	...
10	18Cr-12Ni-2Mo	Castings	SA-351	CF3M	J92800	...	...
11	18Cr-12Ni-2Mo	Castings	SA-351	CF3M	J92800	...	...
12	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF3M	J92800	...	...
(25) 13	18Cr-12Ni-2Mo	Castings	SA-351	CF8M	J92900	...	...
(25) 14	18Cr-12Ni-2Mo	Castings	SA-351	CF8M	J92900	...	...
15	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF8M	J92900	...	...
16	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321H	S32109	...	...
17	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321H	S32109	...	...
18	18Cr-10Ni-Ti	Bar	SA/JIS G4303	SUS321	...	...	...
19	18Cr-11Ni	Plate	SA-240	305	S30500	...	...
20	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...	>130
21	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...	>130
22	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...	≤130
23	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...	≤130
24	18Cr-13Ni-3Mo	Forgings	SA-182	F317	S31700	...	≤130
25	18Cr-13Ni-3Mo	Forgings	SA-182	F317	S31700	...	≤130
26	18Cr-13Ni-3Mo	Plate	SA-240	317	S31700	...	...
27	18Cr-13Ni-3Mo	Plate	SA-240	317	S31700	...	...
28	18Cr-13Ni-3Mo	Plate	SA-240	317L	S31703	...	...
29	18Cr-13Ni-3Mo	Plate	SA-240	317L	S31703	...	...
30	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...
31	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...
32	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...
33	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317L	S31703	...	...
34	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317L	S31703	...	...
35	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317	S31700	...	...
36	18Cr-13Ni-3Mo	Smls. pipe	SA-312	TP317	S31700	...	...
37	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317	S31700	...	...
38	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317	S31700	...	...
39	18Cr-13Ni-3Mo	Smls. pipe	SA-312	TP317L	S31703	...	...
40	18Cr-13Ni-3Mo	Smls. pipe	SA-312	TP317L	S31703	...	...
41	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317L	S31703	...	...
42	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317L	S31703	...	...
43	18Cr-13Ni-3Mo	Smls. & wld. fittings	SA-403	317	S31700	...	...
44	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	CR	...
45	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	CR	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	1	515	205	816	427	816	NP	HA-2	G5, T8
2	8	1	515	205	816	NP	816	NP	HA-2	T8
3	8	1	515	205	816	427	816	NP	HA-2	G5, T8, W12, W13, W14
4	8	1	515	205	816	NP	816	NP	HA-2	T8, W13, W14
5	8	1	515	205	816	427	816	NP	HA-2	G5, T8
6	8	1	515	205	816	NP	816	NP	HA-2	T8
7	8	1	515	205	NP	427	816	NP	HA-2	G5, T8, W12, W14
8	8	1	515	205	816	NP	816	NP	HA-2	T8
9	8	1	515	205	816	427	816	NP	HA-2	G5, T8
10	8	1	485	205	NP	427	454	343	HA-4	G1, G5, G16, G17, G19
11	8	1	485	205	NP	NP	454	343	HA-4	G1, G19
12	8	1	485	205	NP	427	427	NP	HA-4	G1, G5, G16, G17, G19
13	8	1	485	205	816	427	816	343	HA-2	G1, G5, G12, G16, G17, G19, T6
14	8	1	485	205	816	NP	816	343	HA-2	G1, G12, G19, T8
15	8	1	485	205	NP	427	427	NP	HA-2	G1, G5, G16, G17, G19
16	8	1	515	205	NP	427	NP	NP	HA-2	G5, H2, W12
17	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
18	8	1	520	205	NP	427	816	NP	HA-2	G5, G12, G22, H1, T6
19	8	1	515	205	NP	427	NP	NP	HA-1	G5
20	8	1	450	170	NP	NP	454	343	HA-4	G5
21	8	1	450	170	NP	NP	454	343	HA-4	...
22	8	1	485	170	NP	NP	454	343	HA-4	G5
23	8	1	485	170	NP	NP	454	343	HA-4	...
24	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, T8
25	8	1	515	205	NP	NP	816	343	HA-2	G12, T9
26	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, T8
27	8	1	515	205	NP	NP	816	343	HA-2	G12, T9
28	8	1	515	205	NP	NP	454	343	HA-4	G5
29	8	1	515	205	NP	NP	454	343	HA-4	...
30	8	1	515	205	NP	427	NP	NP	HA-2	G5, W12
31	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T8
32	8	1	515	205	NP	NP	816	343	HA-2	G12, G24, T9
33	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
34	8	1	515	205	NP	NP	454	343	HA-4	G24
35	8	1	515	205	NP	427	816	343	HA-2	G5, G12, T8, W12, W14
36	8	1	515	205	NP	NP	816	343	HA-2	G12, T9
37	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T8
38	8	1	515	205	NP	NP	816	343	HA-2	G12, G24, T9
39	8	1	515	205	NP	NP	454	343	HA-4	G5
40	8	1	515	205	NP	NP	454	343	HA-4	...
41	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
42	8	1	515	205	NP	NP	454	343	HA-4	G24
43	8	1	515	205	NP	NP	816	343	HA-2	G5, G12, T8, W14
44	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
45	8	1	515	205	NP	NP	454	343	HA-4	G24

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	121	119	117	115	114
2	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
3	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
4	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
5	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
6	138	131	123	118	114	106	99.7	94.5	92.3	90.7	89.4	87.5	86.9	85.7	85.0
7	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
8	138	131	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	136	134	133	125	119	116	114	112	111	110	108	107
11	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
12	138	138	138	136	134	133	125	119	116	114	112	111	110	108	...
13	138	138	138	136	134	133	125	119	116	114	112	111	110	108	107
14	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
15	138	138	138	136	134	133	125	119	116	114	112	111	110	108	...
16	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
17	138	138	138	135	132	129	129	127	125	123	120	119	117	115	...
18	138	138	138	135	132	129	129	127	125	123	121	119	117	115	114
19	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
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	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
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	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
25	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
26	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
27	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
28	138	138	138	137	135	131	123	118	116	113	111	109	107	105	103
29	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
30	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...
31	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
32	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
33	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
34	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
35	138	138	138	138	138	134	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	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	91.4
38	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
39	138	138	138	138	135	131	123	118	116	113	111	109	107	105	103
40	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
41	117	117	117	117	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
42	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
43	138	138	138	138	138	134	126	119	116	114	112	111	110	108	108
44	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
45	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

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
2	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	...	...	...
3	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	...	...	...
4	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	...	...	...
5	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)
6	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	...	...	... (25)
7	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)
8	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	...	...	... (25)
9	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)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	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	...	...	... (25)
14	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	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	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	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	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	...	...	...
25	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	...	...	...
26	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	...	...	...
27	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	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	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	...	...	...
32	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	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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	...	...	...
38	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	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	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	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-S	...
2	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-S	...
3	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-W	...
4	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-W	...
5	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-WU	...
6	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-WU	...
7	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-WX	...
8	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-WX	...
9	18Cr-15Ni-4Si	Forgings	SA-182	...	S30600	Sol. ann.	...
10	18Cr-15Ni-4Si	Forgings	SA-182	...	S30600	Sol. ann.	...
11	18Cr-15Ni-4Si	Plate	SA-240	...	S30600	Sol. ann.	≤50
12	18Cr-15Ni-4Si	Plate	SA-240	...	S30600	Sol. ann.	≤50
13	18Cr-15Ni-4Si	Smls. & wld. pipe	SA-312	...	S30600	Sol. ann.	...
14	18Cr-15Ni-4Si	Smls. & wld. pipe	SA-312	...	S30600	Sol. ann.	...
15	18Cr-15Ni-4Si	Wld. pipe	SA-312	...	S30600	Sol. ann.	...
16	18Cr-15Ni-4Si	Wld. pipe	SA-312	...	S30600	Sol. ann.	...
17	18Cr-15Ni-4Si	Bar	SA-479	...	S30600	Sol. ann.	≤100
18	18Cr-15Ni-4Si	Bar	SA-479	...	S30600	Sol. ann.	≤100
19	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15	S38100	...	...
20	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15	S38100	...	...
21	18Cr-18Ni-2Si	Plate	SA-240	XM-15	S38100	...	...
22	18Cr-18Ni-2Si	Plate	SA-240	XM-15	S38100	...	...
23	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15	S38100	...	...
24	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15	S38100	...	...
25	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15	S38100	...	...
26	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15	S38100	...	...
27	18Cr-20Ni-5.5Si	Smls. tube	SA-213	...	S32615	Sol. ann.	...
28	18Cr-20Ni-5.5Si	Smls. tube	SA-213	...	S32615	Sol. ann.	...
29	18Cr-20Ni-5.5Si	Plate	SA-240	...	S32615	Sol. ann.	...
30	18Cr-20Ni-5.5Si	Plate	SA-240	...	S32615	Sol. ann.	...
31	18Cr-20Ni-5.5Si	Smls. & wld. pipe	SA-312	...	S32615	Sol. ann.	...
32	18Cr-20Ni-5.5Si	Smls. & wld. pipe	SA-312	...	S32615	Sol. ann.	...
33	18Cr-20Ni-5.5Si	Wld. pipe	SA-312	...	S32615	Sol. ann.	...
34	18Cr-20Ni-5.5Si	Wld. pipe	SA-312	...	S32615	Sol. ann.	...
35	18Cr-20Ni-5.5Si	Bar	SA-479	...	S32615	Sol. ann.	...
36	18Cr-20Ni-5.5Si	Bar	SA-479	...	S32615	Sol. ann.	...
37	19Cr-9Ni- $\frac{1}{2}$ Mo	Castings	SA-351	CF10	J92590	...	...
38	19Cr-9Ni- $\frac{1}{2}$ Mo	Castings	SA-351	CF10	J92590	...	...
39	19Cr-9Ni-2Mo	Castings	SA-351	CF10M	...	...	...
40	19Cr-9Ni-2Mo	Castings	SA-351	CF10M	...	...	...
41	19Cr-10Ni-3Mo	Castings	SA-351	CG8M	J93000	...	...
42	19Cr-10Ni-3Mo	Castings	SA-351	CG8M	J93000	...	...
43	19Cr-15Ni-4Mo	Smls. tube	SA-213	...	S31725	...	...
44	19Cr-15Ni-4Mo	Smls. tube	SA-213	...	S31725	...	...
45	19Cr-15Ni-4Mo	Plate	SA-240	...	S31725	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	1	515	205	NP	NP	454	343	HA-4	G5
2	8	1	515	205	NP	NP	454	343	HA-4	...
3	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
4	8	1	515	205	NP	NP	454	343	HA-4	G24
5	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
6	8	1	515	205	NP	NP	454	343	HA-4	G24
7	8	1	515	205	NP	NP	454	343	HA-4	G5, G24
8	8	1	515	205	NP	NP	454	343	HA-4	G24
9	8	1	540	240	NP	NP	149	NP	HA-2	G5, G32, H6
10	8	1	540	240	NP	NP	149	NP	HA-2	G32, H6
11	8	1	540	240	NP	NP	149	NP	HA-2	G5, G32, H6
12	8	1	540	240	NP	NP	149	NP	HA-2	G32, H6
13	8	1	540	240	NP	NP	149	NP	HA-2	G5, G32, H6
14	8	1	540	240	NP	NP	149	NP	HA-2	G32, H6
15	8	1	540	240	NP	NP	149	NP	HA-2	G5, G24, G32, H6
16	8	1	540	240	NP	NP	149	NP	HA-2	G24, G32, H6
17	8	1	540	240	NP	NP	149	NP	HA-2	G5, G32, H6
18	8	1	540	240	NP	NP	149	NP	HA-2	G32, H6
19	8	1	515	205	NP	NP	538	343	HA-2	G5
20	8	1	515	205	NP	NP	538	343	HA-2	...
21	8	1	515	205	NP	NP	538	343	HA-2	G5
22	8	1	515	205	NP	NP	538	343	HA-2	...
23	8	1	515	205	NP	NP	538	343	HA-2	G5, G24
24	8	1	515	205	NP	NP	538	343	HA-2	G24
25	8	1	515	205	NP	NP	510	343	HA-2	G5, G24
26	8	1	515	205	NP	NP	538	343	HA-2	G24
27	8	1	540	220	NP	NP	204	NP	HA-2	G5, G32, H6
28	8	1	540	220	NP	NP	204	NP	HA-2	G32, H6
29	8	1	540	220	NP	NP	204	NP	HA-2	G5, G32, H6
30	8	1	540	220	NP	NP	204	NP	HA-2	G32, H6
31	8	1	550	220	NP	NP	204	NP	HA-2	G5, G32, H6
32	8	1	550	220	NP	NP	204	NP	HA-2	G32, H6
33	8	1	550	220	NP	NP	204	NP	HA-2	G5, G24, G32, H6
34	8	1	550	220	NP	NP	204	NP	HA-2	G24, G32, H6
35	8	1	550	220	NP	NP	204	NP	HA-2	G5, G32, H6
36	8	1	550	220	NP	NP	204	NP	HA-2	G32, H6
37	8	1	485	205	NP	NP	816	343	HA-1	G1, G5, G19, T6
38	8	1	485	205	NP	NP	816	343	HA-1	G1, G19, T7
39	8	1	485	205	NP	NP	816	NP	HA-2	G1, G5, G19, T6
40	8	1	485	205	NP	NP	816	NP	HA-2	G1, G19, T8
41	8	1	515	240	NP	NP	538	343	HA-2	G1, G5, G19
42	8	1	515	240	NP	NP	538	343	HA-2	G1, G19
43	8	4	515	205	NP	NP	204	204	HA-4	G5, G32
44	8	4	515	205	NP	NP	204	204	HA-4	G32
45	8	4	515	205	NP	NP	204	204	HA-4	G5, G32

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	137	135	131	123	118	116	113	111	109	107	105	103
2	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
3	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
4	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
5	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
6	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
7	117	117	117	116	115	111	105	99.9	97.9	96.0	94.2	93.0	91.1	89.3	87.4
8	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
9	153	...	147	...	135	...	...	...	...	...	...	...	...	...	...
10	153	...	124	...	111	...	...	...	...	...	...	...	...	...	...
11	153	...	147	...	135	...	...	...	...	...	...	...	...	...	...
12	153	...	124	...	111	...	...	...	...	...	...	...	...	...	...
13	153	...	147	...	135	...	...	...	...	...	...	...	...	...	...
14	153	...	124	...	111	...	...	...	...	...	...	...	...	...	...
15	130	...	125	...	116	...	...	...	...	...	...	...	...	...	...
16	130	...	105	...	94.4	...	...	...	...	...	...	...	...	...	...
17	153	...	147	...	135	...	...	...	...	...	...	...	...	...	...
18	153	...	124	...	111	...	...	...	...	...	...	...	...	...	...
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	138	138	137	134	130	126	122	116	114	111	109	107	105	103	101
22	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
23	117	117	117	114	111	107	103	98.5	96.5	94.7	92.8	90.9	89.1	87.1	85.9
24	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
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	147	...	147	...	147	145	...	...	...	...	...	...	...	...	...
28	147	...	121	...	113	107	...	...	...	...	...	...	...	...	...
29	147	...	147	...	147	145	...	...	...	...	...	...	...	...	...
30	147	...	121	...	113	107	...	...	...	...	...	...	...	...	...
31	147	...	147	...	147	145	...	...	...	...	...	...	...	...	...
32	147	...	121	...	114	106	...	...	...	...	...	...	...	...	...
33	125	...	125	...	125	124	...	...	...	...	...	...	...	...	...
34	125	...	103	...	97.2	90.4	...	...	...	...	...	...	...	...	...
35	147	...	147	...	147	145	...	...	...	...	...	...	...	...	...
36	147	...	121	...	114	106	...	...	...	...	...	...	...	...	...
37	138	134	130	126	122	119	118	115	114	111	109	107	105	103	101
38	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
39	138	138	138	136	134	133	125	119	116	114	112	111	110	108	107
40	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
41	148	146	143	139	135	132	128	122	120	117	116	114	113	112	111
42	148	139	127	120	113	102	94.9	90.0	88.4	87.2	86.0	84.7	83.5	82.9	81.7
43	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
44	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
45	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	99.3	98.0	93.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	73.6	72.4	70.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	99.3	98.0	93.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	73.6	72.4	70.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	84.0	83.2	79.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	62.6	61.3	60.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	84.0	83.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	62.6	61.3	60.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	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	...	...	...
38	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	...	...	...
39	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	...	...	...
40	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	...	...	...
41	109	97.7	72.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	80.5	78.9	77.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	19Cr-15Ni-4Mo	Plate	SA-240	...	S31725	...	...
2	19Cr-15Ni-4Mo	Wld. tube	SA-249	...	S31725	...	...
3	19Cr-15Ni-4Mo	Wld. tube	SA-249	...	S31725	...	...
4	19Cr-15Ni-4Mo	Smls. pipe	SA-312	...	S31725	...	...
5	19Cr-15Ni-4Mo	Smls. pipe	SA-312	...	S31725	...	...
6	19Cr-15Ni-4Mo	Wld. pipe	SA-312	...	S31725	...	...
7	19Cr-15Ni-4Mo	Wld. pipe	SA-312	...	S31725	...	...
8	19Cr-15Ni-4Mo	Wld. pipe	SA-358	...	S31725	...	...
9	19Cr-15Ni-4Mo	Wld. pipe	SA-358	...	S31725	...	...
10	19Cr-15Ni-4Mo	Smls. pipe	SA-376	...	S31725	...	...
11	19Cr-15Ni-4Mo	Smls. pipe	SA-376	...	S31725	...	...
12	19Cr-15Ni-4Mo	Fittings	SA-403	...	S31725	...	...
13	19Cr-15Ni-4Mo	Wld. pipe	SA-409	...	S31725	...	...
14	19Cr-15Ni-4Mo	Wld. pipe	SA-409	...	S31725	...	...
15	19Cr-15Ni-4Mo	Bar	SA-479	...	S31725	...	...
16	19Cr-15Ni-4Mo	Bar	SA-479	...	S31725	...	...
17	20Cr-3Ni-1.5Mo-N	Plate	SA-240	...	S32003	...	$t > 5$
18	20Cr-3Ni-1.5Mo-N	Wld. pipe	SA-790	...	S32003	...	...
19	20Cr-3Ni-1.5Mo-N	Sheet	SA-240	...	S32003	...	$t \leq 5$
20	20Cr-3Ni-1.5Mo-N	Smls. tube	SA-789	...	S32003	...	$t \leq 5$
21	20Cr-3Ni-1.5Mo-N	Wld. tube	SA-789	...	S32003	...	$t \leq 5$
22	20Cr-3Ni-1.5Mo-N	Smls. tube	SA-789	...	S32003	...	$t > 5$
23	20Cr-3Ni-1.5Mo-N	Wld. tube	SA-789	...	S32003	...	$t > 5$
24	20Cr-10Ni	Bar	SA-479	ER308	S30880	...	...
25	20Cr-18Ni-6Mo	Castings	SA-351	CK3MCuN	J93254	...	...
26	20Cr-18Ni-6Mo	Castings	SA-351	CK3MCuN	J93254	...	...
27	20Cr-18Ni-6Mo	Forgings	SA-182	F44	S31254	...	...
28	20Cr-18Ni-6Mo	Forgings	SA-182	F44	S31254	...	...
29	20Cr-18Ni-6Mo	Fittings	SA-403	...	S31254	...	...
30	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...	$t > 5$
31	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...	$t > 5$
32	20Cr-18Ni-6Mo	Plate	SA-240	...	S31254	...	> 5
33	20Cr-18Ni-6Mo	Plate	SA-240	...	S31254	...	> 5
34	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...	$t > 5$
35	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...	$t > 5$
36	20Cr-18Ni-6Mo	Smls. pipe	SA-312	...	S31254	...	$t > 5$
37	20Cr-18Ni-6Mo	Smls. pipe	SA-312	...	S31254	...	$t > 5$
38	20Cr-18Ni-6Mo	Wld. pipe	SA-312	...	S31254	...	$t > 5$
39	20Cr-18Ni-6Mo	Wld. pipe	SA-312	...	S31254	...	$t > 5$
40	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...	$t \geq 5$
41	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...	$t \geq 5$
42	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...	$t \leq 5$
43	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...	$t \leq 5$
44	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...	$t \leq 5$
45	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...	$t \leq 5$

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	4	515	205	NP	NP	204	204	HA-4	G32
2	8	4	515	205	NP	NP	204	204	HA-4	G5, G24, G32
3	8	4	515	205	NP	NP	204	204	HA-4	G24, G32
4	8	4	515	205	NP	NP	204	NP	HA-4	G5, G32
5	8	4	515	205	NP	NP	204	NP	HA-4	G32
6	8	4	515	205	NP	NP	204	NP	HA-4	G5, G24, G32
7	8	4	515	205	NP	NP	204	NP	HA-4	G24, G32
8	8	4	515	205	NP	NP	204	204	HA-4	G5, G24, G32
9	8	4	515	205	NP	NP	204	204	HA-4	G24, G32
10	8	4	515	205	NP	NP	204	204	HA-4	G5, G32
11	8	4	515	205	NP	NP	204	204	HA-4	G32
12	8	4	515	205	NP	NP	204	204	HA-4	G5, G32, W14
13	8	4	515	205	NP	NP	204	204	HA-4	G5, G24, G32
14	8	4	515	205	NP	NP	204	204	HA-4	G24, G32
15	8	4	515	205	NP	NP	204	204	HA-4	G5, G32
16	8	4	515	205	NP	NP	204	204	HA-4	G32
17	10H	1	655	450	NP	NP	343	NP	HA-5	G19
18	10H	1	655	450	NP	NP	343	NP	HA-5	G19, G24
19	10H	1	690	485	NP	NP	343	NP	HA-5	G19
20	10H	1	690	485	NP	NP	343	NP	HA-5	G19
21	10H	1	690	485	NP	NP	343	NP	HA-5	G19, G24
22	10H	1	655	450	NP	NP	343	NP	HA-5	G19
23	10H	1	655	450	NP	NP	343	NP	HA-5	G19, G24
24	...	...	515	205	NP	427	NP	NP	HA-2	G5
25	8	4	550	260	NP	399	399	343	HA-2	G1, G5
26	8	4	550	260	NP	NP	399	343	HA-2	G1
27	8	4	650	300	NP	399	399	343	HA-2	G5
28	8	4	650	300	NP	NP	399	343	HA-2	...
29	8	4	650	305	NP	399	NP	NP	HA-2	G5, W12
30	8	4	655	310	NP	NP	399	NP	HA-2	G5
31	8	4	655	310	NP	NP	399	NP	HA-2	...
32	8	4	655	310	NP	399	399	343	HA-2	G5
33	8	4	655	310	NP	NP	399	343	HA-2	...
34	8	4	655	310	NP	399	399	343	HA-2	G5, G24
35	8	4	655	310	NP	NP	399	343	HA-2	G24
36	8	4	655	310	NP	399	399	NP	HA-2	G5
37	8	4	655	310	NP	NP	399	NP	HA-2	...
38	8	4	655	310	NP	399	399	NP	HA-2	G5, G24
39	8	4	655	310	NP	NP	399	NP	HA-2	G24
40	8	4	655	310	NP	399	399	343	HA-2	G5, G24
41	8	4	655	310	NP	NP	399	343	HA-2	G24
42	8	4	675	310	NP	NP	399	NP	HA-2	G5
43	8	4	675	310	NP	NP	399	NP	HA-2	...
44	8	4	675	310	NP	399	399	343	HA-2	G5, G24
45	8	4	675	310	NP	NP	399	343	HA-2	G24

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
2	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
3	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
4	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
5	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
6	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
7	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
8	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
9	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
10	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
11	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
12	138	...	138	...	135	131	...	...	...	...	...	...	...	...	...
13	117	117	117	116	114	111	...	...	...	...	...	...	...	...	...
14	117	108	97.6	92.6	88.8	82.6	...	...	...	...	...	...	...	...	...
15	138	138	138	137	135	131	...	...	...	...	...	...	...	...	...
16	138	127	115	109	105	97.2	...	...	...	...	...	...	...	...	...
17	187	187	180	174	171	169	169	169	169	169	...	...	...	...	...
18	159	159	153	148	145	144	144	144	144	144	...	...	...	...	...
19	197	197	189	183	180	178	178	178	178	178	...	...	...	...	...
20	197	197	189	183	180	178	178	178	178	178	...	...	...	...	...
21	167	167	161	156	153	151	151	151	151	151	...	...	...	...	...
22	187	187	180	174	171	169	169	169	169	169	...	...	...	...	...
23	159	159	153	148	145	144	144	144	144	144	...	...	...	...	...
24	138	138	137	134	130	126	122	116	114	111	109	107	105	103	...
25	158	158	158	154	149	143	139	136	135	134	133	132	...	...	...
26	158	151	141	134	127	119	112	107	106	105	104	103	...	...	...
27	185	185	185	181	176	168	163	159	158	157	156	156	...	...	...
28	185	175	162	154	147	137	129	125	123	121	120	119	...	...	...
29	185	185	185	181	176	168	163	159	158	157	156	156	...	...	...
30	187	187	187	182	178	170	165	161	160	159	158	158	...	...	...
31	187	181	166	157	151	140	133	127	125	124	123	122	...	...	...
32	187	187	186	183	178	170	164	161	160	159	158	158	...	...	...
33	187	178	167	158	151	140	133	128	125	124	123	122	...	...	...
34	159	159	159	155	151	145	140	137	136	135	135	134	...	...	...
35	159	154	141	134	128	119	113	108	107	105	104	104	...	...	...
36	187	187	187	182	178	170	165	161	160	159	158	158	...	...	...
37	187	181	166	157	151	140	133	127	125	124	123	122	...	...	...
38	159	159	159	155	151	145	140	137	136	135	135	134	...	...	...
39	159	154	141	134	128	119	113	108	107	105	104	104	...	...	...
40	159	159	159	155	151	145	140	137	136	135	135	134	...	...	...
41	159	154	141	134	128	119	113	108	107	105	104	104	...	...	...
42	193	193	192	188	183	175	170	166	165	164	163	162	...	...	...
43	193	181	166	157	151	140	133	127	125	124	123	122	...	...	...
44	164	164	163	160	156	149	144	141	140	139	139	138	...	...	...
45	164	154	141	134	128	119	113	108	107	105	104	104	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	20Cr-18Ni-6Mo	Smls. pipe	SA-312	...	S31254	...	$t \leq 5$
2	20Cr-18Ni-6Mo	Smls. pipe	SA-312	...	S31254	...	$t \leq 5$
3	20Cr-18Ni-6Mo	Wld. pipe	SA-312	...	S31254	...	$t \leq 5$
4	20Cr-18Ni-6Mo	Wld. pipe	SA-312	...	S31254	...	$t \leq 5$
5	20Cr-18Ni-6Mo	Plate	SA-240	...	S31254	...	≤ 5
6	20Cr-18Ni-6Mo	Plate	SA-240	...	S31254	...	≤ 5
7	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...	$t < 5$
8	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...	$t < 5$
9	20.5Cr-8.8Ni-Mo-N	Plate	SA-240	...	S31655	...	...
10	20.5Cr-8.8Ni-Mo-N	Plate	SA-240	...	S31655	...	...
11	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...	S32101	...	> 5
12	21Cr-5Mn-1.5Ni-Cu-N	Bar	SA-479	...	S32101	...	...
13	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	...	> 5
14	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	...	> 5
15	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	...	> 5
16	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	...	> 5
17	21Cr-5Mn-1.5Ni-Cu-N	Fittings	SA-815	...	S32101	...	...
18	21Cr-5Mn-1.5Ni-Cu-N	Sheet, strip	SA-240	...	S32101	...	≤ 5
19	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	...	≤ 5
20	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	...	≤ 5
21	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	...	≤ 5
22	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	...	≤ 5
23	21Cr-6Ni-9Mn	Forgings	SA-182	FXM-11	S21904	...	...
24	21Cr-6Ni-9Mn	Smls. pipe	SA-312	TPXM-11	S21904	...	...
25	21Cr-6Ni-9Mn	Smls. pipe	SA-312	TPXM-11	S21904	...	...
26	21Cr-6Ni-9Mn	Wld. pipe	SA-312	TPXM-11	S21904	...	...
27	21Cr-6Ni-9Mn	Wld. pipe	SA-312	TPXM-11	S21904	...	...
28	21Cr-6Ni-9Mn	Plate	SA-666	XM-11	S21904	...	...
29	21Cr-6Ni-9Mn	Plate	SA-666	XM-11	S21904	...	...
30	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11	S21904	...	...
31	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11	S21904	...	...
32	21Cr-11Ni-N	Forgings	SA-182	F45	S30815	...	...
33	21Cr-11Ni-N	Forgings	SA-182	F45	S30815	...	...
34	21Cr-11Ni-N	Smls. tube	SA-213	...	S30815	...	...
35	21Cr-11Ni-N	Smls. tube	SA-213	...	S30815	...	...
36	21Cr-11Ni-N	Plate	SA-240	...	S30815	...	...
37	21Cr-11Ni-N	Plate	SA-240	...	S30815	...	...
38	21Cr-11Ni-N	Wld. tube	SA-249	...	S30815	...	...
39	21Cr-11Ni-N	Wld. tube	SA-249	...	S30815	...	...
40	21Cr-11Ni-N	Smls. pipe	SA-312	...	S30815	...	...
41	21Cr-11Ni-N	Smls. pipe	SA-312	...	S30815	...	...
42	21Cr-11Ni-N	Wld. pipe	SA-312	...	S30815	...	...
43	21Cr-11Ni-N	Wld. pipe	SA-312	...	S30815	...	...
44	21Cr-11Ni-N	Bar	SA-479	...	S30815	...	...
45	21Cr-11Ni-N	Bar	SA-479	...	S30815	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	4	675	310	NP	399	399	NP	HA-2	G5
2	8	4	675	310	NP	NP	399	NP	HA-2	...
3	8	4	675	310	NP	399	399	NP	HA-2	G5, G24
4	8	4	675	310	NP	NP	399	NP	HA-2	G24
5	8	4	690	310	NP	399	399	343	HA-2	G5
6	8	4	690	310	NP	NP	399	343	HA-2	...
7	8	4	690	310	NP	399	399	343	HA-2	G5
8	8	4	690	310	NP	NP	399	343	HA-2	...
9	8	3	635	310	NP	NP	454	NP	HA-2	G5
10	8	3	635	310	NP	NP	454	NP	HA-2	...
11	10H	1	650	450	NP	NP	316	NP	HA-5	G19
12	10H	1	650	450	NP	NP	316	NP	HA-5	G19
13	10H	1	650	450	NP	NP	316	NP	HA-5	G19
14	10H	1	650	450	NP	NP	316	NP	HA-5	G19, G24
15	10H	1	650	450	NP	NP	316	NP	HA-5	G19
16	10H	1	650	450	NP	NP	316	NP	HA-5	G19, G24
17	10H	1	650	450	NP	NP	316	NP	HA-5	G19, W14
18	10H	1	700	530	NP	NP	316	NP	HA-5	G19
19	10H	1	700	530	NP	NP	316	NP	HA-5	G19
20	10H	1	700	530	NP	NP	316	NP	HA-5	G19, G24
21	10H	1	700	530	NP	NP	316	NP	HA-5	G19
22	10H	1	700	530	NP	NP	316	NP	HA-5	G19, G24
23	8	3	620	345	NP	NP	316	316	HA-6	...
24	8	3	620	345	NP	NP	316	316	HA-6	G5
25	8	3	620	345	NP	NP	316	316	HA-6	...
26	8	3	620	345	NP	NP	316	316	HA-6	G5, G24
27	8	3	620	345	NP	NP	316	316	HA-6	G24
28	8	3	620	345	NP	NP	316	316	HA-6	G5
29	8	3	620	345	NP	NP	316	316	HA-6	...
30	8	3	620	345	NP	NP	316	316	HA-6	G5
31	8	3	620	345	NP	NP	316	316	HA-6	...
32	8	2	600	310	899	NP	899	343	HA-6	G5, G6, T5
33	8	2	600	310	899	NP	899	343	HA-6	G6, T6
34	8	2	600	310	899	NP	899	343	HA-6	G5, G6, T5
35	8	2	600	310	899	NP	899	343	HA-6	G6, T6
36	8	2	600	310	899	NP	899	343	HA-6	G5, G6, T5
37	8	2	600	310	899	NP	899	343	HA-6	G6, T6
38	8	2	600	310	899	NP	899	343	HA-6	G5, G6, G24, T5
39	8	2	600	310	899	NP	899	343	HA-6	G6, G24, T6
40	8	2	600	310	899	NP	899	343	HA-6	G5, G6, T5
41	8	2	600	310	899	NP	899	343	HA-6	G6, T6
42	8	2	600	310	899	NP	899	343	HA-6	G5, G6, G24, T5
43	8	2	600	310	899	NP	899	343	HA-6	G6, G24, T6
44	8	2	600	310	899	NP	899	343	HA-6	G5, G6, T5
45	8	2	600	310	899	NP	899	343	HA-6	G6, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	193	193	192	188	183	175	170	166	165	164	163	162	...	...	...
2	193	181	166	157	151	140	133	127	125	124	123	122	...	...	...
3	164	164	163	160	156	149	144	141	140	139	139	138	...	...	...
4	164	154	141	134	128	119	113	108	107	105	104	104	...	...	...
5	197	197	197	193	187	179	173	169	168	167	166	165	...	...	...
6	197	182	166	158	151	140	133	128	125	124	123	122	...	...	...
7	167	167	167	163	159	150	147	144	143	142	141	140	...	...	...
8	167	154	141	134	128	116	113	108	107	105	104	104	...	...	...
9	181	181	177	172	168	161	156	153	152	151	150	148	147	145	143
10	181	179	162	153	145	134	127	121	119	117	115	113	111	109	107
11	186	186	186	...	177	171	170	170	170	...	...	...	...	...	...
12	186	186	186	...	177	171	170	170	170	...	...	...	...	...	...
13	186	186	186	...	177	171	170	170	170	...	...	...	...	...	...
14	158	158	158	...	150	145	145	145	145	...	...	...	...	...	...
15	186	186	186	...	177	171	170	170	170	...	...	...	...	...	...
16	158	158	158	...	150	145	145	145	145	...	...	...	...	...	...
17	186	186	186	...	177	171	170	170	170	...	...	...	...	...	...
18	200	200	200	...	190	184	183	183	183	...	...	...	...	...	...
19	200	200	200	...	190	184	183	183	183	...	...	...	...	...	...
20	170	170	170	...	162	157	156	156	156	...	...	...	...	...	...
21	200	200	200	...	190	184	183	183	183	...	...	...	...	...	...
22	170	170	170	...	162	157	156	156	156	...	...	...	...	...	...
23	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
24	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
25	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
26	151	151	151	146	140	134	130	127	126	...	...	...	...	...	...
27	151	151	150	140	128	115	107	102	99.9	...	...	...	...	...	...
28	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
29	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
30	177	177	177	172	165	158	153	149	148	...	...	...	...	...	...
31	177	177	176	165	151	136	126	120	117	...	...	...	...	...	...
32	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
33	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
34	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
35	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
36	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
37	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
38	145	145	144	141	136	132	128	126	125	124	123	122	121	119	118
39	145	145	144	137	129	117	110	105	103	102	101	99.9	98.7	98.0	96.9
40	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
41	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113
42	145	145	144	141	136	132	128	126	125	124	123	122	121	119	118
43	145	145	144	137	129	117	110	105	103	102	101	99.9	98.7	98.0	96.9
44	172	171	170	165	160	155	151	148	147	146	145	143	142	140	138
45	172	171	169	161	151	138	129	123	121	120	118	117	116	115	113

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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
33	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
34	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
35	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
36	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
37	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
38	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
39	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
40	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
41	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
42	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
43	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
44	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
45	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

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	22Cr-2Ni-Mo-N	Forgings	SA-182	F66	S32202	...	...
2	22Cr-2Ni-Mo-N	Plate	SA-240	...	S32202	...	...
3	22Cr-2Ni-Mo-N	Bar	SA-479	...	S32202	...	...
4	22Cr-2Ni-Mo-N	Smls. tube	SA-789	...	S32202	...	...
5	22Cr-2Ni-Mo-N	Wld. tube	SA-789	...	S32202	...	...
6	22Cr-2Ni-Mo-N	Smls. pipe	SA-790	...	S32202	...	...
7	22Cr-2Ni-Mo-N	Wld. pipe	SA-790	...	S32202	...	...
8	22Cr-2Ni-Mo-N	Smls. fittings	SA-815	...	S32202	...	...
9	22Cr-2Ni-Mo-N	Wld. fittings	SA-815	...	S32202	...	...
10	22Cr-5Ni-3Mo-N	Castings	SA-995	4A	J92205	...	...
11	22Cr-5Ni-3Mo-N	Forgings	SA-182	F51	S31803	...	...
12	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...	...
13	22Cr-5Ni-3Mo-N	Bar	SA-479	...	S31803	...	...
14	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S31803	...	...
15	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S31803	...	...
16	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S31803	...	...
17	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S31803	...	...
18	22Cr-5Ni-3Mo-N	Smls. fittings	SA-815	...	S31803	...	...
19	22Cr-5Ni-3Mo-N	Wld. fittings	SA-815	...	S31803	...	...
20	22Cr-5Ni-3Mo-N	Smls. & wld. fittings	SA-815	...	S31803	...	...
21	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S32205	...	...
22	22Cr-5Ni-3Mo-N	Bar	SA-479	...	S32205	...	...
23	22Cr-5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...	S32205	...	...
24	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S32205	...	...
25	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S32205	...	...
26	22Cr-5Ni-3Mo-N	Smls. & wld. fittings	SA-815	...	S32205	...	...
27	22Cr-5Ni-3Mo-N	Smls. fittings	SA-815	...	S32205	...	...
28	22Cr-5Ni-3Mo-N	Wld. fittings	SA-815	...	S32205	...	...
29	22Cr-5Ni-3Mo-N	Forgings	SA-182	F60	S32205	...	...
30	22Cr-5Ni-3Mo-N	Smls. & wld. tube	SA-789	...	S32205	...	...
31	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S32205	...	...
32	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S32205	...	...
33	22Cr-13Ni-5Mn	Castings	SA-351	CG6MMN	J93790	...	...
34	22Cr-13Ni-5Mn	Forgings	SA-182	FXM-19	S20910	...	...
35	22Cr-13Ni-5Mn	Smls. tube	SA-213	XM-19	S20910	...	...
36	22Cr-13Ni-5Mn	Plate	SA-240	XM-19	S20910	...	...
37	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...	...
38	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...	...
39	22Cr-13Ni-5Mn	Smls. & wld. pipe	SA-312	TPXM-19	S20910	...	...
40	22Cr-13Ni-5Mn	Smls. pipe	SA-312	TPXM-19	S20910	...	...
41	22Cr-13Ni-5Mn	Wld. pipe	SA-312	TPXM-19	S20910	...	...
42	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	1	...
43	22Cr-13Ni-5Mn	Smls. & wld. fittings	SA-403	XM-19	S20910	...	...
44	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	...	...
45	22Cr-13Ni-5Mn	Wld. pipe	SA-813	TPXM-19	S20910	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	10H	1	648	448	NP	NP	316	NP	HA-5	G19
2	10H	1	648	448	NP	NP	316	NP	HA-5	G19
3	10H	1	648	448	NP	NP	316	NP	HA-5	G19
4	10H	1	648	448	NP	NP	316	NP	HA-5	G19
5	10H	1	648	448	NP	NP	316	NP	HA-5	G19, G24
6	10H	1	648	448	NP	NP	316	NP	HA-5	G19
7	10H	1	648	448	NP	NP	316	NP	HA-5	G19, G24
8	10H	1	648	448	NP	NP	316	NP	HA-5	G19
9	10H	1	648	448	NP	NP	316	NP	HA-5	G3, G19
10	10H	1	620	415	NP	NP	260	NP	HA-5	G1, G19
11	10H	1	620	450	316	NP	316	316	HA-5	G19
12	10H	1	620	450	316	NP	316	316	HA-5	G19
13	10H	1	620	450	316	NP	316	NP	HA-5	G19
14	10H	1	620	450	316	NP	316	316	HA-5	G19
15	10H	1	620	450	316	NP	316	316	HA-5	G19, G24
16	10H	1	620	450	316	NP	316	316	HA-5	G19
17	10H	1	620	450	316	NP	316	316	HA-5	G19, G24
18	10H	1	620	450	316	NP	NP	NP	HA-5	G19
19	10H	1	620	450	316	NP	NP	NP	HA-5	G19, G24
20	10H	1	620	450	NP	NP	316	316	HA-5	G19, W14
21	10H	1	655	450	NP	316	316	316	HA-5	G19
22	10H	1	655	450	NP	316	316	NP	HA-5	G19
23	10H	1	655	450	NP	316	NP	NP	HA-5	G19, W12
24	10H	1	655	450	NP	NP	316	316	HA-5	G19
25	10H	1	655	450	NP	NP	316	316	HA-5	G19, G24
26	10H	1	655	450	NP	316	NP	NP	HA-5	G19, W12
27	10H	1	655	450	NP	NP	316	316	HA-5	G19
28	10H	1	655	450	NP	NP	316	316	HA-5	G19, G24
29	10H	1	655	480	NP	316	316	316	HA-5	G19
30	10H	1	655	480	NP	316	NP	NP	HA-5	G19, W12
31	10H	1	655	480	NP	NP	316	316	HA-5	G19
32	10H	1	655	480	NP	NP	316	316	HA-5	G19, G24
33	8	3	585	295	NP	NP	566	343	HA-2	G1
34	8	3	690	380	NP	427	649	343	HA-6	G5, T8
35	8	3	690	380	NP	NP	649	NP	HA-6	T8
36	8	3	690	380	NP	427	649	343	HA-6	G5, T8
37	8	3	690	380	NP	427	NP	NP	HA-6	G5, W12
38	8	3	690	380	NP	NP	649	343	HA-6	G24, T8
39	8	3	690	380	NP	427	NP	NP	HA-6	G5, W12
40	8	3	690	380	NP	NP	649	343	HA-6	T8
41	8	3	690	380	NP	NP	649	343	HA-6	G24, T8
42	8	3	690	380	NP	427	NP	NP	HA-6	G5, W12
43	8	3	690	380	NP	427	649	343	HA-6	G5, T8, W12, W14
44	8	3	690	380	NP	427	649	343	HA-6	G5, G22, T8
45	8	3	690	380	NP	427	NP	NP	HA-6	G5, W12

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	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	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
3	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
4	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
5	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...
6	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
7	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...
8	185	185	182	175	171	170	170	170	170	...	...	...	...	...	...
9	157	157	154	149	146	144	144	144	144	...	...	...	...	...	...
10	177	177	177	173	170	168	168	168	...	...	...	...	...	...	...
11	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
12	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
13	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
14	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
15	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
16	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
17	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
18	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
19	151	151	151	148	145	140	137	135	135	...	...	...	...	...	...
20	177	177	177	174	171	165	161	160	159	...	...	...	...	...	...
21	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
22	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
23	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
24	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
25	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
26	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
27	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
28	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
29	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
30	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
31	187	187	187	184	180	174	170	168	168	...	...	...	...	...	...
32	159	159	159	156	153	148	145	143	143	...	...	...	...	...	...
33	134	133	132	128	123	116	111	107	106	104	102	101	101	99.5	98.2
34	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
35	197	196	195	191	185	180	176	174	172	169	167	165	162	161	159
36	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
37	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
38	168	167	165	162	158	153	149	147	146	144	142	140	138	137	135
39	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
40	197	196	195	191	185	180	176	174	172	169	167	165	162	161	159
41	168	167	165	162	158	153	149	147	146	144	142	140	138	137	135
42	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
43	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
44	197	196	195	191	185	180	176	174	173	171	170	169	167	165	163
45	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	97.5	96.6	95.0	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...
34	161	158	157	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
35	157	156	154	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
36	161	158	157	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	134	132	131	129	111	71.4	48.0	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	157	156	154	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
41	134	132	131	129	111	71.4	48.0	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	161	158	157	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
44	161	158	157	152	132	83.6	56.1	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	22Cr-13Ni-5Mn	Wld. pipe	SA-814	TPXM-19	S20910	...	...
2	23Cr-4Ni-Mo-Cu-N	Plate	SA-240	...	S32304	...	...
3	23Cr-4Ni-Mo-Cu-N	Smls. tube	SA-789	...	S32304	...	>25
4	23Cr-4Ni-Mo-Cu-N	Wld. tube	SA-789	...	S32304	...	>25
5	23Cr-4Ni-Mo-Cu-N	Smls. pipe	SA-790	...	S32304	...	...
6	23Cr-4Ni-Mo-Cu-N	Wld. pipe	SA-790	...	S32304	...	...
7	23Cr-4Ni-Mo-Cu-N	Smls. tube	SA-789	...	S32304	...	≤25
8	23Cr-4Ni-Mo-Cu-N	Wld. tube	SA-789	...	S32304	...	≤25
9	23Cr-12Ni	Smls. & wld. fittings	SA-403	309	S30900	...	...
10	23Cr-12Ni	Smls. tube	SA-213	TP309S	S30908	...	...
11	23Cr-12Ni	Smls. tube	SA-213	TP309S	S30908	...	...
12	23Cr-12Ni	Plate	SA-240	309S	S30908	...	...
13	23Cr-12Ni	Plate	SA-240	309S	S30908	...	...
14	23Cr-12Ni	Wld. tube	SA-249	TP309S	S30908	...	...
15	23Cr-12Ni	Wld. tube	SA-249	TP309S	S30908	...	...
16	23Cr-12Ni	Smls. & wld. pipe	SA-312	TP309S	S30908	...	...
17	23Cr-12Ni	Smls. pipe	SA-312	TP309S	S30908	...	...
18	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...
19	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...
(25) 20	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...
(25) 21	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...
22	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	1	...
23	23Cr-12Ni	Bar	SA-479	309S	S30908	...	...
24	23Cr-12Ni	Bar	SA-479	309S	S30908	...	...
25	23Cr-12Ni	Wld. pipe	SA-813	TP309S	S30908	...	...
26	23Cr-12Ni	Wld. pipe	SA-813	TP309S	S30908	...	...
27	23Cr-12Ni	Wld. pipe	SA-814	TP309S	S30908	...	...
28	23Cr-12Ni	Wld. pipe	SA-814	TP309S	S30908	...	...
29	23Cr-12Ni	Smls. tube	SA-213	TP309H	S30909	...	...
30	23Cr-12Ni	Smls. tube	SA-213	TP309H	S30909	...	...
(25) 31	23Cr-12Ni	Plate	SA-240	309H	S30909	...	...
(25) 32	23Cr-12Ni	Plate	SA-240	309H	S30909	...	...
33	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...	...
34	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...	...
35	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...	...
36	23Cr-12Ni	Smls. pipe	SA-312	TP309H	S30909	...	...
37	23Cr-12Ni	Smls. pipe	SA-312	TP309H	S30909	...	...
(25) 38	23Cr-12Ni	Wld. pipe	SA-312	TP309H	S30909	...	...
(25) 39	23Cr-12Ni	Wld. pipe	SA-312	TP309H	S30909	...	...
40	23Cr-12Ni	Bar	SA-479	309H	S30909	...	...
41	23Cr-12Ni	Bar	SA-479	309H	S30909	...	...
42	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb	S30940	...	...
43	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb	S30940	...	...
44	23Cr-12Ni-Cb	Plate	SA-240	309Cb	S30940	...	...
45	23Cr-12Ni-Cb	Plate	SA-240	309Cb	S30940	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	3	690	380	NP	427	NP	NP	HA-6	G5, W12
2	10H	1	600	400	NP	NP	316	316	HA-6	G19
3	10H	1	600	400	NP	NP	316	316	HA-6	G19
4	10H	1	600	400	NP	NP	316	316	HA-6	G19, G24
5	10H	1	600	400	NP	NP	316	316	HA-6	G19
6	10H	1	600	400	NP	NP	316	316	HA-6	G19, G24
7	10H	1	690	450	NP	NP	316	316	HA-5	G19
8	10H	1	690	450	NP	NP	316	316	HA-5	G19, G24
9	8	2	515	205	NP	427	816	343	HA-2	G5, G12, T5, W12, W14
10	8	2	515	205	816	NP	816	343	HA-2	G5, G12, T5
11	8	2	515	205	816	NP	816	343	HA-2	G12, T6
12	8	2	515	205	816	427	816	343	HA-2	G5, G12, T5
13	8	2	515	205	816	NP	816	343	HA-2	G12, T6
14	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
15	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
16	8	2	515	205	816	427	816	343	HA-2	G5, G12, T5, W12, W14
17	8	2	515	205	816	NP	816	343	HA-2	G12, T6
18	8	2	515	205	816	NP	NP	NP	HA-2	G5, G12, T5, W13
19	8	2	515	205	816	NP	NP	NP	HA-2	G12, T6, W13
20	8	2	515	205	816	NP	816	343	HA-2	G5, G12, G24, T5
21	8	2	515	205	816	NP	816	343	HA-2	G12, G24, T6
22	8	2	515	205	NP	427	NP	NP	HA-2	G5, W12
23	8	2	515	205	538	NP	538	343	HA-2	G5, G12, G22, T5
24	8	2	515	205	538	NP	538	343	HA-2	G12, G22, T6
25	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
26	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
27	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
28	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
29	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
30	8	2	515	205	816	NP	816	NP	HA-2	T7
31	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
32	8	2	515	205	816	NP	816	NP	HA-2	T7
33	8	2	515	205	NP	427	NP	NP	HA-2	G5, W12
34	8	2	515	205	NP	NP	816	NP	HA-2	G5, G24, T6
35	8	2	515	205	NP	NP	816	NP	HA-2	G24, T7
36	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
37	8	2	515	205	816	NP	816	NP	HA-2	T7
38	8	2	515	205	816	NP	816	NP	HA-2	G5, G24, T6
39	8	2	515	205	816	NP	816	NP	HA-2	G24, T7
40	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
41	8	2	515	205	816	NP	816	NP	HA-2	T7
42	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, T5
43	8	2	515	205	NP	NP	816	343	HA-2	G12, T6
44	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, T5
45	8	2	515	205	NP	NP	816	343	HA-2	G12, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	197	196	195	191	185	180	176	174	173	171	170	169	167	165	...
2	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
3	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
4	145	144	140	135	132	128	125	124	123	...	...	...	...	...	...
5	172	169	164	159	155	150	147	145	144	...	...	...	...	...	...
6	145	144	140	135	132	128	125	124	123	...	...	...	...	...	...
7	197	194	189	184	178	173	170	168	167	...	...	...	...	...	...
8	168	165	160	156	152	147	145	143	142	...	...	...	...	...	...
9	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
10	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
11	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
12	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
13	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
14	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
15	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
16	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
17	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
18	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
19	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
20	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
21	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
22	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...
23	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
24	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
25	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
26	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
27	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
28	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
29	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
30	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
31	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
32	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
33	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...
34	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
35	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
36	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
37	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
38	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
39	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
40	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
41	138	129	119	114	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
42	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
43	138	129	120	115	111	105	100	96.7	95.4	94.1	92.9	91.6	90.4	89.2	87.9
44	138	138	138	138	138	138	135	131	129	127	125	124	122	121	119
45	138	129	120	115	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, Division 1, 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	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	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	...	...	...
11	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	...	...	...
12	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	...	...	...
13	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	...	...	...
14	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	...	...	...
15	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	...	...	...
16	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	...	...	...
17	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	...	...	...
18	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	...	...	...
19	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	...	...	...
20	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)
21	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	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	115	89.4	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	86.7	78.5	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	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	...	...	...
26	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	...	...	...
27	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	...	...	...
28	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	...	...	...
29	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	...	...	...
30	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	...	...	...
31	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	...	...	... (25)
32	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	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	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	...	...	...
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
38	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	...	...	... (25)
39	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	...	...	... (25)
40	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	...	...	...
41	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	...	...	...
42	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	...	...	...
43	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	...	...	...
44	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	...	...	...
45	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	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb	S30940	...	...
2	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb	S30940	...	...
3	23Cr-12Ni-Cb	Smls. & wld. pipe	SA-312	TP309Cb	S30940	...	...
4	23Cr-12Ni-Cb	Smls. pipe	SA-312	TP309Cb	S30940	...	...
5	23Cr-12Ni-Cb	Wld. pipe	SA-312	TP309Cb	S30940	...	...
6	23Cr-12Ni-Cb	Wld. pipe	SA-312	TP309Cb	S30940	...	...
7	23Cr-12Ni-Cb	Bar	SA-479	309Cb	S30940	...	...
8	23Cr-12Ni-Cb	Bar	SA-479	309Cb	S30940	...	...
9	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb	S30940	...	...
10	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb	S30940	...	...
11	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb	S30940	...	...
12	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb	S30940	...	...
13	23Cr-25Ni-5.5Mo-N	Forgings	SA-182	...	S32053	...	...
14	23Cr-25Ni-5.5Mo-N	Forgings	SA-182	...	S32053	...	...
15	23Cr-25Ni-5.5Mo-N	Plate	SA-240	...	S32053	...	...
16	23Cr-25Ni-5.5Mo-N	Plate	SA-240	...	S32053	...	...
17	23Cr-25Ni-5.5Mo-N	Wld. tube	SA-249	...	S32053	...	...
18	23Cr-25Ni-5.5Mo-N	Wld. tube	SA-249	...	S32053	...	...
19	23Cr-25Ni-5.5Mo-N	Smls. & wld. pipe	SA-312	...	S32053	...	...
20	23Cr-25Ni-5.5Mo-N	Smls. & wld. pipe	SA-312	...	S32053	...	...
21	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-358	...	S32053	...	...
22	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-358	...	S32053	...	...
23	23Cr-25Ni-5.5Mo-N	Fittings	SA-403	...	S32053	...	...
24	23Cr-25Ni-5.5Mo-N	Fittings	SA-403	...	S32053	...	...
25	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-409	...	S32053	...	...
26	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-409	...	S32053	...	...
27	23Cr-25Ni-5.5Mo-N	Bar	SA-479	...	S32053	...	...
28	23Cr-25Ni-5.5Mo-N	Bar	SA-479	...	S32053	...	...
29	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-813	...	S32053	...	...
30	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-813	...	S32053	...	...
31	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-814	...	S32053	...	...
32	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-814	...	S32053	...	...
33	24Cr-10Ni-4Mo-N	Castings	SA-995	2A	J93345	...	...
34	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-182	F58	S31266	...	...
35	24Cr-22Ni-6Mo-2W-Cu-N	Smls. tube	SA-213	...	S31266	...	...
36	24Cr-22Ni-6Mo-2W-Cu-N	Plate	SA-240	...	S31266	...	...
(25) 37	24Cr-22Ni-6Mo-2W-Cu-N	Wld. tube	SA-249	...	S31266	...	...
38	24Cr-22Ni-6Mo-2W-Cu-N	Smls. pipe	SA-312	...	S31266	...	...
(25) 39	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-312	...	S31266	...	...
(25) 40	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-358	...	S31266	...	...
41	24Cr-22Ni-6Mo-2W-Cu-N	Smls. fittings	SA-403	...	S31266	...	...
42	24Cr-22Ni-6Mo-2W-Cu-N	Wld. fittings	SA-403	...	S31266	...	...
43	24Cr-22Ni-6Mo-2W-Cu-N	Bar, shapes	SA-479	...	S31266	...	...
(25) 44	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-813	...	S31266	...	...
45	25Cr-4Ni-4Mo-Ti	Plate	SA-240	...	S44635	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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)

Applicability and Max. Temperature										
Line No.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted) (SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
2	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
3	8	2	515	205	NP	427	816	343	HA-2	G5, G12, T5, W12
4	8	2	515	205	NP	NP	816	343	HA-2	G12, T6
5	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
6	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
7	8	2	515	205	NP	NP	538	343	HA-2	G5, G12, G22
8	8	2	515	205	NP	NP	538	343	HA-2	G12, G22
9	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
10	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
11	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G13, G24, T5
12	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
13	8	4	640	295	NP	NP	350	NP	NFN-12	G5
14	8	4	640	295	NP	NP	350	NP	NFN-12	...
15	8	4	640	295	NP	NP	350	NP	NFN-12	G5
16	8	4	640	295	NP	NP	350	NP	NFN-12	...
17	8	4	640	295	NP	NP	350	NP	NFN-12	G5, W12
18	8	4	640	295	NP	NP	350	NP	NFN-12	W12
19	8	4	640	295	NP	NP	350	NP	NFN-12	G5, W12
20	8	4	640	295	NP	NP	350	NP	NFN-12	W12
21	8	4	640	295	NP	NP	350	NP	NFN-12	G5, W12
22	8	4	640	295	NP	NP	350	NP	NFN-12	W12
23	8	4	640	295	NP	NP	350	NP	NFN-12	G5
24	8	4	640	295	NP	NP	350	NP	NFN-12	...
25	8	4	640	295	NP	NP	350	NP	NFN-12	G5, W12
26	8	4	640	295	NP	NP	350	NP	NFN-12	W12
27	8	4	640	295	NP	NP	350	NP	NFN-12	G5
28	8	4	640	295	NP	NP	350	NP	NFN-12	...
29	8	4	640	295	NP	NP	350	NP	NFN-12	G5, G12, W12
30	8	4	640	295	NP	NP	350	NP	NFN-12	G12, W12
31	8	4	640	295	NP	NP	350	NP	NFN-12	G5, G12, W12
32	8	4	640	295	NP	NP	350	NP	NFN-12	G12, W12
33	10H	1	655	450	NP	NP	316	316	HA-5	G1, G19
34	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
35	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
36	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
37	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19, G24
38	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
39	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19, G24
40	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19, G24
41	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
42	45	...	752	421	NP	NP	426	NP	HA-10	G3, G5, G19
43	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19
44	45	...	752	421	NP	NP	426	NP	HA-10	G5, G19, G24
45	10I	1	620	515	NP	NP	260	260	HA-5	G19

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
2	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
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	117	117	117	117	117	117	115	111	109	108	107	105	104	102	101
12	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
13	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
14	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
15	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
16	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
17	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
18	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
19	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
20	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
21	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
22	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
23	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
24	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
25	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
26	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
27	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
28	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
29	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
30	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
31	183	183	182	...	173	165	160	155	153	152	...	...	...	...	...
32	183	177	164	...	151	141	134	129	127	125	...	...	...	...	...
33	187	187	186	180	173	167	167	167	167	...	...	...	...	...	...
34	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
35	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
36	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
37	183	183	179	174	169	163	158	155	154	153	151	150	149	148	...
38	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
39	183	183	179	174	169	163	158	155	154	153	151	150	149	148	...
40	183	183	179	174	169	163	158	155	154	153	151	150	149	148	...
41	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
42	183	183	179	174	169	163	158	155	154	153	151	150	149	148	...
43	215	215	210	204	199	191	186	182	181	179	178	177	175	174	...
44	183	183	179	174	169	163	158	155	154	153	151	150	149	148	...
45	177	175	171	166	162	156	152	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
2	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	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	86.7	78.5	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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	...	...	...
12	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	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	25Cr-4Ni-4Mo-Ti	Wld. tube	SA-268	...	S44635	...	...
2	25Cr-5Ni-3Mo-2Cu	Castings	SA-995	1B	J93372	...	...
3	25Cr-5Ni-3Mo-2Cu	Plate	SA-240	...	S32550	...	...
4	25Cr-5Ni-3Mo-2Cu	Bar	SA-479	...	S32550	...	...
5	25Cr-5Ni-3Mo-2Cu	Smls. tube	SA-789	...	S32550	...	...
6	25Cr-5Ni-3Mo-2Cu	Wld. tube	SA-789	...	S32550	...	...
7	25Cr-5Ni-3Mo-2Cu	Smls. pipe	SA-790	...	S32550	...	...
8	25Cr-5Ni-3Mo-2Cu	Wld. pipe	SA-790	...	S32550	...	...
9	25Cr-6Ni-Mo-N	Forgings	SA-182	...	S32506	...	...
10	25Cr-6Ni-Mo-N	Plate, sheet	SA-240	...	S32506	...	...
11	25Cr-6Ni-Mo-N	Bar	SA-479	...	S32506	...	...
12	25Cr-6Ni-Mo-N	Smls. tube	SA-789	...	S32506	...	...
13	25Cr-6Ni-Mo-N	Wld. tube	SA-789	...	S32506	...	...
14	25Cr-6Ni-Mo-N	Smls. pipe	SA-790	...	S32506	...	...
15	25Cr-6Ni-Mo-N	Wld. pipe	SA-790	...	S32506	...	...
16	25Cr-6Ni-Mo-N	Plate	SA-240	...	S31200	...	...
17	25Cr-6.5Ni-3Mo-N	Smls. tube	SA-789	...	S31260	...	...
18	25Cr-6.5Ni-3Mo-N	Wld. tube	SA-789	...	S31260	...	...
19	25Cr-6.5Ni-3Mo-N	Smls. pipe	SA-790	...	S31260	...	...
20	25Cr-6.5Ni-3Mo-N	Wld. pipe	SA-790	...	S31260	...	...
21	25Cr-6.5Ni-3Mo-N	Plate	SA-240	...	S31260	...	...
22	25Cr-7Ni-3Mo-W-Cu-N	Forgings	SA-182	F54	S39274	...	...
23	25Cr-7Ni-3Mo-W-Cu-N	Smls. tube	SA-789	...	S39274	...	...
24	25Cr-7Ni-3Mo-W-Cu-N	Wld. tube	SA-789	...	S39274	...	...
25	25Cr-7Ni-3Mo-W-Cu-N	Smls. pipe	SA-790	...	S39274	...	...
26	25Cr-7Ni-3Mo-W-Cu-N	Wld. pipe	SA-790	...	S39274	...	...
27	25Cr-7Ni-4Mo-N	Forgings	SA-182	F53	S32750	...	...
28	25Cr-7Ni-4Mo-N	Plate, sheet	SA-240	...	S32750	...	...
29	25Cr-7Ni-4Mo-N	Smls. tube	SA-789	...	S32750	...	...
30	25Cr-7Ni-4Mo-N	Wld. tube	SA-789	...	S32750	...	...
31	25Cr-7Ni-4Mo-N	Smls. pipe	SA-790	...	S32750	...	...
32	25Cr-7Ni-4Mo-N	Wld. pipe	SA-790	...	S32750	...	...
(25) 33	25Cr-7.5Ni-3.5Mo-N-Cu-W	Castings	SA-995	CD3MWCuN	J93380	...	...
(25) 34	25Cr-7.5Ni-3.5Mo-N-Cu-W	Forgings	SA-182	F55	S32760	...	...
35	25Cr-7.5Ni-3.5Mo-N-Cu-W	Plate	SA-240	...	S32760	...	...
36	25Cr-7.5Ni-3.5Mo-N-Cu-W	Bar	SA-479	...	S32760	Annealed	...
37	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. tube	SA-789	...	S32760	...	...
38	25Cr-7.5Ni-3.5Mo-N-Cu-W	Wld. tube	SA-789	...	S32760	...	...
39	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. pipe	SA-790	...	S32760	...	...
40	25Cr-7.5Ni-3.5Mo-N-Cu-W	Wld. pipe	SA-790	...	S32760	...	...
41	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. fittings	SA-815	...	S32760	...	...
42	25Cr-12Ni	Castings	SA-351	CH8	J93400	...	...
43	25Cr-12Ni	Castings	SA-351	CH8	J93400	...	...
44	25Cr-12Ni	Cast pipe	SA-451	CPH8	J93400	...	...
45	25Cr-12Ni	Castings	SA-351	CH20	J93402	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
I	III	VIII-1	XII							
1	10I	1	620	515	NP	NP	260	260	HA-5	G19, G24
2	10H	1	690	485	NP	316	NP	NP	HA-5	G19, G29
3	10H	1	760	550	NP	NP	260	260	HA-5	G19
4	10H	1	760	550	NP	NP	260	260	HA-5	G19
5	10H	1	760	550	NP	NP	260	260	HA-5	G19
6	10H	1	760	550	NP	NP	260	260	HA-5	G19, G24
7	10H	1	760	550	NP	NP	260	260	HA-5	G19
8	10H	1	760	550	NP	NP	260	260	HA-5	G19, G24
9	10H	1	620	450	NP	NP	316	NP	HA-5	G19
10	10H	1	620	450	NP	NP	316	NP	HA-5	G19
11	10H	1	620	450	NP	NP	316	NP	HA-5	G19
12	10H	1	620	450	NP	NP	316	NP	HA-5	G19
13	10H	1	620	450	NP	NP	316	NP	HA-5	G19, G24
14	10H	1	620	450	NP	NP	316	NP	HA-5	G19
15	10H	1	620	450	NP	NP	316	NP	HA-5	G19, G24
16	10H	1	690	450	NP	NP	316	316	HA-5	G19
17	10H	1	690	450	NP	NP	343	343	HA-5	G19
18	10H	1	690	450	NP	NP	343	343	HA-5	G19, G24
19	10H	1	690	450	NP	NP	343	343	HA-5	G19
20	10H	1	690	450	NP	NP	343	343	HA-5	G19, G24
21	10H	1	690	485	NP	NP	343	343	HA-5	G19
22	10H	1	800	550	NP	NP	329	329	HA-8	G19
23	10H	1	800	550	NP	NP	329	329	HA-8	G19
24	10H	1	800	550	NP	NP	329	329	HA-8	G19, G24
25	10H	1	800	550	NP	NP	329	329	HA-8	G19
26	10H	1	800	550	NP	NP	329	329	HA-8	G19, G24
27	10H	1	800	550	NP	NP	316	NP	HA-5	G19
28	10H	1	800	550	NP	NP	316	NP	HA-5	G19
29	10H	1	800	550	NP	NP	316	316	HA-5	G19
30	10H	1	800	550	NP	NP	316	316	HA-5	G19, G24
31	10H	1	800	550	NP	NP	316	316	HA-5	G19
32	10H	1	800	550	NP	NP	316	316	HA-5	G19, G24
33	10H	1	690	450	NP	NP	316	NP	HA-5	G19
34	10H	1	750	550	NP	NP	316	NP	HA-9	G19
35	10H	1	750	550	NP	NP	316	NP	HA-9	G19
36	10H	1	750	550	NP	NP	316	NP	HA-9	G19
37	10H	1	750	550	NP	NP	316	NP	HA-9	G19
38	10H	1	750	550	NP	NP	316	NP	HA-9	G19, G24
39	10H	1	750	550	NP	NP	316	NP	HA-9	G19
40	10H	1	750	550	NP	NP	316	NP	HA-9	G19, G24
41	10H	1	750	550	NP	NP	316	NP	HA-9	G19, W14
42	8	2	450	195	NP	427	816	343	HA-3	G1, G5, G12, G16, G17, G19, T6
43	8	2	450	195	NP	NP	816	343	HA-3	G1, G12, G19, T7
44	8	2	450	195	NP	427	NP	NP	HA-3	G5, G16, G17, G19
45	8	2	485	205	NP	427	816	343	HA-2	G1, G5, G12, G16, G17, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	151	149	145	141	137	132	129	...	...	...	...	...	...	...	...
2	197	197	197	195	192	190	190	189	189	...	...	...	...	...	...
3	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
4	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
5	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
6	184	184	183	178	173	168	166	...	...	...	...	...	...	...	...
7	216	216	215	209	203	198	195	...	...	...	...	...	...	...	...
8	184	184	183	178	173	168	166	...	...	...	...	...	...	...	...
9	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
10	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
11	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
12	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
13	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
14	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
15	177	177	...	175	171	166	166	166	166	...	...	...	...	...	...
16	197	197	197	192	187	182	180	180	180	...	...	...	...	...	...
17	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
18	168	168	167	163	158	155	155	154	154	154	...	...	...	...	...
19	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
20	168	168	167	163	158	155	155	154	154	154	...	...	...	...	...
21	197	197	196	192	187	182	181	181	181	181	...	...	...	...	...
22	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
23	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
24	194	194	193	188	185	184	184	184	184	184	...	...	...	...	...
25	229	229	227	221	218	216	216	216	216	216	...	...	...	...	...
26	194	194	193	188	185	184	184	184	184	184	...	...	...	...	...
27	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
28	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
29	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
30	194	194	192	188	183	177	174	173	172	...	...	...	...	...	...
31	228	228	227	221	215	208	205	203	202	...	...	...	...	...	...
32	194	194	192	188	183	177	174	173	172	...	...	...	...	...	...
33	184	184	184	184	184	183	183	183	183	...	...	...	...	...	...
34	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
35	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
36	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
37	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
38	182	182	179	175	173	171	170	170	170	...	...	...	...	...	...
39	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
40	182	182	179	175	173	171	170	170	170	...	...	...	...	...	...
41	214	214	211	206	203	201	201	201	201	...	...	...	...	...	...
42	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	96.9
43	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
44	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	...
45	138	132	125	120	117	114	114	114	114	114	113	112	110	107	104

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	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	...	...	...
43	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	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	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	...	...	...

(25)
(25)

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	25Cr-12Ni	Castings	SA-351	CH20	J93402	...	...
2	25Cr-12Ni	Cast pipe	SA-451	CPH20	J93402	...	...
3	25Cr-20Ni	Castings	SA-351	CK20	J94202	...	...
4	25Cr-20Ni	Castings	SA-351	CK20	J94202	...	...
5	25Cr-20Ni	Cast pipe	SA-451	CPK20	J94202	...	...
6	25Cr-20Ni	Forgings	SA-182	F310	S31000	...	>130
7	25Cr-20Ni	Forgings	SA-182	F310	S31000	...	≤130
8	25Cr-20Ni	Forgings	SA-965	F310	S31000	...	...
9	25Cr-20Ni	Smls. tube	SA-213	...	S31002	...	...
10	25Cr-20Ni	Smls. tube	SA-213	...	S31002	...	...
11	25Cr-20Ni	Smls. pipe	SA-312	...	S31002	...	...
12	25Cr-20Ni	Smls. pipe	SA-312	...	S31002	...	...
13	25Cr-20Ni	Smls. tube	SA-213	TP310S	S31008	...	...
14	25Cr-20Ni	Smls. tube	SA-213	TP310S	S31008	...	...
15	25Cr-20Ni	Plate	SA-240	310S	S31008	...	...
16	25Cr-20Ni	Plate	SA-240	310S	S31008	...	...
17	25Cr-20Ni	Wld. tube	SA-249	TP310S	S31008	...	...
18	25Cr-20Ni	Wld. tube	SA-249	TP310S	S31008	...	...
19	25Cr-20Ni	Smls. & wld. pipe	SA-312	TP310S	S31008	...	...
20	25Cr-20Ni	Smls. pipe	SA-312	TP310S	S31008	...	...
(25)	21	25Cr-20Ni	Wld. pipe	SA-312	TP310S	S31008	...
(25)	22	25Cr-20Ni	Wld. pipe	SA-312	TP310S	S31008	...
	23	25Cr-20Ni	Wld. pipe	SA-358	310S	S31008	1
	24	25Cr-20Ni	Smls. & wld. fittings	SA-403	310S	S31008	...
	25	25Cr-20Ni	Bar	SA-479	310S	S31008	...
	26	25Cr-20Ni	Bar	SA-479	310S	S31008	...
	27	25Cr-20Ni	Wld. pipe	SA-813	TP310S	S31008	...
	28	25Cr-20Ni	Wld. pipe	SA-813	TP310S	S31008	...
	29	25Cr-20Ni	Wld. pipe	SA-814	TP310S	S31008	...
	30	25Cr-20Ni	Wld. pipe	SA-814	TP310S	S31008	...
	31	25Cr-20Ni	Smls. tube	SA-213	TP310H	S31009	...
	32	25Cr-20Ni	Plate	SA-240	310H	S31009	...
	33	25Cr-20Ni	Plate	SA-240	310H	S31009	...
	34	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...
	35	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...
	36	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...
	37	25Cr-20Ni	Smls. pipe	SA-312	TP310H	S31009	...
	38	25Cr-20Ni	Smls. pipe	SA-312	TP310H	S31009	...
(25)	39	25Cr-20Ni	Wld. pipe	SA-312	TP310H	S31009	...
(25)	40	25Cr-20Ni	Wld. pipe	SA-312	TP310H	S31009	...
	41	25Cr-20Ni	Bar	SA-479	310H	S31009	...
	42	25Cr-20Ni	Bar	SA-479	310H	S31009	...
	43	25Cr-20Ni	Bar	SA/JIS G4303	SUS310S	...	...
	44	25Cr-20Ni-Cb	Smls. tube	SA-213	TP310Cb	S31040	...
	45	25Cr-20Ni-Cb	Smls. tube	SA-213	TP310Cb	S31040	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	8	2	485	205	NP	NP	816	343	HA-2	G1, G12, T7
2	8	2	485	205	NP	427	NP	NP	HA-2	G5, G16, G17
3	8	2	450	195	NP	427	816	343	HA-3	G1, G5, G12, G16, G17, T6
4	8	2	450	195	NP	NP	816	343	HA-3	G1, G12, T8
5	8	2	450	195	NP	427	NP	NP	HA-3	G5, G16, G17
6	8	2	485	205	NP	427	NP	NP	HA-2	G5
7	8	2	515	205	NP	427	816	343	HA-2	G5, G12, G14, T5
8	8	2	515	205	NP	427	816	343	HA-2	G5, G12, T5
9	8	2	500	205	NP	NP	450	NP	HA-2	G5
10	8	2	500	205	NP	NP	450	NP	HA-2	...
11	8	2	500	205	NP	NP	450	NP	HA-2	G5
12	8	2	500	205	NP	NP	450	NP	HA-2	...
13	8	2	515	205	816	NP	816	343	HA-2	G5, G12, T5
14	8	2	515	205	816	NP	816	343	HA-2	G12, T6
15	8	2	515	205	816	427	816	343	HA-2	G5, G12, T5
16	8	2	515	205	816	NP	816	343	HA-2	G12, T6
17	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
18	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
19	8	2	515	205	816	427	816	343	HA-2	G5, G12, T5, W12, W14
20	8	2	515	205	816	NP	816	343	HA-2	G12, T6
21	8	2	515	205	816	NP	816	343	HA-2	G5, G12, G14, G24, T5
22	8	2	515	205	816	NP	816	343	HA-2	G12, G14, G24, T6
23	8	2	515	205	NP	427	NP	NP	HA-2	G5, W12
24	8	2	515	205	NP	427	816	343	HA-2	G5, G12, T5, W12, W14
25	8	2	515	205	538	NP	538	343	HA-2	G12, G22, T6
26	8	2	515	205	538	427	538	343	HA-2	G5, G12, G22, T5
27	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
28	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
29	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
30	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
31	8	2	515	205	816	427	816	NP	HA-2	G5, T6
32	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
33	8	2	515	205	816	NP	816	NP	HA-2	T7
34	8	2	515	205	NP	427	NP	NP	HA-2	G5, W12
35	8	2	515	205	NP	NP	816	NP	HA-2	G5, G12, G24, T6
36	8	2	515	205	NP	NP	816	NP	HA-2	G12, G24, T7
37	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
38	8	2	515	205	816	NP	816	NP	HA-2	T7
39	8	2	515	205	816	NP	816	NP	HA-2	G5, G24, T6
40	8	2	515	205	816	NP	816	NP	HA-2	G24, T7
41	8	2	515	205	816	NP	816	NP	HA-2	G5, T6
42	8	2	515	205	816	NP	816	NP	HA-2	T7
43	8	2	520	205	538	427	538	NP	HA-2	G5, G12, G22, T5
44	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, T5
45	8	2	515	205	NP	NP	816	343	HA-2	G12, T6

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	124	111	106	104	100	97.1	94.6	93.2	91.0	88.6	86.8	84.3	81.8	79.3
2	138	132	125	120	117	114	114	114	114	114	113	112	110	107	...
3	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	96.9
4	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
5	128	123	116	112	109	106	106	106	106	105	105	103	102	99.8	...
6	138	138	136	133	130	128	128	128	127	125	123	122	120	118	...
7	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
8	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
9	138	138	138	138	138	134	130	127	126	125	123	120	117	115	...
10	138	129	122	118	115	109	104	98.5	96.0	93.5	91.0	88.7	86.7	85.2	...
11	138	138	138	138	138	134	130	127	126	125	123	120	117	115	...
12	138	129	122	118	115	109	104	98.5	96.0	93.5	91.0	88.7	86.7	85.2	...
13	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
14	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
15	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
16	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
17	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
18	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
19	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
20	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
21	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
22	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
23	138	138	138	138	138	138	135	129	127	125	123	122	120	119	...
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	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
27	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
28	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
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	137	134	129	127	125	123	122	120	119	117
32	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
33	138	129	120	115	111	105	99.5	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	...
35	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.6
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	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
38	138	129	120	115	111	105	99.5	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
39	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.6
40	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
41	138	138	138	138	138	137	134	129	127	125	123	122	120	119	117
42	138	129	120	115	111	105	99.5	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
43	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
44	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
45	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	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	...	...	...
4	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	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	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	...	...	...
8	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	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	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	...	...	...
14	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	...	...	...
15	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	...	...	...
16	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	...	...	...
17	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	...	...	...
18	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	...	...	...
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	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	...	...	...
21	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	...	...	... (25)
22	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	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	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	...	...	...
25	85.3	77.8	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	112	87.2	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	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	...	...	...
28	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	...	...	...
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	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	...	...	...
32	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	...	...	...
33	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	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
38	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	...	...	...
39	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	...	...	... (25)
40	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	...	...	... (25)
41	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	...	...	...
42	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	...	...	...
43	112	87.2	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	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	...	...	...
45	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	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	25Cr-20Ni-Cb	Plate	SA-240	310Cb	S31040	...	...
2	25Cr-20Ni-Cb	Plate	SA-240	310Cb	S31040	...	...
3	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb	S31040	...	...
4	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb	S31040	...	...
5	25Cr-20Ni-Cb	Smls. & wld. pipe	SA-312	TP310Cb	S31040	...	...
6	25Cr-20Ni-Cb	Smls. pipe	SA-312	TP310Cb	S31040	...	...
7	25Cr-20Ni-Cb	Wld. pipe	SA-312	TP310Cb	S31040	...	...
8	25Cr-20Ni-Cb	Wld. pipe	SA-312	TP310Cb	S31040	...	...
9	25Cr-20Ni-Cb	Bar	SA-479	310Cb	S31040	...	...
10	25Cr-20Ni-Cb	Bar	SA-479	310Cb	S31040	...	...
11	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb	S31040	...	...
12	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb	S31040	...	...
13	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb	S31040	...	...
14	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb	S31040	...	...
15	25Cr-20Ni-Cb-N	Smls. tube	SA-213	TP310HCbN	S31042	...	...
16	25Cr-20Ni-Cb-N	Smls. tube	SA-213	TP310HCbN	S31042	...	...
17	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLN	S31050	...	...
18	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLN	S31050	...	...
19	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	6 < t ≤ 32
20	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	6 < t ≤ 32
21	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	t > 6
22	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	t > 6
23	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	6 < t ≤ 32
24	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	6 < t ≤ 32
25	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	6 < t ≤ 32
26	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	6 < t ≤ 32
27	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	≤ 6
28	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	≤ 6
29	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	t ≤ 6
30	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	t ≤ 6
31	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	≤ 6
32	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	≤ 6
33	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	≤ 6
34	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	≤ 6
35	26Cr-4Ni-Mo	Plate	SA-240	329	S32900	...	...
36	26Cr-4Ni-Mo	Wld. tube	SA-789	...	S32900	...	...
37	26Cr-4Ni-Mo	Smls. tube	SA-789	...	S32900	...	...
38	26Cr-4Ni-Mo	Wld. pipe	SA-790	...	S32900	...	...
39	26Cr-4Ni-Mo	Smls. pipe	SA-790	...	S32900	...	...
40	26Cr-4Ni-Mo-N	Plate	SA-240	...	S32950	...	...
41	26Cr-4Ni-Mo-N	Wld. tube	SA-789	...	S32950	...	...
42	26Cr-4Ni-Mo-N	Smls. tube	SA-789	...	S32950	...	...
43	26Cr-4Ni-Mo-N	Wld. pipe	SA-790	...	S32950	...	...
44	26Cr-4Ni-Mo-N	Smls. pipe	SA-790	...	S32950	...	...
45	27Cr-7.5Ni-4.5Mo-Co-N	Smls. tube	SA-789	...	S32707	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					Limits					
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, T5
2	8	2	515	205	NP	NP	816	343	HA-2	G12, T6
3	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
4	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
5	8	2	515	205	NP	427	816	343	HA-2	G5, G12, T5, W12, W14
6	8	2	515	205	NP	NP	816	343	HA-2	G12, T6
7	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
8	8	2	515	205	NP	NP	816	343	HA-2	G12, G14, G24, T6
9	8	2	515	205	NP	NP	538	343	HA-2	G5, G12, G22, T5
10	8	2	515	205	NP	NP	538	343	HA-2	G12, G22, T6
11	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
12	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
13	8	2	515	205	NP	NP	816	343	HA-2	G5, G12, G24, T5
14	8	2	515	205	NP	NP	816	343	HA-2	G12, G24, T6
15	8	3	655	295	732	NP	NP	NP	HA-2	G5, G12, S4, T8
16	8	3	655	295	732	NP	NP	NP	HA-2	G12, S4, T9
17	8	2	540	255	NP	NP	316	316	HA-2	G5
18	8	2	540	255	NP	NP	316	316	HA-2	...
19	8	2	540	255	NP	NP	482	343	HA-2	G5
20	8	2	540	255	NP	NP	482	343	HA-2	...
21	8	2	540	255	NP	NP	316	316	HA-2	G5
22	8	2	540	255	NP	NP	316	316	HA-2	...
23	8	2	540	255	NP	NP	482	343	HA-2	G5, G24
24	8	2	540	255	NP	NP	482	343	HA-2	G24
25	8	2	540	255	NP	NP	482	343	HA-2	G5, G24
26	8	2	540	255	NP	NP	482	343	HA-2	G24
27	8	2	580	270	NP	NP	482	343	HA-2	G5
28	8	2	580	270	NP	NP	482	343	HA-2	...
29	8	2	580	270	NP	NP	316	316	HA-2	G5
30	8	2	580	270	NP	NP	316	316	HA-2	...
31	8	2	580	270	NP	NP	482	343	HA-2	G5, G24
32	8	2	580	270	NP	NP	482	343	HA-2	G24
33	8	2	580	270	NP	NP	482	343	HA-2	G5, G24
34	8	2	580	270	NP	NP	482	343	HA-2	G24
35	10H	1	620	485	NP	NP	260	260	HA-5	G19
36	10H	1	620	485	NP	NP	260	260	HA-5	G19, G24
37	10H	1	620	485	NP	NP	260	260	HA-5	G19
38	10H	1	620	485	NP	NP	260	260	HA-5	G19, G24
39	10H	1	620	485	NP	NP	260	260	HA-5	G19
40	10H	1	690	485	NP	NP	316	316	HA-5	G19
41	10H	1	690	485	NP	NP	316	316	HA-5	G19, G24
42	10H	1	690	485	NP	NP	316	316	HA-5	G19
43	10H	1	690	485	NP	NP	316	316	HA-5	G19, G24
44	10H	1	690	485	NP	NP	316	316	HA-5	G19
45	10H	1	920	700	NP	NP	260	NP	HA-5	G19

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
2	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
3	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
4	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
5	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
6	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
7	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
8	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
9	138	138	138	138	138	138	135	129	127	125	123	122	120	119	117
10	138	129	120	115	111	105	100	95.4	94.0	92.8	91.5	90.3	89.0	87.8	86.5
11	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
12	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
13	117	117	117	117	117	117	114	109	108	106	105	103	102	101	99.3
14	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
15	187	187	184	179	175	170	167	165	165	165	164	164	163	162	160
16	187	177	163	156	149	140	133	129	127	126	124	123	121	120	119
17	154	153	151	147	143	138	135	132	130	...	...	...	...	...	...
18	154	150	143	137	131	123	117	111	109	...	...	...	...	...	...
19	154	153	151	147	143	138	135	132	130	129	129	128	127	126	124
20	154	150	143	137	131	123	117	111	109	106	104	102	99.5	96.9	95.0
21	154	153	151	147	143	138	135	132	130	...	...	...	...	...	...
22	154	150	143	137	131	123	117	111	109	...	...	...	...	...	...
23	130	130	128	125	122	118	114	112	111	110	110	109	108	107	105
24	130	127	121	116	111	105	99.6	94.5	92.3	90.6	88.6	86.1	84.2	82.3	81.0
25	130	130	128	125	122	118	114	112	111	110	110	109	108	107	105
26	130	127	121	116	111	105	99.6	94.5	92.3	90.6	88.6	86.1	84.2	82.3	81.0
27	165	165	163	158	154	149	146	142	141	140	138	138	137	135	134
28	165	159	151	144	138	130	123	117	115	112	110	107	105	102	100
29	165	165	163	158	154	149	146	142	141	...	...	...	...	...	...
30	165	159	151	144	138	130	123	117	115	...	...	...	...	...	...
31	141	141	139	135	132	126	123	121	120	119	118	117	116	115	113
32	141	135	128	123	118	110	104	100	97.6	95.3	93.4	90.9	89.1	87.2	85.3
33	141	141	139	135	132	126	123	121	120	119	118	117	116	115	113
34	141	135	128	123	118	110	104	100	97.6	95.3	93.4	90.9	89.1	87.2	85.3
35	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
36	151	151	151	148	145	142	142	...	...	...	...	...	...	...	...
37	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
38	151	151	151	148	145	142	142	...	...	...	...	...	...	...	...
39	177	177	177	174	171	168	168	...	...	...	...	...	...	...	...
40	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
41	168	167	166	163	158	155	155	155	155	...	...	...	...	...	...
42	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
43	168	167	166	163	158	155	155	155	155	...	...	...	...	...	...
44	197	197	196	191	186	182	182	182	182	...	...	...	...	...	...
45	262	262	262	262	260	255	245	243	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
2	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	...	...	...
3	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	...	...	...
4	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	...	...	...
5	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	...	...	...
6	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	...	...	...
7	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	...	...	...
8	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	...	...	...
9	112	87.2	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	85.3	77.8	59.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	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	...	...	...
12	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	...	...	...
13	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	...	...	...
14	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	...	...	...
15	158	156	153	150	118	90.2	68.9	52.9	41.1	32.2	25.2	...	...	...	...	...	...
16	117	115	114	112	110	90.2	68.9	52.9	41.1	32.2	25.2	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	122	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	103	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	79.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	103	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	79.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	132	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	98.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	83.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	83.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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
1	27Cr-7.5Ni-4.5Mo-Co-N	Smls. pipe	SA-790	...	S32707	...	...
2	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	≥10
3	29Cr-6.5Ni-2Mo-N	Bar	SA-479	...	S32906	...	...
4	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	≥10
5	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	≥10
6	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	<10
7	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	<10
8	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	<10

Table 1A (Cont'd)
Section I; Section III, Division 1, 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.	P-No.	Group No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits				External Pressure Chart No.	Notes
					(NP = Not Permitted)					
					(SPT = Supports Only)					
					I	III	VIII-1	XII		
1	10H	1	920	700	NP	NP	260	NP	HA-5	G19
2	10H	1	750	550	NP	NP	316	316	HA-5	G19
3	10H	1	750	550	NP	NP	316	316	HA-5	G19
4	10H	1	750	550	NP	NP	316	316	HA-5	G19
5	10H	1	750	550	NP	NP	316	316	HA-5	G19
6	10H	1	800	650	NP	NP	316	316	HA-5	G19
7	10H	1	800	650	NP	NP	316	316	HA-5	G19
8	10H	1	800	650	NP	NP	316	316	HA-5	G19

Table 1A (Cont'd)
Section I; Section III, Division 1, 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														
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475
1	262	262	262	262	260	255	245	243	...	...	...	...	...	...	...
2	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
3	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
4	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
5	215	215	213	208	204	198	196	195	195	...	...	...	...	...	...
6	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...
7	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...
8	229	229	227	221	217	211	208	207	207	...	...	...	...	...	...

Table 1A (Cont'd)
Section I; Section III, Division 1, 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	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 1A**GENERAL NOTES**

- (25) (a) The following abbreviations are used: N, Normalized; Norm. rld., Normalized rolled; NT, Normalized and tempered; QT, Quenched and tempered; 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) 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.
- (d) 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.
- (e) Stress values for 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 T12).
- (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.

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.
- 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.
- 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)**

- G19 This steel may be expected to develop embrittlement after service at moderately elevated temperature. See Nonmandatory Appendix A, A-207 and A-208.
- G20 These stresses are based on weld metal properties.
- 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, Figure 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.
- G30 These stresses apply to all product forms (C, H, and P) as defined in SA/EN 10028-7.
- G31 The allowable stress value given for 250°C can be used up to the temperature of 260°C.
- G32 The allowable stress value given for 200°C can be used up to the temperature of 204°C.
- G33 The allowable stress value at 65°C shall be used at 66°C.

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.
- (25) H3 DELETED
- (25) H4 DELETED
- 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.
- H6 Material shall be solution annealed at 1100°C to 1170°C, followed by a rapid cooling in water or air.

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 DN 100 and the maximum thickness in any pipe size shall be Schedule 80.
- 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.
- T11 Allowable stresses for temperatures of 350°C and above are values obtained from time-dependent properties.
- T12 Allowable stresses for temperatures of 650°C and above are values obtained from time-dependent properties.

NOTES TO TABLE 1A (CONT'D)**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.
- 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 2¹/₄Cr-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/SA-1016M.
 - (d) A complete volumetric inspection of the entire length of each tube shall be performed in accordance with SA-450/SA-1016M.
 - (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.

INTENTIONALLY LEFT BLANK

Table 1B
Section I; Section III, Division 1, 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/EN 1706	...	AC-42000-S	T6
43	...	Castings	SB-26	...	A24430	F
44	...	Plate, sheet	SB-209	...	A91060	O
45	...	Plate, sheet	SB-209	...	A91060	H112

Table 1B
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	0.15–12.67	21	90	30	NP	121 (Cl. 3 only)	204	204	NFA-7	G16
2	12.70–76.20	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-7	G25
3	6.35–12.67	21	110	60	NP	148 (Cl. 3 only)	204	204	NFA-7	G16, W3
4	12.70–50.80	21	105	40	NP	93 (Cl. 3 only)	204	204	NFA-7	G26, W3
5	50.83–76.20	21	100	40	NP	93 (Cl. 3 only)	204	204	NFA-7	G26, W3
6	0.43–12.67	21	110	75	NP	148 (Cl. 3 only)	204	204	NFA-7	G16, W3
7	12.70–50.80	21	115	85	NP	148 (Cl. 3 only)	204	204	NFA-7	G25, W3
8	0.23–12.67	21	130	110	NP	121 (Cl. 3 only)	204	204	NFA-7	G16, W3
9	12.70–25.40	21	140	115	NP	121 (Cl. 3 only)	204	204	NFA-7	G25, W3
10	0.25–12.70	21	90	30	NP	121 (Cl. 3 only)	204	204	NFA-7	G16
11	1.27–12.70	21	90	30	NP	121 (Cl. 3 only)	204	204	NFA-7	G16, W3
12	0.25–12.70	21	130	110	NP	121 (Cl. 3 only)	204	204	NFA-1	G16, W3
13	0.25–12.70	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	30	NP	121 (Cl. 3 only)	204	204	NFA-7	G16
17	...	21	90	30	NP	121 (Cl. 3 only)	204	204	NFA-7	G16, W3
18	0.15–12.67	22	145	55	NP	148 (Cl. 3 only)	204	204	NFA-7	G16
19	12.70–76.20	22	150	60	NP	148 (Cl. 3 only)	204	204	NFA-7	G25
20	6.35–12.67	22	150	60	NP	148 (Cl. 3 only)	204	204	NFA-7	G16, W3
21	12.70–76.20	22	160	60	NP	148 (Cl. 3 only)	204	204	NFA-7	G25, W3
22	0.43–12.67	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	0.23–12.67	22	215	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	0.25–6.34	23	185	95	NP	204 (Cl. 3 only)	204	204	NFA-12	G16, G24, W4
27	6.35–12.69	23	185	95	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	0.25–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12	G24, W7
30	6.35–76.20	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12	G24, W7
31	0.25–6.34	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	0.25–6.34	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	...	...	220	180	NP	NP	121	NP	NFA-12	G15, W4
43	...	...	120	41	NP	204 (Cl. 3 only)	204	204	NFA-1	G15, W4
44	0.15–76.2	21	55	15	NP	149 (Cl. 3 only)	204	204	NFA-7	T3
45	6.35–12.7	21	75	50	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3

Table 1B
Section I; Section III, Division 1, 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																	
	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	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
2	23.0	22.1	21.4	20.5	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
3	31.5	31.0	28.2	26.1	22.6	18.8	15.0	12.0	...	...	...	...	...	...	...	...	...	...
4	27.6	26.6	25.6	24.5	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
5	27.6	26.6	25.6	24.0	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
6	31.5	31.5	30.6	28.7	22.6	18.8	15.0	12.0	...	...	...	...	...	...	...	...	...	...
7	33.5	33.5	32.5	30.5	22.6	18.8	15.0	12.0	...	...	...	...	...	...	...	...	...	...
8	37.4	37.4	37.4	35.9	26.5	19.0	15.4	12.0	...	...	...	...	...	...	...	...	...	...
9	39.4	39.4	39.4	37.8	26.5	19.0	15.4	12.0	...	...	...	...	...	...	...	...	...	...
10	20.7	19.9	19.3	18.4	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
11	20.7	19.9	19.3	18.4	15.0	11.2	9.4	7.7	...	...	...	...	...	...	...	...	...	...
12	37.4	37.4	37.4	35.9	26.5	19.0	15.4	12.0	...	...	...	...	...	...	...	...	...	...
13	51.2	51.2	48.5	45.1	32.6	22.6	16.9	12.4	...	...	...	...	...	...	...	...	...	...
14	37.4	37.4	37.4	35.9	26.5	19.0	15.4	12.0	...	...	...	...	...	...	...	...	...	...
15	41.4	41.4	41.4	39.4	26.5	19.0	15.4	12.0	...	...	...	...	...	...	...	...	...	...
16	20.7	19.9	19.3	18.4	15.0	11.2	8.7	6.7	...	...	...	...	...	...	...	...	...	...
17	20.7	19.9	19.3	18.4	15.0	11.2	8.7	6.7	...	...	...	...	...	...	...	...	...	...
18	36.8	36.8	36.8	36.8	30.7	23.8	15.1	10.1	...	...	...	...	...	...	...	...	...	...
19	39.1	39.1	39.1	39.1	30.7	23.8	15.1	10.1	...	...	...	...	...	...	...	...	...	...
20	39.1	39.1	39.1	39.1	31.3	23.9	15.2	10.1	...	...	...	...	...	...	...	...	...	...
21	41.4	41.2	41.2	41.2	31.3	23.9	15.2	10.1	...	...	...	...	...	...	...	...	...	...
22	53.2	53.2	53.2	53.2	35.2	24.0	15.5	10.1	...	...	...	...	...	...	...	...	...	...
23	55.2	55.2	55.2	55.2	35.2	24.0	15.5	10.1	...	...	...	...	...	...	...	...	...	...
24	61.1	61.1	61.1	61.1	35.2	24.0	15.5	10.1	...	...	...	...	...	...	...	...	...	...
25	63.0	63.0	63.0	63.0	35.2	24.0	15.5	10.1	...	...	...	...	...	...	...	...	...	...
26	53.2	53.2	53.2	52.9	42.6	39.5	28.0	21.2	...	...	...	...	...	...	...	...	...	...
27	53.2	53.2	53.2	52.9	42.6	39.5	28.0	21.2	...	...	...	...	...	...	...	...	...	...
28	59.1	59.1	59.1	58.5	42.6	39.5	28.0	21.2	...	...	...	...	...	...	...	...	...	...
29	47.3	47.3	47.3	46.8	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
30	47.3	47.3	47.3	46.8	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
31	74.9	74.9	74.9	71.3	51.8	40.0	28.9	21.2	...	...	...	...	...	...	...	...	...	...
32	74.9	74.9	74.9	71.3	51.8	40.0	28.9	21.2	...	...	...	...	...	...	...	...	...	...
33	82.7	82.7	82.7	79.2	51.8	40.0	28.9	21.2	...	...	...	...	...	...	...	...	...	...
34	78.8	78.8	78.8	75.5	50.5	39.9	28.8	21.2	...	...	...	...	...	...	...	...	...	...
35	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
36	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
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	63.0	63.0	62.8	62.8	56.4	...	...	...	...	...	...	...	...	...	...	...	...	...
43	27.6	27.6	27.4	25.9	24.0	21.5	19.6	17.8	...	...	...	...	...	...	...	...	...	...
44	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.40	...	...	...	...	...	...	...	...	...	...
45	21.7	20.7	18.2	16.2	12.4	11.1	7.03	4.87	...	...	...	...	...	...	...	...	...	...

Table 1B
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	A91060	H112
2	...	Plate, sheet	SB-209	...	A91060	H112
3	...	Plate, sheet	SB-209	...	A91060	H12
4	...	Plate, sheet	SB-209	...	A91060	H14
5	...	Drawn smls. tube	SB-210	...	A91060	O
6	...	Drawn smls. tube	SB-210	...	A91060	H14
7	...	Drawn smls. tube	SB-210	...	A91060	H113
8	...	Bar, rod, shapes	SB-221	...	A91060	O
9	...	Bar, rod, shapes	SB-221	...	A91060	H112
10	...	Cond. & heat exch. tubes	SB-234	...	A91060	H14
11	...	Smls. extr. tube	SB-241	...	A91060	O
12	...	Smls. extr. tube	SB-241	...	A91060	H112
13	...	Plate, sheet	SB-209	...	A91100	O
14	...	Plate, sheet	SB-209	...	A91100	H112
15	...	Plate, sheet	SB-209	...	A91100	H112
16	...	Plate, sheet	SB-209	...	A91100	H112
17	...	Plate, sheet	SB-209	...	A91100	H12
18	...	Plate, sheet	SB-209	...	A91100	H14
19	...	Bar, rod, shapes	SB-221	...	A91100	O
20	...	Bar, rod, shapes	SB-221	...	A91100	H112
21	...	Smls. extr. tube	SB-241	...	A91100	O
22	...	Smls. extr. tube	SB-241	...	A91100	H112
23	...	Die forgings	SB-247	...	A92014	T4
24	...	Die forgings	SB-247	...	A92014	T6
25	...	Die forgings	SB-247	...	A92014	T6
26	...	Bar, rod, wire	SB-211	...	A92024	T4
27	...	Bar, rod, wire	SB-211	...	A92024	T4
28	...	Bar, rod, wire	SB-211	...	A92024	T4
29	...	Bar, rod, wire	SB-211	...	A92024	T4
30	...	Bar, rod, shapes	SB-221	...	A92024	T3
31	...	Bar, rod, shapes	SB-221	...	A92024	T3
32	...	Bar, rod, shapes	SB-221	...	A92024	T3
33	...	Bar, rod, shapes	SB-221	...	A92024	T3
34	...	Plate, sheet	SB-209	...	A93003	O
35	...	Plate, sheet	SB-209	...	A93003	H112
36	...	Plate, sheet	SB-209	...	A93003	H112
37	...	Plate, sheet	SB-209	...	A93003	H112
38	...	Plate, sheet	SB-209	...	A93003	H12
39	...	Plate, sheet	SB-209	...	A93003	H14
40	...	Drawn smls. tube	SB-210	...	A93003	O
41	...	Drawn smls. tube	SB-210	...	A93003	H113
42	...	Drawn smls. tube	SB-210	...	A93003	H12
43	...	Drawn smls. tube	SB-210	...	A93003	H14
44	...	Drawn smls. tube	SB-210	...	A93003	H18
45	...	Bar, rod, shapes	SB-221	...	A93003	O

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	12.70–25.4	21	70	35	NP	149 (Cl. 3 only)	204	204	NFA-7	T4, W3
2	25.43–76.2	21	60	30	NP	121 (Cl. 3 only)	204	204	NFA-7	T3, W3
3	0.43–50.8	21	75	60	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3
4	0.23–25.4	21	85	70	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3
5	0.46–12.7	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	T3
6	0.46–12.7	...	85	70	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3
7	0.46–12.7	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3
8	...	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	G13, T3
9	...	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	G13, T3, W3
10	0.25–5.08	21	85	70	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W4
11	...	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	T3
12	...	21	60	15	NP	149 (Cl. 3 only)	204	204	NFA-7	T3, W3
13	0.15–76.2	21	75	25	NP	121 (Cl. 3 only)	204	204	NFA-7	T4
14	6.35–12.7	21	90	50	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
15	12.7–50.8	21	85	35	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
16	50.8–76.2	21	80	30	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
17	0.43–50.8	21	95	75	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
18	0.23–25.4	21	110	95	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
19	...	21	75	20	NP	121 (Cl. 3 only)	204	204	NFA-7	T4
20	...	21	75	20	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
21	...	21	75	20	NP	121 (Cl. 3 only)	204	204	NFA-7	T4
22	...	21	75	20	NP	121 (Cl. 3 only)	204	204	NFA-7	T4, W3
23	≤101.6	...	380	205	NP	204 (Cl. 3 only)	204	204	NFA-6	T3, W4
24	≤50.8	...	450	385	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
25	50.81–101.6	...	435	370	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
26	3.18–12.69	...	425	310	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
27	12.70–114.30	...	425	290	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
28	114.31–165.10	...	425	275	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
29	165.11–203.2	...	400	260	NP	204 (Cl. 3 only)	204	204	NFA-6	T2, W4
30	≤6.34	...	395	290	NP	204 (Cl. 3 only)	204	204	NFA-6	G24, T2, W4
31	6.35–19.04	...	415	305	NP	204 (Cl. 3 only)	204	204	NFA-6	G24, T2, W4
32	19.05–38.09	...	450	315	NP	204 (Cl. 3 only)	204	204	NFA-6	G24, T2, W4
33	≥38.10	...	470	330	NP	204 (Cl. 3 only)	204	204	NFA-6	G24, T2, W4
34	0.15–76.20	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3
35	6.35–12.67	21	115	70	NP	148 (Cl. 3 only)	204	204	NFA-1	T4, W3
36	12.70–50.80	21	105	40	NP	93 (Cl. 3 only)	204	204	NFA-1	T3, W3
37	50.83–76.20	21	100	40	NP	93 (Cl. 3 only)	204	204	NFA-1	T3, W3
38	0.43–50.80	21	115	85	NP	148 (Cl. 3 only)	204	204	NFA-1	T4, W3
39	0.23–25.40	21	140	115	NP	121 (Cl. 3 only)	204	204	NFA-2	T4, W3
40	0.25–12.70	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3
41	0.25–12.70	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3, W3
42	0.25–12.70	21	115	85	NP	148 (Cl. 3 only)	204	204	NFA-1	T4, W3
43	0.25–12.70	21	140	115	NP	121 (Cl. 3 only)	204	204	NFA-2	T4, W3
44	0.25–12.70	21	185	165	NP	121 (Cl. 3 only)	204	204	NFA-2	T4, W3
45	...	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	19.7	18.7	16.4	14.7	11.6	9.77	6.70	5.40	...	...	...	...	...	...	...	...	...	...
2	17.7	16.8	14.8	13.2	10.2	7.73	5.80	4.36	...	...	...	...	...	...	...	...	...	...
3	21.7	21.7	19.9	18.0	14.4	12.5	7.77	5.27	...	...	...	...	...	...	...	...	...	...
4	23.6	23.6	23.6	23.6	17.7	12.7	8.78	6.10	...	...	...	...	...	...	...	...	...	...
5	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.36	...	...	...	...	...	...	...	...	...	...
6	23.6	23.6	23.6	23.6	17.7	12.7	8.78	6.13	...	...	...	...	...	...	...	...	...	...
7	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.36	...	...	...	...	...	...	...	...	...	...
8	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.36	...	...	...	...	...	...	...	...	...	...
9	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.36	...	...	...	...	...	...	...	...	...	...
10	23.6	23.6	23.6	23.6	17.7	12.7	8.78	6.13	...	...	...	...	...	...	...	...	...	...
11	11.5	11.3	10.6	9.39	8.19	7.37	5.67	4.36	...	...	...	...	...	...	...	...	...	...
12	11.5	11.3	10.6	9.39	8.19	6.97	5.68	4.68	...	...	...	...	...	...	...	...	...	...
13	16.1	16.1	16.0	15.6	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
14	25.6	25.6	23.3	21.0	16.3	12.0	7.29	4.66	...	...	...	...	...	...	...	...	...	...
15	23.0	23.0	21.5	19.4	15.0	11.9	7.19	4.66	...	...	...	...	...	...	...	...	...	...
16	18.4	18.4	18.0	17.4	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
17	27.6	27.6	26.7	24.7	19.0	14.1	8.73	5.67	...	...	...	...	...	...	...	...	...	...
18	31.5	31.5	30.9	28.3	19.0	14.1	8.73	5.67	...	...	...	...	...	...	...	...	...	...
19	13.8	13.8	13.7	13.4	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
20	13.8	13.8	13.7	13.4	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
21	13.8	13.8	13.7	13.4	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
22	13.8	13.8	13.7	13.4	12.3	9.80	7.18	5.38	...	...	...	...	...	...	...	...	...	...
23	108	108	89.2	85.3	78.7	48.8	29.5	12.5	...	...	...	...	...	...	...	...	...	...
24	128	128	125	98.4	78.2	48.6	29.7	12.4	...	...	...	...	...	...	...	...	...	...
25	124	124	121	95.1	78.1	48.6	29.7	12.4	...	...	...	...	...	...	...	...	...	...
26	122	122	118	90.6	70.7	46.3	32.7	21.2	...	...	...	...	...	...	...	...	...	...
27	122	122	118	90.6	70.7	46.3	32.7	21.2	...	...	...	...	...	...	...	...	...	...
28	122	122	118	90.6	70.7	46.3	32.7	21.2	...	...	...	...	...	...	...	...	...	...
29	114	114	111	84.6	66.0	43.3	30.7	19.5	...	...	...	...	...	...	...	...	...	...
30	112	112	109	83.2	64.6	42.6	30.6	20.0	...	...	...	...	...	...	...	...	...	...
31	118	118	114	87.2	68.0	44.7	32.0	20.9	...	...	...	...	...	...	...	...	...	...
32	128	128	124	94.4	73.4	48.3	34.3	22.0	...	...	...	...	...	...	...	...	...	...
33	134	134	130	99.1	76.8	50.4	36.3	24.0	...	...	...	...	...	...	...	...	...	...
34	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
35	33.5	32.9	29.9	27.7	24.6	20.9	17.0	14.0	...	...	...	...	...	...	...	...	...	...
36	27.6	26.6	25.6	24.5	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
37	27.6	26.6	25.6	24.1	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
38	33.5	33.5	32.5	30.5	24.6	20.9	17.0	14.0	...	...	...	...	...	...	...	...	...	...
39	39.4	39.4	39.4	37.8	29.2	21.1	17.5	14.0	...	...	...	...	...	...	...	...	...	...
40	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
41	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
42	33.5	33.5	32.5	30.5	24.6	20.9	17.0	14.0	...	...	...	...	...	...	...	...	...	...
43	39.4	39.4	39.4	37.8	29.2	21.1	17.5	14.0	...	...	...	...	...	...	...	...	...	...
44	53.2	53.2	50.4	46.9	36.6	24.8	18.5	13.4	...	...	...	...	...	...	...	...	...	...
45	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Bar, rod, shapes	SB-221	...	A93003	H112
2	...	Cond. & heat exch. tubes	SB-234	...	A93003	H14
3	...	Cond. & heat exch. tubes	SB-234	...	A93003	H25
4	...	Smls. extr. tube	SB-241	...	A93003	O
5	...	Smls. extr. tube	SB-241	...	A93003	H112
6	...	Smls. pipe	SB-241	...	A93003	H112
7	...	Smls. pipe	SB-241	...	A93003	H18
8	...	Die forgings	SB-247	...	A93003	H112
9	...	Die forgings	SB-247	...	A93003	H112 wld.
10	...	Plate, sheet	SB-209	...	A93004	O
11	...	Plate, sheet	SB-209	...	A93004	H112
12	...	Plate, sheet	SB-209	...	A93004	H32
13	...	Plate, sheet	SB-209	...	A93004	H34
14	...	Plate, sheet	SB-209	...	A95052	O
15	...	Plate, sheet	SB-209	...	A95052	H112
16	...	Plate, sheet	SB-209	...	A95052	H112
17	...	Plate, sheet	SB-209	...	A95052	H32
18	...	Plate, sheet	SB-209	...	A95052	H34
19	...	Drawn smls. tube	SB-210	...	A95052	O
20	...	Drawn smls. tube	SB-210	...	A95052	H32
21	...	Drawn smls. tube	SB-210	...	A95052	H34
22	...	Cond. & heat exch. tubes	SB-234	...	A95052	H32
23	...	Cond. & heat exch. tubes	SB-234	...	A95052	H34
24	...	Smls. extr. tube	SB-241	...	A95052	O
25	...	Plate, sheet	SB-209	...	A95083	O
26	...	Plate, sheet	SB-209	...	A95083	O
27	...	Plate, sheet	SB-209	...	A95083	O
28	...	Plate, sheet	SB-209	...	A95083	O
29	...	Plate, sheet	SB-209	...	A95083	O
30	...	Plate, sheet	SB-209	...	A95083	H112
31	...	Plate, sheet	SB-209	...	A95083	H112
32	...	Plate, sheet	SB-209	...	A95083	H32
33	...	Plate, sheet	SB-209	...	A95083	H32
34	...	Bar, rod, shapes	SB-221	...	A95083	O
35	...	Bar, rod, shapes	SB-221	...	A95083	H111
36	...	Bar, rod, shapes	SB-221	...	A95083	H112
37	...	Smls. extr. tube	SB-241	...	A95083	O
38	...	Smls. extr. tube	SB-241	...	A95083	H111
39	...	Smls. extr. tube	SB-241	...	A95083	H112
40	...	Die & hand forgings	SB-247	...	A95083	H111
41	...	Die & hand forgings	SB-247	...	A95083	H112
42	...	Die & hand forgings	SB-247	...	A95083	H111 wld.
43	...	Die & hand forgings	SB-247	...	A95083	H112 wld.
44	...	Plate, sheet	SB-928	...	A95083	H321
45	...	Plate, sheet	SB-928	...	A95083	H321

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3, W3
2	0.25–5.08	21	140	115	NP	121 (Cl. 3 only)	204	204	NFA-2	T4, W4
3	0.25–5.08	21	150	130	NP	121 (Cl. 3 only)	204	204	NFA-2	T4, W4
4	...	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3
5	...	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3, W3
6	≥25.40	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3, W4
7	<25.40	21	185	165	NP	121 (Cl. 3 only)	204	204	NFA-1	T4, W4
8	≤101.60	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3
9	≤101.60	21	95	35	NP	121 (Cl. 3 only)	204	204	NFA-1	T3, W7
10	0.15–76.20	22	150	60	NP	148 (Cl. 3 only)	204	204	NFA-3	...
11	6.35–76.20	22	160	60	NP	148 (Cl. 3 only)	204	204	NFA-3	W3
12	0.43–50.80	22	195	145	NP	121 (Cl. 3 only)	204	204	NFA-3	W3
13	0.23–25.40	22	220	170	NP	121 (Cl. 3 only)	204	204	NFA-4	W3
14	0.15–76.20	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA-8	...
15	6.35–12.69	22	195	110	NP	121 (Cl. 3 only)	204	204	NFA-8	W3
16	12.70–76.20	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA-8	W3
17	0.43–50.80	22	215	160	NP	93 (Cl. 3 only)	204	204	NFA-3	W3
18	0.23–25.40	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA-4	W3
19	0.25–11.43	22	170	70	NP	148 (Cl. 3 only)	204	204	NFA-8	...
20	0.25–11.43	22	215	160	NP	93 (Cl. 3 only)	204	204	NFA-8	W4
21	0.25–11.43	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA-8	W4
22	0.25–5.08	22	215	160	NP	93 (Cl. 3 only)	204	204	NFA-8	W4
23	0.25–5.08	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA-8	W4
24	...	22	170	70	NP	121 (Cl. 3 only)	204	204	NFA-8	...
25	1.30–38.10	25	275	125	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
26	38.11–76.20	25	270	115	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
27	76.21–127.00	25	260	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
28	127.01–177.80	25	255	105	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
29	177.81–203.20	25	250	95	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
30	6.35–38.10	25	275	125	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
31	38.11–76.20	25	270	115	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
32	3.18–38.10	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
33	38.11–76.20	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
34	≤127.00	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
35	≤127.00	25	275	165	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
36	≤127.00	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
37	...	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43
38	...	25	275	165	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
39	...	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
40	≤101.60	25	270	140	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W4
41	≤101.60	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W4
42	≤101.60	25	260	...	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W7
43	≤101.60	25	260	...	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W7
44	3.20 < t ≤ 40.00	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
45	40.00 < t ≤ 80.00	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
2	39.4	39.4	39.4	37.8	29.2	21.1	17.5	14.0	...	...	...	...	...	...	...	...	...	...
3	43.3	43.3	43.3	41.3	29.2	21.1	17.5	14.0	...	...	...	...	...	...	...	...	...	...
4	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
5	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
6	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
7	53.2	53.2	50.4	46.9	36.6	24.8	18.5	13.4	...	...	...	...	...	...	...	...	...	...
8	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
9	23.0	22.9	22.9	22.3	16.4	12.6	10.1	8.0	...	...	...	...	...	...	...	...	...	...
10	39.1	39.1	39.1	39.1	34.1	26.6	17.3	11.8	...	...	...	...	...	...	...	...	...	...
11	41.4	41.2	41.2	41.2	34.8	26.7	17.3	11.8	...	...	...	...	...	...	...	...	...	...
12	55.2	55.2	55.2	55.2	39.3	26.9	17.7	11.8	...	...	...	...	...	...	...	...	...	...
13	63.0	63.0	63.0	63.0	39.3	26.9	17.7	11.8	...	...	...	...	...	...	...	...	...	...
14	43.7	43.7	43.6	43.5	38.1	28.8	17.4	11.1	...	...	...	...	...	...	...	...	...	...
15	55.2	55.2	55.2	55.2	42.0	29.0	17.7	11.1	...	...	...	...	...	...	...	...	...	...
16	43.7	43.7	43.6	43.5	40.7	28.9	17.6	11.1	...	...	...	...	...	...	...	...	...	...
17	61.1	61.1	61.1	61.1	42.0	29.0	17.7	11.1	...	...	...	...	...	...	...	...	...	...
18	67.0	67.0	67.0	67.0	42.0	29.0	17.7	11.1	...	...	...	...	...	...	...	...	...	...
19	46.0	46.0	45.9	45.8	38.1	28.8	16.7	10.3	...	...	...	...	...	...	...	...	...	...
20	61.1	61.1	61.1	61.1	41.4	29.0	16.9	10.3	...	...	...	...	...	...	...	...	...	...
21	67.0	67.0	67.0	67.0	41.4	29.0	16.9	10.3	...	...	...	...	...	...	...	...	...	...
22	61.1	61.1	61.1	61.1	42.0	29.0	17.7	11.1	...	...	...	...	...	...	...	...	...	...
23	67.0	67.0	67.0	67.0	42.0	29.0	17.7	11.1	...	...	...	...	...	...	...	...	...	...
24	46.0	46.0	45.9	45.8	38.1	28.8	16.7	10.3	...	...	...	...	...	...	...	...	...	...
25	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	86.8	86.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	80.6	80.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	86.7	86.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	80.8	80.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	A95086	O
2	...	Plate, sheet	SB-209	...	A95086	H112
3	...	Plate, sheet	SB-209	...	A95086	H112
4	...	Plate, sheet	SB-209	...	A95086	H112
5	...	Plate, sheet	SB-209	...	A95086	H112
6	...	Plate, sheet	SB-209	...	A95086	H32
7	...	Plate, sheet	SB-209	...	A95086	H34
8	...	Bar, rod, shapes	SB-221	...	A95086	H112
9	...	Smls. extr. tube	SB-241	...	A95086	O
10	...	Smls. extr. tube	SB-241	...	A95086	H111
11	...	Smls. extr. tube	SB-241	...	A95086	H112
12	...	Plate, sheet	SB-928	...	A95086	H116
13	...	Plate, sheet	SB-209	...	A95154	O
14	...	Plate, sheet	SB-209	...	A95154	H112
15	...	Plate, sheet	SB-209	...	A95154	H112
16	...	Plate, sheet	SB-209	...	A95154	H32
17	...	Plate, sheet	SB-209	...	A95154	H34
18	...	Drawn smls. tube	SB-210	...	A95154	O
19	...	Drawn smls. tube	SB-210	...	A95154	H34
20	...	Bar, rod, shapes	SB-221	...	A95154	O
21	...	Bar, rod, shapes	SB-221	...	A95154	H112
22	...	Plate, sheet	SB-209	...	A95254	O
23	...	Plate, sheet	SB-209	...	A95254	H112
24	...	Plate, sheet	SB-209	...	A95254	H112
25	...	Plate, sheet	SB-209	...	A95254	H32
26	...	Plate, sheet	SB-209	...	A95254	H34
27	...	Plate, sheet	SB-209	...	A95454	O
28	...	Plate, sheet	SB-209	...	A95454	H112
29	...	Plate, sheet	SB-209	...	A95454	H112
30	...	Plate, sheet	SB-209	...	A95454	H32
31	...	Plate, sheet	SB-209	...	A95454	H34
32	...	Bar, rod, shapes	SB-221	...	A95454	O
33	...	Bar, rod, shapes	SB-221	...	A95454	H111
34	...	Bar, rod, shapes	SB-221	...	A95454	H112
35	...	Cond. & heat exch. tubes	SB-234	...	A95454	H32
36	...	Cond. & heat exch. tubes	SB-234	...	A95454	H34
37	...	Smls. extr. tube	SB-241	...	A95454	O
38	...	Smls. extr. tube	SB-241	...	A95454	H111
39	...	Smls. extr. tube	SB-241	...	A95454	H112
40	...	Plate, sheet	SB-209	...	A95456	O
41	...	Plate, sheet	SB-209	...	A95456	O
42	...	Plate, sheet	SB-209	...	A95456	O
43	...	Plate, sheet	SB-209	...	A95456	O
44	...	Plate, sheet	SB-209	...	A95456	O
45	...	Plate, sheet	SB-209	...	A95456	H112

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	0.51–50.80	25	240	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43
2	4.78–12.69	25	250	125	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W3
3	12.70–25.40	25	240	110	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W3
4	25.41–50.80	25	240	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W3
5	50.81–76.20	25	235	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43
6	0.51–50.80	25	275	195	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
7	0.23–25.40	25	305	235	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
8	≤127.00	25	240	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W4
9	...	25	240	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43
10	...	25	250	145	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W3
11	...	25	240	95	NP	66 (Cl. 3 only)	66	66	NFA-9	G18, G19, G43, W3
12	1.60 < t ≤ 50.00	25	275	195	NP	NP	66	66	NFA-11	G18, G19, G43, W3
13	0.51–76.2	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43
14	6.35–12.7	22	220	125	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
15	12.7–76.2	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43, W3
16	0.51–50.8	22	250	180	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
17	0.23–25.4	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
18	0.25–11.4	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43
19	0.25–11.4	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43, W3
20	...	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43
21	...	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43, W3
22	1.30–76.2	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43
23	6.35–12.7	22	220	125	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
24	12.7–76.2	22	205	75	NP	66 (Cl. 3 only)	66	66	NFA-5	G18, G19, G43, W3
25	1.30–50.8	22	250	180	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
26	1.30–25.4	22	270	200	NP	66 (Cl. 3 only)	66	66	NFA-11	G18, G19, G43, W3
27	0.51–76.2	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1
28	6.35–12.7	22	220	125	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
29	12.7–76.2	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
30	0.51–50.8	22	250	180	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
31	0.51–25.4	22	270	200	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
32	≤127	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1
33	≤127	22	230	130	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
34	≤127	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
35	0.25–5.08	22	250	180	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W4
36	0.25–5.08	22	270	200	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W4
37	...	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1
38	...	22	230	130	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
39	...	22	215	85	NP	121 (Cl. 3 only)	204	204	NFA-6	T1, W3
40	1.30–38.10	25	290	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19
41	38.11–76.20	25	285	125	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19
42	76.21–127.00	25	275	115	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19
43	127.01–177.80	25	270	110	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19
44	177.81–203.2	25	260	105	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19
45	6.35–38.10	25	290	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, W3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	70.9	70.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	86.7	86.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	70.9	70.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	64.4	64.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	78.8	78.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	63.0	63.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	70.9	70.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	63.0	63.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	50.6	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	70.9	70.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	76.8	76.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
28	63.0	63.0	63.0	63.0	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
29	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
30	70.9	70.9	70.9	70.9	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
31	76.8	76.8	76.8	75.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
32	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
33	65.0	65.0	65.0	65.0	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
34	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
35	70.9	70.9	70.9	70.9	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
36	76.8	76.8	76.8	75.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
37	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
38	65.0	65.0	65.0	65.0	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
39	55.2	55.2	55.2	55.2	37.5	28.8	21.7	16.4	...	...	...	...	...	...	...	...	...	...
40	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	80.8	80.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	78.1	78.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	73.5	73.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	A95456	H112
2	...	Plate, sheet	SB-209	...	A95456	H32
3	...	Plate, sheet	SB-209	...	A95456	H32
4	...	Plate, sheet	SB-209	...	A95456	H32
5	...	Bar, rod, shapes	SB-221	...	A95456	O
6	...	Bar, rod, shapes	SB-221	...	A95456	H111
7	...	Bar, rod, shapes	SB-221	...	A95456	H112
8	...	Smls. extr. tube	SB-241	...	A95456	O
9	...	Smls. extr. tube	SB-241	...	A95456	H111
10	...	Smls. extr. tube	SB-241	...	A95456	H112
11	...	Plate, sheet	SB-928	...	A95456	H321
12	...	Plate, sheet	SB-928	...	A95456	H321
13	...	Plate, sheet	SB-928	...	A95456	H321
14	...	Plate, sheet	SB-209	...	A95652	O
15	...	Plate, sheet	SB-209	...	A95652	H112
16	...	Plate, sheet	SB-209	...	A95652	H112
17	...	Plate, sheet	SB-209	...	A95652	H32
18	...	Plate, sheet	SB-209	...	A95652	H34
19	...	Plate, sheet	SB-209	...	A96061	T4
20	...	Plate, sheet	SB-209	...	A96061	T451
21	...	Plate, sheet	SB-209	...	A96061	T6
22	...	Plate, sheet	SB-209	...	A96061	T651
23	...	Plate, sheet	SB-209	...	A96061	T651
24	...	Plate, sheet	SB-209	...	A96061	T4 wld.
25	...	Plate, sheet	SB-209	...	A96061	T451 wld.
26	...	Plate, sheet	SB-209	...	A96061	T6 wld.
27	...	Plate, sheet	SB-209	...	A96061	T651 wld.
28	...	Drawn smls. tube	SB-210	...	A96061	T4
29	...	Drawn smls. tube	SB-210	...	A96061	T6
30	...	Drawn smls. tube	SB-210	...	A96061	T4 wld.
31	...	Drawn smls. tube	SB-210	...	A96061	T6 wld.
32	...	Bar, rod, wire	SB-211	...	A96061	T6
33	...	Bar, rod, wire	SB-211	...	A96061	T651
34	...	Bar, rod, wire	SB-211	...	A96061	T6 wld.
35	...	Bar, rod, wire	SB-211	...	A96061	T651 wld.
36	...	Bar, rod, shapes	SB-221	...	A96061	T4
37	...	Bar, rod, shapes	SB-221	...	A96061	T6
38	...	Bar, rod, shapes	SB-221	...	A96061	T4 wld.
39	...	Bar, rod, shapes	SB-221	...	A96061	T6 wld.
40	...	Cond. & heat exch. tubes	SB-234	...	A96061	T4
41	...	Cond. & heat exch. tubes	SB-234	...	A96061	T6
42	...	Cond. & heat exch. tubes	SB-234	...	A96061	T4 wld.
43	...	Cond. & heat exch. tubes	SB-234	...	A96061	T6 wld.
44	...	Smls. extr. tube	SB-241	...	A96061	T4
45	...	Smls. extr. tube	SB-241	...	A96061	T6

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	38.11–76.20	25	285	125	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
2	4.78–12.69	25	315	230	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
3	12.70–38.10	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
4	38.11–76.20	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
5	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43
6	≤127.0	25	290	180	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
7	≤127.0	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
8	...	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43
9	...	25	290	180	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
10	...	25	285	130	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
11	4.00–12.50	25	315	230	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
12	12.51–40.00	25	305	215	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
13	40.01–80.00	25	285	200	NP	66 (Cl. 3 only)	66	66	NFA-10	G18, G19, G43, W3
14	1.30–76.2	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA-8	T2
15	6.35–12.69	22	195	110	NP	121 (Cl. 3 only)	204	204	NFA-8	T1, W3
16	12.70–76.20	22	170	65	NP	121 (Cl. 3 only)	204	204	NFA-8	T2, W3
17	1.30–50.8	22	210	160	NP	93 (Cl. 3 only)	204	204	NFA-3	T1, W3
18	1.30–25.4	22	235	180	NP	93 (Cl. 3 only)	204	204	NFA-4	T1, W3
19	0.15–6.34	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W4
20	6.35–76.20	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W4
21	0.15–6.34	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12	G24, T3, W4
22	6.35–101.60	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W4, W9
23	101.61–152.40	23	275	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W4, W9
24	0.15–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W7
25	6.35–76.20	23	165	...	NP	NP	204	204	NFA-13	G24, T3, W7
26	0.15–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12	G24, T3, W7
27	6.35–152.40	23	165	...	NP	NP	204	204	NFA-12,13	G24, T3, W7, W9
28	0.64–12.70	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA-13	T3, W4
29	0.64–12.70	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
30	0.64–12.70	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-13	T3, W7
31	0.64–12.70	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W7, W9
32	3.18–6.34	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12	G24, T3, W4
33	6.35–203.20	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W4, W9
34	3.18–6.34	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12	G13, G24, T3, W7
35	6.35–203.20	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G13, G24, T3, W7, W9
36	...	23	180	110	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W4
37	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W4, W9
38	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W7
39	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G13, G24, T3, W7, W9
40	0.64–5.08	23	205	110	NP	204 (Cl. 3 only)	204	204	NFA-13	T3, W4
41	0.64–5.08	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12	T3, W4
42	0.64–5.08	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-13	T3, W7
43	0.64–5.08	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12	T3, W7
44	...	23	180	110	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W4
45	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W4, W9

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	90.3	90.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	86.9	86.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	80.7	80.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	90.6	90.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	86.7	86.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	80.8	80.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	43.4	43.4	43.4	43.3	41.8	29.2	18.2	8.00	...	...	...	...	...	...	...	...	...	...
15	55.2	55.2	54.9	50.7	41.5	29.1	18.3	7.92	...	...	...	...	...	...	...	...	...	...
16	43.4	43.4	43.4	43.3	41.8	29.2	18.2	8.00	...	...	...	...	...	...	...	...	...	...
17	61.4	61.4	60.1	50.3	41.6	29.1	18.3	7.93	...	...	...	...	...	...	...	...	...	...
18	66.9	66.9	64.7	49.8	41.6	29.1	18.3	7.94	...	...	...	...	...	...	...	...	...	...
19	59.1	59.1	59.1	58.5	47.4	43.7	31.5	24.2	...	...	...	...	...	...	...	...	...	...
20	59.1	59.1	59.1	58.5	47.4	43.7	31.5	24.2	...	...	...	...	...	...	...	...	...	...
21	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
22	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
23	78.8	78.8	78.8	75.4	55.9	44.1	31.6	23.3	...	...	...	...	...	...	...	...	...	...
24	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
25	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
26	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
27	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
28	59.1	59.1	59.1	58.5	47.4	43.7	31.5	24.2	...	...	...	...	...	...	...	...	...	...
29	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
30	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
31	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
32	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
33	82.7	82.7	82.7	79.3	57.3	44.9	32.4	23.9	...	...	...	...	...	...	...	...	...	...
34	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
35	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
36	51.2	51.2	51.2	51.0	41.3	40.1	31.2	25.7	...	...	...	...	...	...	...	...	...	...
37	74.9	74.9	74.9	71.3	54.0	44.0	32.2	24.2	...	...	...	...	...	...	...	...	...	...
38	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
39	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
40	59.1	59.1	59.1	58.5	47.4	43.7	31.5	24.2	...	...	...	...	...	...	...	...	...	...
41	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
42	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
43	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
44	51.2	51.2	51.2	51.0	41.3	40.1	31.2	25.7	...	...	...	...	...	...	...	...	...	...
45	74.9	74.9	74.9	71.3	54.0	44.0	32.2	24.2	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Smls. extr. tube	SB-241	...	A96061	T4 wld.
2	...	Smls. extr. tube	SB-241	...	A96061	T6 wld.
3	...	Smls. pipe	SB-241	...	A96061	T6 drawn
4	...	Smls. pipe	SB-241	...	A96061	T6
5	...	Smls. pipe	SB-241	...	A96061	T6 wld.
6	...	Die forgings	SB-247	...	A96061	T6
7	...	Hand forgings	SB-247	...	A96061	T6
8	...	Hand forgings	SB-247	...	A96061	T6
9	...	Die & hand forgings	SB-247	...	A96061	T6 wld.
10	...	Shapes	SB-308	...	A96061	T6
11	...	Shapes	SB-308	...	A96061	T6 wld.
12	...	Drawn smls. tube	SB-210	...	A96063	T6
13	...	Drawn smls. tube	SB-210	...	A96063	T6 wld.
14	...	Bar, rod, shapes	SB-221	...	A96063	T1
15	...	Bar, rod, shapes	SB-221	...	A96063	T1
16	...	Bar, rod, shapes	SB-221	...	A96063	T5
17	...	Bar, rod, shapes	SB-221	...	A96063	T5
18	...	Bar, rod, shapes	SB-221	...	A96063	T6
19	...	Bar, rod, shapes	SB-221	...	A96063	T5 wld.
20	...	Bar, rod, shapes	SB-221	...	A96063	T6 wld.
21	...	Smls. extr. tube	SB-241	...	A96063	T1
22	...	Smls. extr. tube	SB-241	...	A96063	T1
23	...	Smls. extr. tube	SB-241	...	A96063	T5
24	...	Smls. extr. tube	SB-241	...	A96063	T5
25	...	Smls. extr. tube	SB-241	...	A96063	T6
26	...	Smls. extr. tube	SB-241	...	A96063	T5 wld.
27	...	Smls. extr. tube	SB-241	...	A96063	T6 wld.
28	...	Smls. pipe	SB-241	...	A96063	T6
29	...	Smls. pipe	SB-241	...	A96063	T6 wld.
30	...	Bar, rod	SB-187	...	C10200	O60
31	...	Bar, rod	SB-187	...	C10200	O60
32	...	Smls. tube	SB-75	...	C10200	O50, O60
33	...	Smls. tube	SB-75	...	C10200	O50, O60
34	...	Smls. pipe	SB-42	...	C10200	O61
35	...	Smls. pipe	SB-42	...	C10200	O61
(25) 36	...	Plate, sheet, strip, bar	SB-152	...	C10200	H00
(25) 37	...	Plate, sheet, strip, bar	SB-152	...	C10200	H01
(25) 38	...	Plate, sheet, strip, bar	SB-152	...	C10200	H02
(25) 39	...	Plate, sheet, strip, bar	SB-152	...	C10200	H03
(25) 40	...	Plate, sheet, strip, bar	SB-152	...	C10200	H04
(25) 41	...	Plate, sheet, strip, bar	SB-152	...	C10200	M20, O25
(25) 42	...	Plate, sheet, strip, bar	SB-152	...	C10200	M20, O25
(25) 43	...	Smls. pipe	SB-42	...	C10200	H55
(25) 44	...	Smls. tube	SB-75	...	C10200	H55
(25) 45	...	Smls. cond. tube	SB-111	...	C10200	H55

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-13	G24, T3, W7
2	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G24, T3, W7, W9
3	<25.40	23	290	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
4	≥25.40	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
5	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W7, W9
6	≤101.60	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
7	≤101.60	23	255	230	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
8	101.61–203.20	23	240	220	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
9	≤203.20	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W7, W9
10	...	23	260	240	NP	204 (Cl. 3 only)	204	204	NFA-12,13	T3, W4, W9
11	...	23	165	...	NP	204 (Cl. 3 only)	204	204	NFA-12,13	G13, T3, W7, W9
12	0.64–12.70	23	230	190	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W4
13	0.64–12.70	23	115	55	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W7
14	≤12.70	23	115	60	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W4
15	12.71–25.40	23	110	55	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W4
16	≤12.70	23	150	110	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W4
17	12.71–25.40	23	145	105	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W4
18	≤25.40	23	205	170	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W4
19	≤25.40	23	115	55	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W7
20	≤25.40	23	115	55	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W7
21	≤12.70	23	115	60	NP	176 (Cl. 3 only)	NP	NP	NFA-1	T3, W4
22	12.71–25.40	23	110	55	NP	176 (Cl. 3 only)	NP	NP	NFA-1	T3, W4
23	≤12.70	23	150	110	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W4
24	12.71–25.40	23	145	105	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W4
25	≤25.40	23	205	170	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W4
26	≤25.40	23	115	55	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W7
27	≤25.40	23	115	55	NP	176 (Cl. 3 only)	204	204	NFA-1	T3, W7
28	≤25.40	23	205	170	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W4
29	≤25.40	23	115	55	NP	204 (Cl. 3 only)	204	204	NFA-1	T3, W7
30	All	31	195	55	NP	149	204	204	NFC-1	G5, T3
31	All	31	195	55	NP	149	204	204	NFC-1	T3
32	All	31	205	62	204	149 (Cl. 3 only)	204	204	NFC-1	G1, G5, T3
33	All	31	205	62	204	149 (Cl. 3 only)	204	204	NFC-1	G1, T3
34	All	31	205	60	204	149	204	204	NFC-1	G1, T3
35	All	31	205	60	204	149	204	204	NFC-1	G1, G5, T3
36	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	G41, T3, W3
37	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	G41, T3, W3
38	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	G41, T3, W3
39	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	G41, T3, W3
40	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	G41, T3, W3
41	...	31	205	70	NP	149 (Cl. 3 only)	204	204	NFC-1	T3
42	...	31	205	70	NP	121 (Cl. 3 only)	204	204	NFC-1	G5, T2
43	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC-6	G1, G9, W3
44	All	31	250	205	204	204 (Cl. 3 only)	204	204	NFC-6	G1, G9, W3
45	...	31	250	205	NP	204	204	204	NFC-6	G9, W3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
2	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
3	82.7	82.7	82.7	79.3	57.3	44.2	32.5	24.2	...	...	...	...	...	...	...	...	...	...
4	74.9	74.9	74.9	71.3	54.0	44.0	32.2	24.2	...	...	...	...	...	...	...	...	...	...
5	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
6	74.9	74.9	74.9	71.3	54.0	44.0	32.2	24.2	...	...	...	...	...	...	...	...	...	...
7	72.9	72.9	72.9	52.9	52.7	44.0	32.0	24.2	...	...	...	...	...	...	...	...	...	...
8	68.9	68.9	68.9	68.6	50.6	42.5	32.0	24.8	...	...	...	...	...	...	...	...	...	...
9	47.3	47.3	47.3	47.1	37.7	32.1	24.8	19.7	...	...	...	...	...	...	...	...	...	...
10	74.9	74.9	74.9	71.3	49.1	39.2	28.7	21.5	...	...	...	...	...	...	...	...	...	...
11	47.3	47.3	47.3	47.1	34.2	29.3	22.7	18.0	...	...	...	...	...	...	...	...	...	...
12	65.0	65.0	64.9	57.1	37.2	24.1	14.9	9.3	...	...	...	...	...	...	...	...	...	...
13	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
14	33.5	33.5	33.5	33.5	28.7	21.3	14.3	9.3	...	...	...	...	...	...	...	...	...	...
15	31.5	31.5	31.5	31.5	27.4	23.7	14.2	9.3	...	...	...	...	...	...	...	...	...	...
16	43.3	43.3	43.3	43.3	31.3	23.9	14.5	9.3	...	...	...	...	...	...	...	...	...	...
17	41.4	41.4	40.3	38.4	29.4	23.8	14.3	9.3	...	...	...	...	...	...	...	...	...	...
18	59.1	59.1	58.0	50.5	33.9	24.0	14.7	9.3	...	...	...	...	...	...	...	...	...	...
19	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
20	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
21	33.5	33.5	33.5	33.5	28.7	21.3	...	...	...	...	...	...	...	...	...	...	...	...
22	31.5	31.5	31.5	31.5	27.4	23.7	...	...	...	...	...	...	...	...	...	...	...	...
23	43.3	43.3	43.3	43.3	31.3	23.9	14.5	9.3	...	...	...	...	...	...	...	...	...	...
24	41.4	41.4	40.3	38.4	30.0	23.8	14.4	9.3	...	...	...	...	...	...	...	...	...	...
25	59.1	59.1	58.0	50.5	33.9	24.0	14.7	9.3	...	...	...	...	...	...	...	...	...	...
26	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
27	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
28	59.1	59.1	58.0	50.5	33.9	24.0	14.7	9.3	...	...	...	...	...	...	...	...	...	...
29	33.5	33.5	33.5	33.5	26.6	21.0	14.4	10.2	...	...	...	...	...	...	...	...	...	...
30	36.8	36.8	36.8	36.8	36.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
31	36.8	32.3	32.3	32.3	32.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
32	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
33	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
34	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
35	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
36	46.0	40.4	40.4	40.4	40.2	31.3	21.9	14.8	...	...	...	...	...	...	...	...	...	...
37	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
38	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
39	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
40	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
41	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
42	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
43	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
44	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
45	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

Table 1B (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	...	Smls. U-bend tube	SB-395	...	C10200	H55
(25) 2	...	Smls. pipe	SB-42	...	C10200	H80
(25) 3	...	Smls. tube	SB-75	...	C10200	H80
(25) 4	...	Smls. cond. tube	SB-111	...	C10200	H80
(25) 5	...	Plate, sheet, strip, bar	SB-152	...	C10400	H00
(25) 6	...	Plate, sheet, strip, bar	SB-152	...	C10400	H01
(25) 7	...	Plate, sheet, strip, bar	SB-152	...	C10400	H02
(25) 8	...	Plate, sheet, strip, bar	SB-152	...	C10400	H03
(25) 9	...	Plate, sheet, strip, bar	SB-152	...	C10400	H04
(25) 10	...	Plate, sheet, strip, bar	SB-152	...	C10400	M20, 025
(25) 11	...	Plate, sheet, strip, bar	SB-152	...	C10400	M20, 025
(25) 12	...	Plate, sheet, strip, bar	SB-152	...	C10500	H00
(25) 13	...	Plate, sheet, strip, bar	SB-152	...	C10500	H01
(25) 14	...	Plate, sheet, strip, bar	SB-152	...	C10500	H02
(25) 15	...	Plate, sheet, strip, bar	SB-152	...	C10500	H03
(25) 16	...	Plate, sheet, strip, bar	SB-152	...	C10500	H04
(25) 17	...	Plate, sheet, strip, bar	SB-152	...	C10500	M20, 025
(25) 18	...	Plate, sheet, strip, bar	SB-152	...	C10500	M20, 025
(25) 19	...	Plate, sheet, strip, bar	SB-152	...	C10700	H00
(25) 20	...	Plate, sheet, strip, bar	SB-152	...	C10700	H01
(25) 21	...	Plate, sheet, strip, bar	SB-152	...	C10700	H02
(25) 22	...	Plate, sheet, strip, bar	SB-152	...	C10700	H03
(25) 23	...	Plate, sheet, strip, bar	SB-152	...	C10700	H04
(25) 24	...	Plate, sheet, strip, bar	SB-152	...	C10700	M20, 025
(25) 25	...	Plate, sheet, strip, bar	SB-152	...	C10700	M20, 025
26	...	Bar	SB-187	...	C11000	H04
27	...	Bar, rod	SB-187	...	C11000	O60
28	...	Bar, rod	SB-187	...	C11000	O60
29	...	Plate, sheet, strip, bar	SB-152	...	C11000	H00
30	...	Plate, sheet, strip, bar	SB-152	...	C11000	H01
31	...	Plate, sheet, strip, bar	SB-152	...	C11000	H02
32	...	Plate, sheet, strip, bar	SB-152	...	C11000	H03
33	...	Plate, sheet, strip, bar	SB-152	...	C11000	H04
34	...	Plate, sheet, strip, bar	SB-152	...	C11000	M20, 025
35	...	Plate, sheet, strip, bar	SB-152	...	C11000	M20, 025
36	...	Smls. tube	SB-75	...	C12000	O50, O60
37	...	Smls. tube	SB-75	...	C12000	O50, O60
38	...	Smls. pipe	SB-42	...	C12000	O61
39	...	Smls. pipe	SB-42	...	C12000	O61
(25) 40	...	Smls. pipe	SB-42	...	C12000	H55
(25) 41	...	Smls. tube	SB-75	...	C12000	H55
(25) 42	...	Smls. cond. tube	SB-111	...	C12000	H55
(25) 43	...	Smls. U-bend tube	SB-395	...	C12000	H55
(25) 44	...	Smls. pipe	SB-42	...	C12000	H80
(25) 45	...	Smls. tube	SB-75	...	C12000	H80

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC-6	G9, W3
2	6 < DN ≤ 50	31	310	275	204	149	204	204	NFC-6	G1, G6, G9, G39, T20, W3
3	≤102	31	310	275	204	177	204	204	NFC-6	G1, G6, G9, G39, T20, W3
4	...	31	310	275	NP	149	204	204	NFC-6	G6, G9, G39, T20, W3
5	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
6	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
7	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
8	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
9	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
10	...	31	205	70	NP	149	204	204	NFC-1	T3
11	...	31	205	70	NP	121	204	204	NFC-1	G5, T2
12	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
13	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
14	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
15	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
16	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
17	...	31	205	70	NP	149	204	204	NFC-1	T3
18	...	31	205	70	NP	121	204	204	NFC-1	G5, T2
19	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
20	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
21	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
22	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
23	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
24	...	31	205	70	NP	149	204	204	NFC-1	T3
25	...	31	205	70	NP	121	204	204	NFC-1	G5, T2
26	All	31	195	55	NP	149	204	204	NFC-1	G41, T3
27	All	31	195	55	NP	149	204	204	NFC-1	T3
28	All	31	195	55	NP	149	204	204	NFC-1	G5, T3
29	...	31	205	70	NP	NP	204	204	NFC-1	G41, T3, W3
30	...	31	205	70	NP	NP	204	204	NFC-1	G41, T3, W3
31	...	31	205	70	NP	NP	204	204	NFC-1	G41, T3, W3
32	...	31	205	70	NP	NP	204	204	NFC-1	G41, T3, W3
33	...	31	205	70	NP	NP	204	204	NFC-1	G41, T3, W3
34	...	31	205	70	NP	NP	204	204	NFC-1	T3
35	...	31	205	70	NP	NP	204	204	NFC-1	G5, T2
36	All	31	205	62	204	149 (Cl. 3 only)	204	204	NFC-1	G1, T3
37	All	31	205	62	204	149 (Cl. 3 only)	204	204	NFC-1	G1, G5, T3
38	All	31	205	60	204	149	204	204	NFC-1	G1, T3
39	All	31	205	60	204	149	204	204	NFC-1	G1, G5, T3
40	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC-6	G1, G9, W3
41	All	31	250	205	204	204 (Cl. 3 only)	204	204	NFC-6	G1, G9, W3
42	...	31	250	205	NP	204	204	204	NFC-6	G9, W3
43	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC-6	G9, W3
44	6 < DN ≤ 50	31	310	275	204	149	204	204	NFC-6	G1, G6, G9, G39, T20, W3
45	≤102	31	310	275	204	177 (Cl. 3 only)	204	204	NFC-6	G1, G6, G9, G39, T20, W3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
2	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
3	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
4	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
5	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
6	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
7	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
8	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
9	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
10	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
11	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
12	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
13	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
14	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
15	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
16	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
17	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
18	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
19	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
20	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
21	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
22	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
23	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
24	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
25	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
26	36.8	32.3	32.3	32.3	32.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
27	36.8	32.3	32.3	32.3	32.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
28	36.8	36.8	36.8	36.8	36.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
29	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
30	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
31	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
32	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
33	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
34	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
35	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
36	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
37	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
38	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
39	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
40	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
41	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
42	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
43	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
44	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
45	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table 1B (Cont'd)
Section I; Section III, Division 1, 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
(25) 1	...	Smls. cond. tube	SB-111	...	C12000	H80
2	...	Smls. pipe	SB-42	...	C12200	O61
3	...	Smls. pipe	SB-42	...	C12200	O61
4	...	Smls. tube	SB-75	...	C12200	O50
5	...	Smls. tube	SB-75	...	C12200	O50
6	...	Smls. tube	SB-75	...	C12200	O60
7	...	Smls. tube	SB-75	...	C12200	O60
(25) 8	...	Finned tube	SB-359	...	C12200	O61
(25) 9	...	Finned tube	SB-359	...	C12200	O61
10	...	Wld. cond. tube	SB-543	...	C12200	W061
11	...	Wld. cond. tube	SB-543	...	C12200	W061
(25) 12	...	Plate, sheet, strip, bar	SB-152	...	C12200	H00
(25) 13	...	Plate, sheet, strip, bar	SB-152	...	C12200	H01
(25) 14	...	Plate, sheet, strip, bar	SB-152	...	C12200	H02
(25) 15	...	Plate, sheet, strip, bar	SB-152	...	C12200	H03
(25) 16	...	Plate, sheet, strip, bar	SB-152	...	C12200	H04
(25) 17	...	Plate, sheet, strip, bar	SB-152	...	C12200	M20, O25
(25) 18	...	Plate, sheet, strip, bar	SB-152	...	C12200	M20, O25
19	...	Wld. cond. tube	SB-543	...	C12200	WC55
(25) 20	...	Smls. pipe	SB-42	...	C12200	H55
(25) 21	...	Smls. tube	SB-75	...	C12200	H55
(25) 22	...	Smls. cond. tube	SB-111	...	C12200	H55
(25) 23	...	Finned tube	SB-359	...	C12200	H55
(25) 24	...	Smls. U-bend tube	SB-395	...	C12200	H55
(25) 25	...	Smls. pipe	SB-42	...	C12200	H80
(25) 26	...	Smls. cond. tube	SB-75	...	C12200	H80
(25) 27	...	Smls. tube	SB-111	...	C12200	H80
(25) 28	...	Finned tube	SB-359	...	C12200	H80
(25) 29	...	Plate, sheet, strip, bar	SB-152	...	C12300	H00
(25) 30	...	Plate, sheet, strip, bar	SB-152	...	C12300	H01
(25) 31	...	Plate, sheet, strip, bar	SB-152	...	C12300	H02
(25) 32	...	Plate, sheet, strip, bar	SB-152	...	C12300	H03
(25) 33	...	Plate, sheet, strip, bar	SB-152	...	C12300	H04
34	...	Plate, sheet, strip, bar	SB-152	...	C12300	M20, O25
35	...	Plate, sheet, strip, bar	SB-152	...	C12300	M20, O25
(25) 36	...	Plate, sheet, strip, bar	SB-152	...	C14200	M20, O25
(25) 37	...	Plate, sheet, strip, bar	SB-152	...	C14200	M20, O25
(25) 38	...	Smls. cond. tube	SB-111	...	C14200	H55
(25) 39	...	Smls. U-bend tube	SB-395	...	C14200	H55
(25) 40	...	Smls. cond. tube	SB-111	...	C14200	H80
41	...	Smls. cond. tube	SB-111	...	C19200	O61
42	...	Smls. cond. tube	SB-111	...	C19200	O61
43	...	Smls. U-bend tube	SB-395	...	C19200	O61
44	...	Smls. U-bend tube	SB-395	...	C19200	O61
45	...	Wld. cond. tube	SB-543	...	C19400	W061

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	31	310	275	NP	149	204	204	NFC-6	G6, G9, G39, T20, W3
2	All	31	205	60	204	149	204	204	NFC-1	G1, T3
3	All	31	205	60	204	149	204	204	NFC-1	G1, G5, T3
4	All	31	205	62	204	149	204	204	NFC-7	G1, T3
5	All	31	205	62	204	149	204	204	NFC-7	G1, G5, T3
6	All	31	205	62	204	149	204	204	NFC-1	G1, T3
7	All	31	205	62	204	149	204	204	NFC-1	G1, G5, T3
8	...	31	205	62	NP	149 (Cl. 3 only)	204	NP	NFC-1	T3
9	...	31	205	62	NP	149 (Cl. 3 only)	204	NP	NFC-1	G5, T3
10	...	31	205	60	NP	149 (Cl. 3 only)	204	204	NFC-1	G14, T3, W11
11	...	31	205	60	NP	149 (Cl. 3 only)	204	204	NFC-1	G5, G14, T3, W11
12	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
13	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
14	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
15	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
16	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
17	...	31	205	70	NP	121	204	204	NFC-1	G5, T2
18	...	31	205	70	NP	149	204	204	NFC-1	T3
19	...	31	220	105	NP	149 (Cl. 3 only)	204	204	NFC-1	G14, G40, T20, W10
20	50 < DN ≤ 300	31	250	205	204	204	204	204	NFC-6	G1, G9, W3
21	All	31	250	205	204	204 (Cl. 3 only)	204	204	NFC-6	G1, G9, W3
22	...	31	250	205	NP	204	204	204	NFC-6	G9, W3
23	...	31	250	205	NP	149 (Cl. 3 only)	204	NP	NFC-6	G9, W3
24	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC-6	G9, W3
25	6 < DN ≤ 50	31	310	275	204	149	204	204	NFC-6	G1, G6, G9, G39, T20, W3
26	<102	31	310	275	204	177 (Cl. 3 only)	204	204	NFC-6	G1, G6, G9, G39, T20, W3
27	...	31	310	275	NP	149	204	204	NFC-6	G6, G9, G39, T20, W3
28	...	31	310	275	NP	NP	204	NP	NFC-6	G6, G9, G39, T1, T20, W3
29	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
30	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
31	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
32	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
33	...	31	205	70	NP	149	204	204	NFC-1	G41, T3, W3
34	...	31	205	70	NP	149	204	204	NFC-1	T3
35	...	31	205	70	NP	121	204	204	NFC-1	G5, T2
36	...	31	205	70	NP	149 (Cl. 3 only)	NP	NP	NFC-1	...
37	...	31	205	70	NP	121 (Cl. 3 only)	NP	NP	NFC-1	G5
38	...	31	250	205	NP	204	204	204	NFC-6	G9, W3
39	...	31	250	205	NP	204 (Cl. 3 only)	204	204	NFC-6	G9, W3
40	...	31	310	275	NP	149	204	204	NFC-6	G6, G9, G39, T20, W3
41	...	31	260	85	NP	NP	149	149	NFC-1	...
42	...	31	260	85	NP	NP	149	149	NFC-1	G5, T2
43	...	31	260	85	NP	NP	149	149	NFC-1	...
44	...	31	260	85	NP	NP	149	149	NFC-1	G5, T2
45	...	31	310	105	NP	NP	204	204	NFC-5	G14, T20, W11

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
2	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
3	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
4	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
5	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
6	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
7	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
8	41.4	36.4	36.4	36.4	36.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
9	41.4	41.4	41.4	41.4	41.4	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
10	35.2	30.9	30.9	30.9	30.8	26.5	18.6	12.6	...	...	...	...	...	...	...	...	...	...
11	35.2	35.2	35.2	35.2	35.2	26.5	18.6	12.6	...	...	...	...	...	...	...	...	...	...
12	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
13	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
14	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
15	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
16	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
17	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
18	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
19	53.8	53.8	53.8	53.6	51.7	50.7	24.4	...	...	...	...	...	...	...	...	...	...	...
20	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
21	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
22	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
23	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
24	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
25	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
26	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
27	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
28	88.9	88.9	88.9	88.9	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
29	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
30	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
31	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
32	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
33	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
34	46.0	40.4	40.4	40.4	40.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
35	46.0	46.0	46.0	46.0	42.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
36	46.0	40.4	40.4	40.4	40.2	...	...	...	...	...	...	...	...	...	...	...	...	...
37	46.0	46.0	46.0	46.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
39	70.9	70.9	70.9	70.9	68.8	67.0	65.1	63.3	...	...	...	...	...	...	...	...	...	...
40	88.6	88.6	88.6	88.6	86.0	82.1	39.8	...	...	...	...	...	...	...	...	...	...	...
41	55.2	49.0	45.7	43.9	42.7	...	...	...	...	...	...	...	...	...	...	...	...	...
42	55.2	55.2	55.2	55.2	42.8	...	...	...	...	...	...	...	...	...	...	...	...	...
43	55.2	49.0	45.7	43.9	42.7	...	...	...	...	...	...	...	...	...	...	...	...	...
44	55.2	55.2	55.2	55.2	42.8	...	...	...	...	...	...	...	...	...	...	...	...	...
45	58.6	57.9	57.0	55.6	53.7	52.6	37.0	29.2	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Wld. cond. tube	SB-543	...	C19400	W061
2	...	Wld. cond. tube	SB-543	...	C19400	WC55
(25) 3	...	Smls. pipe	SB-43	...	C23000	O61
(25) 4	...	Smls. pipe	SB-43	...	C23000	H58
5	...	Smls. cond. tube	SB-111	...	C23000	O61
(25) 6	...	Smls. tube	SB-135	...	C23000	O50
(25) 7	...	Smls. red brass tube	SB-135	...	C23000	O60
8	...	Smls. tube	SB-395	...	C23000	O61
9	...	Wld. cond. tube	SB-543	...	C23000	W061
10	...	Wld. cond. tube	SB-543	...	C23000	WC55
(25) 11	...	Smls. tube	SB-111	...	C28000	O61
12	...	Plate	SB-171	...	C36500	M10, M20
13	...	Plate	SB-171	...	C36500	O20, O25
14	...	Plate	SB-171	...	C36500	M10, M20
15	...	Plate	SB-171	...	C36500	O20, O25
(25) 16	...	Plate, sheet	SB-171	...	C36500	M10, M20
(25) 17	...	Plate, sheet	SB-171	...	C36500	O20, O25
(25) 18	...	Forgings	SB-283	...	C37700	M10, O20
(25) 19	...	Forgings	SB-283	...	C37700	M10, O20
(25) 20	...	Forgings	SB-283	...	C37700	M10, O20
(25) 21	...	Forgings	SB-283	...	C37700	M10, O20
(25) 22	...	Plate, sheet	SB-171	...	C44300	M10, M20
(25) 23	...	Plate, sheet	SB-171	...	C44300	O20, O25
(25) 24	...	Smls. cond. tube	SB-111	...	C44300	O61
(25) 25	...	Finned tube	SB-359	...	C44300	O61
26	...	Smls. U-bend tube	SB-395	...	C44300	O61
27	...	Wld. cond. tube	SB-543	...	C44300	W061
(25) 28	...	Plate, sheet	SB-171	...	C44400	M10, M20
(25) 29	...	Plate, sheet	SB-171	...	C44400	O20, O25
(25) 30	...	Smls. cond. tube	SB-111	...	C44400	O61
(25) 31	...	Finned tube	SB-359	...	C44400	O61
32	...	Smls. U-bend tube	SB-395	...	C44400	O61
33	...	Wld. cond. tube	SB-543	...	C44400	W061
(25) 34	...	Plate, sheet	SB-171	...	C44500	M10, M20
(25) 35	...	Plate, sheet	SB-171	...	C44500	O20, O25
(25) 36	...	Smls. cond. tube	SB-111	...	C44500	O61
(25) 37	...	Finned tube	SB-359	...	C44500	O61
38	...	Smls. U-bend tube	SB-395	...	C44500	O61
39	...	Wld. cond. tube	SB-543	...	C44500	W061
40	...	Plate	SB-171	...	C46400	M10, M20
41	...	Plate	SB-171	...	C46400	O20, O25
(25) 42	...	Plate, sheet	SB-171	...	C46400	M10, M20
(25) 43	...	Plate, sheet	SB-171	...	C46400	O20, O25
44	...	Plate	SB-171	...	C46500	M10, M20
45	...	Plate	SB-171	...	C46500	O20, O25

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	31	310	105	NP	NP	204	204	NFC-5	G5, G14, T3, W11
2	...	31	310	150	NP	149 (Cl. 3 only)	204	204	NFC-5	G14, T3, W10
3	...	32	275	85	232	149 (Cl. 3 only)	232	232	NFC-1	T3
4	...	32	300	125	232	149 (Cl. 3 only)	232	232	NFC-1	G41, T3, W3
5	...	32	275	85	NP	149 (Cl. 3 only)	232	232	NFC-1	T3
6	...	32	275	80	NP	149 (Cl. 3 only)	NP	NP	NFC-1	...
7	...	32	275	80	NP	149 (Cl. 3 only)	232	232	NFC-1	T3
8	...	32	275	85	NP	149 (Cl. 3 only)	232	232	NFC-1	T3
9	...	32	275	85	NP	149 (Cl. 3 only)	232	232	NFC-1	G14, T3, W11
10	...	32	290	140	NP	149 (Cl. 3 only)	232	232	NFC-2	G14, G41, T3, W10
11	...	32	345	140	204	177 (Cl. 3 only)	204	204	NFC-3	G1, G6, T3
12	100 < t ≤ 140	32	275	85	NP	177 (Cl. 3 only)	204	204	NFC-2	G7, T4
13	100 < t ≤ 140	32	275	85	NP	177 (Cl. 3 only)	204	204	NFC-2	G7, T4
14	50 < t ≤ 100	32	310	105	NP	177 (Cl. 3 only)	204	204	NFC-2	T4
15	50 < t ≤ 100	32	310	105	NP	177 (Cl. 3 only)	204	204	NFC-2	T4
16	≤50	32	345	140	NP	177 (Cl. 3 only)	204	204	NFC-2	T3
17	≤50	32	345	140	NP	177 (Cl. 3 only)	204	204	NFC-2	T3
18	>38	...	317	103	NP	NP	204	204	NFC-2	G17, T1, W14
19	>38	...	317	103	NP	NP	204	204	NFC-2	G5, G17, T1, W14
20	≤38	...	345	124	NP	NP	204	204	NFC-2	G17, T1, W14
21	≤38	...	345	124	NP	NP	204	204	NFC-2	G5, G17, T1, W14
22	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
23	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
24	...	32	310	105	232	177 (Cl. 3 only)	232	232	NFC-2	G6, T20
25	...	32	310	105	NP	177 (Cl. 3 only)	232	NP	NFC-2	G6, T20
26	...	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
27	...	32	310	105	NP	NP	232	232	NFC-2	G7, G14, T20, W11
28	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
29	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
30	...	32	310	105	232	177 (Cl. 3 only)	232	232	NFC-2	G6, T20
31	...	32	310	105	NP	177 (Cl. 3 only)	232	NP	NFC-2	G6, T20
32	...	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
33	...	32	310	105	NP	NP	232	232	NFC-2	G7, G14, T20, W11
34	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
35	≤100	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
36	...	32	310	105	232	177 (Cl. 3 only)	232	232	NFC-2	G6, T20
37	...	32	310	105	NP	177 (Cl. 3 only)	232	NP	NFC-2	G6, T20
38	...	32	310	105	NP	177 (Cl. 3 only)	232	232	NFC-2	T20
39	...	32	310	105	NP	NP	232	232	NFC-2	G7, G14, T20, W11
40	80 < t ≤ 140	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
41	80 < t ≤ 140	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
42	≤80	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
43	≤80	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
44	80 < t ≤ 140	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
45	80 < t ≤ 140	32	345	125	NP	149 (Cl. 3 only)	204	204	NFC-2	T3

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	58.6	58.6	58.6	58.6	58.6	53.3	37.0	29.2	...	...	...	...	...	...	...	...	...	...
2	75.3	75.3	74.9	72.5	70.0	53.3	37.0	29.2	...	...	...	...	...	...	...	...	...	...
3	55.2	55.2	55.2	55.2	55.1	48.9	37.2	19.4	0.422	...	...	...	...	...	...	...	...	...
4	55.2	55.2	55.2	55.2	55.1	48.9	37.2	19.4	0.422	...	...	...	...	...	...	...	...	...
5	55.2	55.2	55.2	55.2	55.1	48.9	37.2	19.4	0.422	...	...	...	...	...	...	...	...	...
6	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...	...	...	...	...	...	...	...
7	55.2	55.2	55.2	55.2	55.1	48.9	37.2	19.4	0.422	...	...	...	...	...	...	...	...	...
8	55.2	55.2	55.2	55.2	55.1	48.9	37.2	19.4	0.422	...	...	...	...	...	...	...	...	...
9	46.9	46.9	46.9	46.9	46.8	41.9	32.0	16.6	0.134	...	...	...	...	...	...	...	...	...
10	46.9	46.9	46.9	46.9	46.8	41.9	32.0	16.6	0.134	...	...	...	...	...	...	...	...	...
11	91.9	91.9	91.9	91.9	91.6	76.3	42.3	17.6	...	...	...	...	...	...	...	...	...	...
12	55.2	55.2	55.2	55.2	55.2	55.2	40.3	22.3	...	...	...	...	...	...	...	...	...	...
13	55.2	55.2	55.2	55.2	55.2	55.2	40.3	22.3	...	...	...	...	...	...	...	...	...	...
14	68.9	68.9	68.9	68.9	68.9	68.9	43.0	11.7	...	...	...	...	...	...	...	...	...	...
15	68.9	68.9	68.9	68.9	68.9	68.9	43.0	11.7	...	...	...	...	...	...	...	...	...	...
16	91.9	91.9	91.9	91.9	91.6	76.3	42.3	17.6	...	...	...	...	...	...	...	...	...	...
17	91.9	91.9	91.9	91.9	91.6	76.3	42.3	17.6	...	...	...	...	...	...	...	...	...	...
18	68.9	57.4	57.4	55.6	35.7	22.4	13.7	8.0	...	...	...	...	...	...	...	...	...	...
19	68.9	68.9	68.9	55.6	35.7	22.4	13.7	8.0	...	...	...	...	...	...	...	...	...	...
20	82.7	68.9	68.9	55.6	35.7	22.4	13.7	8.0	...	...	...	...	...	...	...	...	...	...
21	82.7	82.7	82.7	55.6	35.7	22.4	13.7	8.0	...	...	...	...	...	...	...	...	...	...
22	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
23	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
24	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
25	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
26	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
27	58.6	58.6	58.6	58.6	58.6	58.6	35.3	15.6	3.90	...	...	...	...	...	...	...	...	...
28	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
29	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
30	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
31	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
32	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
33	58.6	58.6	58.6	58.6	58.6	58.6	35.3	15.6	3.90	...	...	...	...	...	...	...	...	...
34	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
35	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
36	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
37	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
38	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.60	...	...	...	...	...	...	...	...	...
39	58.6	58.6	58.6	58.6	58.6	58.6	35.3	15.6	3.90	...	...	...	...	...	...	...	...	...
40	82.7	82.7	82.7	82.7	82.2	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
41	82.7	82.7	82.7	82.7	82.2	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
42	91.9	91.9	91.9	91.9	91.0	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
43	91.9	91.9	91.9	91.9	91.0	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
44	82.7	82.7	82.7	82.7	82.2	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
45	82.7	82.7	82.7	82.7	82.2	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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
(25)	1 ...	Plate, sheet	SB-171	...	C46500	M10, M20
(25)	2 ...	Plate, sheet	SB-171	...	C46500	O20, O25
	3 ...	Smls. cond. tube	SB-111	...	C60800	O61
	4 ...	Smls. cond. tube	SB-111	...	C60800	O61
(25)	5 ...	Smls. U-bend tube	SB-395	...	C60800	O61
(25)	6 ...	Smls. U-bend tube	SB-395	...	C60800	O61
(25)	7 ...	Plate	SB-171	...	C61400	M10, M20, O20, O25
(25)	8 ...	...	...	...	...	...
(25)	9 ...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25)	10 ...	Plate	SB-171	...	C61400	M10, M20, O20, O25
(25)	11 ...	...	...	...	...	...
(25)	12 ...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25)	13 ...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25)	14 ...	Plate	SB-171	...	C63000	M10, M20, O20, O25
(25)	15 ...	...	...	...	...	...
(25)	16 ...	Plate	SB-171	...	C63000	M10, M20, O20, O25
(25)	17 ...	...	...	...	...	...
(25)	18 ...	Plate	SB-171	...	C63000	M10, M20, O20, O25
(25)	19 ...	...	...	...	...	...
(25)	20 ...	Forgings	SB-283	...	C64200	M10, O20
(25)	21 ...	Forgings	SB-283	...	C64200	M10, O20
(25)	22 ...	Forgings	SB-283	...	C64200	M10, O20
(25)	23 ...	Forgings	SB-283	...	C64200	M10, O20
	24 ...	Bar, rod	SB-98	...	C65100	O60
(25)	25 ...	Bar, rod	SB-98	...	C65100	O60
	26 ...	Bar, rod	SB-98	...	C65100	H02
	27 ...	Bar, rod	SB-98	...	C65100	H02
(25)	28 ...	Smls. pipe & tube	SB-315	...	C65500	O30, O61
(25)	29 ...	Smls. pipe & tube	SB-315	...	C65500	O30, O61
(25)	30 ...	Plate, sheet, strip, bar	SB-96	...	C65500	O61
(25)	31 ...	Plate, sheet, strip, bar	SB-96	...	C65500	O61
	32 ...	Bar, rod	SB-98	...	C65500	O60
(25)	33 ...	Bar, rod	SB-98	...	C65500	O60
	34 ...	Bar, rod	SB-98	...	C65500	H02
(25)	35 ...	Bar, rod	SB-98	...	C66100	O60
	36 ...	Bar, rod	SB-98	...	C66100	O60
	37 ...	Bar, rod	SB-98	...	C66100	H02
(25)	38 ...	Smls. cond. tube	SB-111	...	C68700	O61
(25)	39 ...	Smls. cond. tube	SB-111	...	C68700	O61
(25)	40 ...	Smls. U-bend tube	SB-395	...	C68700	O61
(25)	41 ...	Smls. U-bend tube	SB-395	...	C68700	O61
(25)	42 ...	Wld. cond. tube	SB-543	...	C68700	W061
(25)	43 ...	Wld. cond. tube	SB-543	...	C68700	W061
	44 ...	Smls. cond. tube	SB-111	...	C70400	O61
	45 ...	Wld. tube	SB-543	...	C70400	W061

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	≤80	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
2	≤80	32	345	140	NP	149 (Cl. 3 only)	204	204	NFC-2	T3
3	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC-2	G6, T3
4	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC-2	G5, G6, T3
5	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC-2	G6, T3
6	...	35	345	130	NP	149 (Cl. 3 only)	260	260	NFC-2	G5, G6, T3
7	50 < t ≤ 140	35	450	195	NP	260 (Cl. 3 only)	260	260	NFC-8	...
8	...	...	...	...	...	...	...	...	...	...
9	50 < t ≤ 140	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	...	...	...	...	...	...	...	...	...	...
12	12 < t ≤ 50	35	485	205	NP	260 (Cl. 3 only)	260	260	NFC-8	...
13	≤12	35	495	220	NP	232 (Cl. 3 only)	260	260	NFC-8	...
14	100 < t ≤ 140	35	550	205	NP	260 (Cl. 3 only)	371	343	NFC-8	T6
15	...	...	...	...	...	...	...	...	...	...
16	50 < t ≤ 100	35	585	230	NP	260 (Cl. 3 only)	371	343	NFC-8	T6
17	...	...	...	...	...	...	...	...	...	...
18	≤50	35	620	250	NP	260 (Cl. 3 only)	371	343	NFC-8	T6
19	...	...	...	...	...	...	...	...	...	...
20	>38	...	469	156	NP	NP	260	260	NFC-3	G10, T20, W14
21	>38	...	469	156	NP	NP	260	260	NFC-3	G5, G10, T20, W14
22	≤38	...	483	172	NP	NP	260	260	NFC-3	G10, T20, W14
23	≤38	...	483	172	NP	NP	260	260	NFC-3	G5, G10, T20, W14
24	All	33	275	85	NP	149	177	177	NFC-1	G17, T20
25	All	33	275	85	NP	149	177	177	NFC-1	G5, G17, T20
26	All	33	380	140	NP	149	177	177	NFC-2	G17, T20, W3
27	≤50	33	380	140	NP	149	177	177	NFC-2	G5, G17, T20, W3
28	...	33	345	103	NP	149 (Cl. 3 only)	204	204	NFC-2	G17, T20
29	...	33	345	100	NP	149 (Cl. 3 only)	204	204	NFC-2	G5, G17, T20
30	≤50	33	345	125	NP	149 (Cl. 3 only)	177	177	NFC-2	G17, T3
31	≤50	33	345	125	NP	149 (Cl. 3 only)	177	177	NFC-2	G5, G17, T3
32	All	33	360	105	NP	149	177	177	NFC-2	G17, T20
33	All	33	360	105	NP	149	177	177	NFC-2	G5, G17, T20
34	≤50	33	485	260	NP	149	177	177	NFC-2	G17, W3
35	All	33	360	105	NP	149	177	177	NFC-2	G5, G17, T20
36	All	33	360	105	NP	149	177	177	NFC-2	G17, T20
37	≤50	33	485	260	NP	149	177	177	NFC-2	G17, W3
38	...	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC-2	T3
39	...	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC-2	G5, T3
40	...	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC-2	T3
41	...	32	345	125	NP	149 (Cl. 3 only)	232	232	NFC-2	G5, T3
42	...	32	345	125	NP	NP	232	232	NFC-2	G14, T3, W11
43	...	32	345	125	NP	NP	232	232	NFC-2	G5, G14, T3, W11
44	...	34	260	85	NP	66 (Cl. 3 only)	66	66	NFC-2	G43
45	...	34	260	85	NP	NP	66	66	NFC-2	G14, G43, W11

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	91.9	91.9	91.9	91.9	91.0	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
2	91.9	91.9	91.9	91.9	91.0	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
3	87.3	84.3	84.3	84.0	82.6	70.4	44.9	30.6	17.7	9.48	...	...	...	...	...	...	...	...
4	87.3	87.3	87.3	87.3	87.3	70.4	44.9	30.6	17.7	9.48	...	...	...	...	...	...	...	...
5	87.3	84.3	84.3	84.0	82.6	70.4	44.9	30.6	17.7	9.48	...	...	...	...	...	...	...	...
6	87.3	87.3	87.3	87.3	87.3	70.4	44.9	30.6	17.7	9.48	...	...	...	...	...	...	...	...
7	128	128	127	126	125	125	124	121	118	115	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	128	128	127	126	125	125	124	121	118	115	...	...	...	...	...	...	...	...
10	138	137	136	136	134	134	133	131	128	124	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	138	137	136	136	134	134	133	131	128	124	...	...	...	...	...	...	...	...
13	142	142	142	142	142	142	140	135	131	127	...	...	...	...	...	...	...	...
14	138	138	138	138	138	138	138	137	136	135	97.9	74.1	54.7	38.9	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	152	152	152	152	152	152	152	151	150	148	97.9	74.1	54.7	38.9	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	165	165	165	165	165	165	165	165	164	162	97.9	74.1	54.7	38.9	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	106	99.2	97.4	97.3	97.3	97.3	84.5	57.5	41.5	25.1	...	...	...	...	...	...	...	...
21	106	106	106	106	106	106	84.5	57.5	41.5	25.1	...	...	...	...	...	...	...	...
22	115	108	106	106	106	106	84.5	57.5	41.5	25.1	...	...	...	...	...	...	...	...
23	115	115	115	115	115	115	84.5	57.5	41.5	25.1	...	...	...	...	...	...	...	...
24	55.2	54.8	54.3	54.0	53.6	53.1	50.8	...	...	...	...	...	...	...	...	...	...	...
25	55.2	55.2	55.2	55.2	55.2	55.2	50.8	...	...	...	...	...	...	...	...	...	...	...
26	91.9	91.9	90.6	88.7	86.2	83.2	72.3	...	...	...	...	...	...	...	...	...	...	...
27	91.9	91.9	91.9	91.9	91.9	91.9	72.3	...	...	...	...	...	...	...	...	...	...	...
28	68.9	68.8	68.6	68.4	68.1	67.8	50.8	31.9	...	...	...	...	...	...	...	...	...	...
29	68.9	68.9	68.9	68.9	68.9	68.9	50.8	31.9	...	...	...	...	...	...	...	...	...	...
30	82.7	82.5	82.3	82.0	81.8	75.4	50.8	...	...	...	...	...	...	...	...	...	...	...
31	82.7	82.7	82.7	82.7	82.7	75.4	50.8	...	...	...	...	...	...	...	...	...	...	...
32	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
33	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	...	...
34	138	138	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...	...
35	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	...	...
36	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
37	138	138	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...	...
38	82.7	81.8	81.1	80.6	80.1	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
39	82.7	82.7	82.7	82.7	82.7	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
40	82.7	81.8	81.1	80.6	80.1	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
41	82.7	82.7	82.7	82.7	82.7	47.2	24.8	14.9	5.88	...	...	...	...	...	...	...	...	...
42	70.3	69.6	69.0	68.5	68.1	40.1	21.1	12.7	5.00	...	...	...	...	...	...	...	...	...
43	70.3	70.3	70.3	70.3	70.3	40.1	21.1	12.7	5.00	...	...	...	...	...	...	...	...	...
44	55.2	55.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	46.9	46.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Smls. cond. tube	SB-111	...	C70400	H55
2	...	Smls. pipe & tube	SB-466	...	C70600	O60
3	...	Smls. pipe & tube	SB-466	...	C70600	O60
4	...	Wld. pipe	SB-467	...	C70600	W061
5	...	Wld. pipe	SB-467	...	C70600	W061
6	...	Bar, rod	SB-151	...	C70600	O60
7	...	Bar, rod	SB-151	...	C70600	O60
8	...	Plate	SB-171	...	C70600	M10, M20
9	...	Plate	SB-171	...	C70600	M10, M20
10	...	Plate, sheet	SB-171	...	C70600	M10, M20
11	...	Plate, sheet	SB-171	...	C70600	M10, M20
12	...	Plate	SB-171	...	C70600	M10, M20
13	...	Plate	SB-171	...	C70600	M10, M20
14	...	Plate	SB-171	...	C70600	O20, O25
15	...	Plate	SB-171	...	C70600	O20, O25
16	...	Plate, sheet	SB-171	...	C70600	O20, O25
17	...	Plate, sheet	SB-171	...	C70600	O20, O25
18	...	Plate	SB-171	...	C70600	O20, O25
19	...	Plate	SB-171	...	C70600	O20, O25
20	...	Smls. cond. tube	SB-111	...	C70600	O61
21	...	Smls. cond. tube	SB-111	...	C70600	O61
22	...	Smls. cond. tube	SB-111	...	C70600	O61
23	...	Smls. cond. tube	SB-111	...	C70600	O61
24	...	Finned tube	SB-359	...	C70600	O61
25	...	Finned tube	SB-359	...	C70600	O61
26	...	Smls. U-bend tube	SB-395	...	C70600	O61
27	...	Smls. U-bend tube	SB-395	...	C70600	O61
28	...	Wld. pipe	SB-467	...	C70600	W061
29	...	Wld. pipe	SB-467	...	C70600	W061
30	...	Wld. tube	SB-543	...	C70600	W061
31	...	Wld. tube	SB-543	...	C70600	W061
32	...	Finned wld. tube	SB-956	...	C70600	W061
33	...	Finned wld. tube	SB-956	...	C70600	W061
34	...	Wld. pipe	SB-467	...	C70600	WM50
35	...	Smls. tube	SB-111	...	C70600	H55
36	...	Smls. pipe & tube	SB-466	...	C70600	H55
37	...	Wld. tube	SB-543	...	C70600	WC55
38	...	Finned wld. tube	SB-956	...	C70600	WC55
39	...	Wld. pipe	SB-467	...	C70600	Wld. fr. cold rld. strip
40	...	Smls. pipe & tube	SB-466	...	C70620	O60
41	...	Smls. pipe & tube	SB-466	...	C70620	O60
42	...	Wld. pipe	SB-467	...	C70620	W061
43	...	Wld. pipe	SB-467	...	C70620	W061
44	...	Bar, rod	SB-151	...	C70620	O60
45	...	Bar, rod	SB-151	...	C70620	O60

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	34	275	205	NP	66 (Cl. 3 only)	66	66	NFC-2	G7, G43, W3
2	...	34	260	90	NP	204	316	316	NFC-3	T6
3	...	34	260	90	NP	204	316	316	NFC-3	G5, T5
4	>114	34	260	90	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T5
5	>114	34	260	90	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T5
6	All	34	260	105	NP	93	NP	NP	NFC-3	...
7	All	34	260	105	NP	93	NP	NP	NFC-3	G5
8	≤140	34	275	105	NP	204	NP	NP	NFC-3	...
9	≤140	34	275	105	NP	204	NP	NP	NFC-3	G5
10	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	...
11	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	G5, T22
12	≤140	34	275	105	NP	NP	316	316	NFC-3	T5
13	≤140	34	275	105	NP	NP	316	316	NFC-3	G5, T5, T22
14	≤140	34	275	105	NP	204	NP	NP	NFC-3	...
15	≤140	34	275	105	NP	204	NP	NP	NFC-3	G5
16	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	...
17	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	G5, T22
18	≤140	34	275	105	NP	NP	316	316	NFC-3	T5
19	≤140	34	275	105	NP	NP	316	316	NFC-3	G5, T22
20	...	34	275	105	316	204	NP	NP	NFC-3	G1, T5
21	...	34	275	105	316	204	NP	NP	NFC-3	G1, G5, T22
22	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	T5
23	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, T22
24	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G1, T5
25	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G1, G5, T22
26	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	T5
27	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, T22
28	≤114	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T5, T22
29	≤114	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T5, T22
30	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T22
31	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T5, T22
32	...	34	275	100	NP	NP	316	NP	NFC-3	G14, T5, T22
33	...	34	275	100	NP	NP	316	NP	NFC-3	G5, G14, T5, T22
34	≤114	34	310	205	NP	NP	316	316	NFC-3	G14, G42, T5
35	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC-3	G41, T5, W3
36	...	34	310	240	NP	NP	316	316	NFC-3	G41, T5, W3
37	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G41, G42, T5, W10
38	...	34	310	240	NP	NP	316	NP	NFC-3	G14, G41, G42, T5, W10
39	≤114	34	375	310	NP	NP	316	316	NFC-3	G14, G42, T5
40	...	34	260	90	NP	204	316	316	NFC-3	T6
41	...	34	260	90	NP	204	316	316	NFC-3	G5, T6
42	>114	34	260	90	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T5
43	>114	34	260	90	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T5
44	All	34	260	105	NP	93	NP	NP	NFC-3	...
45	All	34	260	105	NP	93	NP	NP	NFC-3	G5

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	59.8	57.9	56.2	54.9	53.7	53.1	51.9	51.1	50.8	49.2	45.2	39.0	...	...	...	...	...	...
3	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	51.7	45.2	39.0	...	...	...	...	...	...
4	50.8	49.7	47.9	46.8	46.2	44.9	44.2	43.6	43.1	41.3	35.6	26.2	...	...	...	...	...	...
5	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	41.3	35.6	26.2	...	...	...	...	...	...
6	68.9	67.2	65.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...
10	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
11	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	...	...	...	...	...	...	...	...	...
12	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
13	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
14	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
15	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...
16	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
17	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	...	...	...	...	...	...	...	...	...
18	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
19	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
20	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
21	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
22	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
23	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
24	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
25	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
26	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
27	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
28	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
29	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
30	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
31	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
32	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
33	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
34	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
35	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
36	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
37	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
38	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
39	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
40	59.8	57.9	56.2	54.9	53.7	53.1	51.9	51.1	50.8	49.2	45.2	39.0	...	...	...	...	...	...
41	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	51.7	45.2	39.0	...	...	...	...	...	...
42	50.8	50.8	47.9	46.8	46.2	44.9	44.2	43.6	43.1	41.3	35.6	26.2	...	...	...	...	...	...
43	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	41.3	35.6	26.2	...	...	...	...	...	...
44	68.9	67.2	65.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Forgings	SB-283	...	C70620	M10
2	...	Forgings	SB-283	...	C70620	M10
3	...	Plate	SB-171	...	C70620	M10, M20
4	...	Plate	SB-171	...	C70620	M10, M20
5	...	Plate, sheet	SB-171	...	C70620	M10, M20
6	...	Plate, sheet	SB-171	...	C70620	M10, M20
7	...	Plate	SB-171	...	C70620	M10, M20
8	...	Plate	SB-171	...	C70620	M10, M20
9	...	Forgings	SB-283	...	C70620	O20
10	...	Forgings	SB-283	...	C70620	O20
11	...	Plate	SB-171	...	C70620	O20, O25
12	...	Plate	SB-171	...	C70620	O20, O25
13	...	Plate, sheet	SB-171	...	C70620	O20, O25
14	...	Plate, sheet	SB-171	...	C70620	O20, O25
15	...	Plate	SB-171	...	C70620	O20, O25
16	...	Plate	SB-171	...	C70620	O20, O25
17	...	Smls. cond. tube	SB-111	...	C70620	O61
18	...	Smls. cond. tube	SB-111	...	C70620	O61
19	...	Smls. cond. tube	SB-111	...	C70620	O61
20	...	Smls. cond. tube	SB-111	...	C70620	O61
21	...	Finned tube	SB-359	...	C70620	O61
22	...	Finned tube	SB-359	...	C70620	O61
23	...	Smls. U-bend tube	SB-395	...	C70620	O61
24	...	Smls. U-bend tube	SB-395	...	C70620	O61
25	...	Wld. pipe	SB-467	...	C70620	W061
26	...	Wld. pipe	SB-467	...	C70620	W061
27	...	Wld. tube	SB-543	...	C70620	W061
28	...	Wld. tube	SB-543	...	C70620	W061
29	...	Finned wld. tube	SB-956	...	C70620	W061
30	...	Finned wld. tube	SB-956	...	C70620	W061
31	...	Forgings	SB-283	...	C70620	M10
32	...	Forgings	SB-283	...	C70620	M10
33	...	Wld. pipe	SB-467	...	C70620	WM50
34	...	Smls. tube	SB-111	...	C70620	H55
35	...	Smls. pipe & tube	SB-466	...	C70620	H55
36	...	Wld. tube	SB-543	...	C70620	WC55
37	...	Finned wld. tube	SB-956	...	C70620	WC55
38	...	Wld. pipe	SB-467	...	C70620	Wld. fr. cold rld. strip
39	...	Smls. tube	SB-466	...	C71000	O60
40	...	Smls. tube	SB-466	...	C71000	O60
41	...	Smls. cond. tube	SB-111	...	C71000	O61
42	...	Smls. cond. tube	SB-111	...	C71000	O61
43	...	Finned tube	SB-359	...	C71000	O61
44	...	Finned tube	SB-359	...	C71000	O61
45	...	Smls. tube	SB-395	...	C71000	O61

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	>152	34	276	103	NP	NP	316	316	NFC-3	T5
2	>152	34	276	103	NP	NP	316	316	NFC-3	G5, T5
3	≤140	34	275	105	NP	204	NP	NP	NFC-3	...
4	≤140	34	275	105	NP	204	NP	NP	NFC-3	G5
5	≤125	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	...
6	≤125	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	G5
7	≤125	34	275	105	NP	NP	316	316	NFC-3	T5
8	≤125	34	275	105	NP	NP	316	316	NFC-3	G5, T5
9	All	34	276	103	NP	NP	316	316	NFC-3	T5
10	All	34	276	103	NP	NP	316	316	NFC-3	G5, T5
11	≤140	34	275	105	NP	204	NP	NP	NFC-3	...
12	≤140	34	275	105	NP	204	NP	NP	NFC-3	G5
13	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	...
14	≤140	34	275	105	NP	232 (Cl. 3 only)	NP	NP	NFC-3	G5
15	≤127	34	275	105	NP	NP	316	316	NFC-3	T5
16	≤127	34	275	105	NP	NP	316	316	NFC-3	G5, T5
17	...	34	275	105	316	204	NP	NP	NFC-3	G1, T5, W10
18	...	34	275	105	316	204	NP	NP	NFC-3	G1, G5, T5, W10
19	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	T5
20	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, T5
21	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G1, T5, W10
22	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G1, G5, T5, W10
23	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	T5
24	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, T5
25	≤114	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T5
26	≤114	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T22
27	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G42, T5
28	...	34	275	105	NP	232 (Cl. 3 only)	316	316	NFC-3	G5, G14, G42, T22
29	...	34	275	100	NP	NP	316	NP	NFC-3	G14, G42, T5
30	...	34	275	100	NP	NP	316	NP	NFC-3	G5, G14, G42, T22
31	≤152	34	310	124	NP	NP	316	316	NFC-3	T22
32	≤152	34	310	124	NP	NP	316	316	NFC-3	G5, T22
33	≤114	34	310	205	NP	NP	316	316	NFC-3	G14, G42, W11
34	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC-3	G41, T5
35	...	34	310	240	NP	NP	316	316	NFC-3	G41, T5
36	...	34	310	240	NP	232 (Cl. 3 only)	316	316	NFC-3	G14, G41, G42, T5
37	...	34	310	240	NP	NP	316	NP	NFC-3	G14, G41, G42, T5
38	≤114	34	370	310	NP	NP	316	316	NFC-3	G14, G42, T5
39	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC-3	T7
40	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC-3	G5, T7
41	...	34	310	110	371	371 (Cl. 3 only)	371	343	NFC-3	G1, T7
42	...	34	310	110	371	371 (Cl. 3 only)	371	343	NFC-3	G5, T7
43	...	34	310	110	NP	371 (Cl. 3 only)	371	NP	NFC-3	G1, T7
44	...	34	310	110	NP	371 (Cl. 3 only)	371	NP	NFC-3	G5, T7
45	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC-3	T7

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
2	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
3	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
4	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
5	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
6	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	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	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	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	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
11	68.9	67.3	65.1	63.4	62.0	61.0	60.1	59.2	...	...	...	...	...	...	...	...	...	...
12	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
13	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...	...	...
14	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
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	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
17	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
18	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
19	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
20	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
21	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
22	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
23	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
24	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
25	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
26	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
27	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
28	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
29	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
30	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	51.3	41.3	35.6	26.2	...	...	...	...	...	...
31	82.7	80.3	78.3	76.7	74.4	72.9	72.1	70.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
32	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	60.4	51.7	45.2	39.0	...	...	...	...	...	...
33	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
34	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
35	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	51.7	45.2	39.0	...	...	...	...	...	...
36	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
37	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
38	58.6	57.3	55.5	54.3	53.0	51.8	51.2	50.0	45.8	41.3	35.6	26.2	...	...	...	...	...	...
39	73.8	71.8	69.9	68.4	66.7	65.1	63.5	61.9	60.5	59.2	57.9	56.4	51.9	47.6	...	...	...	...
40	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	56.4	51.9	47.6	...	...	...	...
41	73.8	71.8	69.9	68.4	66.7	65.1	63.5	61.9	60.5	59.2	57.9	56.4	51.9	47.6	...	...	...	...
42	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	56.4	51.9	47.6	...	...	...	...
43	73.8	71.8	69.9	68.4	66.7	65.1	63.5	61.9	60.5	59.2	57.9	56.4	51.9	47.6	...	...	...	...
44	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	56.4	51.9	47.6	...	...	...	...
45	73.8	71.8	69.9	68.4	66.7	65.1	63.5	61.9	60.5	59.2	57.9	56.4	51.9	47.6	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Smls. tube	SB-395	...	C71000	O61
2	...	Wld. pipe	SB-467	...	C71500	W061
3	...	Wld. pipe	SB-467	...	C71500	W061
4	...	Plate, sheet	SB-171	...	C71500	M10, M20
5	...	Plate, sheet	SB-171	...	C71500	M10, M20
6	...	Plate, sheet	SB-171	...	C71500	O20, O25
7	...	Plate, sheet	SB-171	...	C71500	O20, O25
8	...	Plate, sheet	SB-171	...	C71500	M10, M20
9	...	Plate, sheet	SB-171	...	C71500	M10, M20
10	...	Plate, sheet	SB-171	...	C71500	O20, O25
11	...	Plate, sheet	SB-171	...	C71500	O20, O25
12	...	Wld. pipe	SB-467	...	C71500	W061
13	...	Wld. pipe	SB-467	...	C71500	W061
14	...	Smls. pipe & tube	SB-466	...	C71500	O60
15	...	Smls. pipe & tube	SB-466	...	C71500	O60
16	...	Smls. cond. tube	SB-111	...	C71500	O61
17	...	Smls. cond. tube	SB-111	...	C71500	O61
18	...	Finned tube	SB-359	...	C71500	O61
19	...	Finned tube	SB-359	...	C71500	O61
20	...	Smls. U-bend tube	SB-395	...	C71500	O61
21	...	Smls. U-bend tube	SB-395	...	C71500	O61
22	...	Wld. cond. tube	SB-543	...	C71500	W061
23	...	Wld. cond. tube	SB-543	...	C71500	W061
24	...	Finned wld. cond. tube	SB-956	...	C71500	W061
25	...	Finned wld. cond. tube	SB-956	...	C71500	W061
26	...	Smls. cond. tube	SB-111	...	C71500	HR50
27	...	Smls. U-bend tube	SB-395	...	C71500	HR50
28	...	Wld. pipe	SB-467	...	C71520	W061
29	...	Wld. pipe	SB-467	...	C71520	W061
30	...	Forgings	SB-283	...	C71520	M10
31	...	Forgings	SB-283	...	C71520	M10
32	...	Plate, sheet	SB-171	...	C71520	M10, M20
33	...	Plate, sheet	SB-171	...	C71520	M10, M20
34	...	Forgings	SB-283	...	C71520	O20
35	...	Forgings	SB-283	...	C71520	O20
36	...	Plate, sheet	SB-171	...	C71520	O20, O25
37	...	Plate, sheet	SB-171	...	C71520	O20, O25
38	...	Forgings	SB-283	...	C71520	M10
39	...	Forgings	SB-283	...	C71520	M10
40	...	Plate, sheet	SB-171	...	C71520	M10, M20
41	...	Plate, sheet	SB-171	...	C71520	M10, M20
42	...	Plate, sheet	SB-171	...	C71520	O20, O25
43	...	Plate, sheet	SB-171	...	C71520	O20, O25
44	...	Wld. pipe	SB-467	...	C71520	W061
45	...	Wld. pipe	SB-467	...	C71520	W061

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	34	310	110	NP	371 (Cl. 3 only)	371	343	NFC-3	G5, T7
2	>114	34	310	105	NP	316 (Cl. 3 only)	NP	NP	NFC-3	G14, W11
3	>114	34	310	105	NP	316 (Cl. 3 only)	NP	NP	NFC-3	G5, G14, W11
4	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	...
5	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	G5
6	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	...
7	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	G5
8	≤60	34	345	140	NP	371	371	343	NFC-4	...
9	≤60	34	345	140	NP	371	371	343	NFC-4	G5
10	≤60	34	345	140	NP	371	371	343	NFC-4	...
11	≤60	34	345	140	NP	371	371	343	NFC-4	G5
12	≤114	34	345	140	NP	316 (Cl. 3 only)	NP	NP	NFC-4	G14
13	≤114	34	345	140	NP	316 (Cl. 3 only)	NP	NP	NFC-4	G5, G14
14	...	34	360	125	NP	371	371	343	NFC-4	...
15	...	34	360	125	NP	371	371	343	NFC-4	G5
16	...	34	360	125	371	371	371	343	NFC-4	G1
17	...	34	360	125	371	371	371	343	NFC-4	G1, G5
18	...	34	360	125	NP	371 (Cl. 3 only)	371	NP	NFC-4	G1
19	...	34	360	125	NP	371 (Cl. 3 only)	371	NP	NFC-4	G1, G5
20	...	34	360	125	NP	371 (Cl. 3 only)	371	343	NFC-4	...
21	...	34	360	125	NP	371 (Cl. 3 only)	371	343	NFC-4	G5
22	...	34	360	125	NP	316 (Cl. 3 only)	316	316	NFC-4	G14, W11
23	...	34	360	125	NP	316 (Cl. 3 only)	316	316	NFC-4	G5, G14, W11
24	...	34	360	125	NP	NP	316	NP	NFC-4	G14, W11
25	...	34	360	125	NP	NP	316	NP	NFC-4	G5, G14, W11
26	...	34	495	345	NP	371	427	343	NFC-4	T9, W3
27	...	34	495	345	NP	371	427	343	NFC-8	T9, W3
28	>114	34	310	100	NP	316 (Cl. 3 only)	NP	NP	NFC-3	G14
29	>114	34	310	100	NP	316 (Cl. 3 only)	NP	NP	NFC-3	G5, G14
30	>152	34	310	124	NP	NP	371	343	NFC-4	...
31	>152	34	310	124	NP	NP	371	343	NFC-4	G5
32	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	...
33	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	G5
34	...	34	310	124	NP	NP	371	343	NFC-4	...
35	...	34	310	124	NP	NP	371	343	NFC-4	G5
36	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	...
37	60 < t ≤ 140	34	310	125	NP	371	371	343	NFC-4	G5
38	≤152	34	345	138	NP	NP	371	343	NFC-4	...
39	≤152	34	345	138	NP	NP	371	343	NFC-4	G5
40	≤60	34	345	140	NP	371	371	343	NFC-4	...
41	≤60	34	345	140	NP	371	371	343	NFC-4	G5
42	≤60	34	345	140	NP	371	371	343	NFC-4	...
43	≤60	34	345	140	NP	371	371	343	NFC-4	G5
44	≤114	34	345	140	NP	316 (Cl. 3 only)	NP	NP	NFC-4	G14
45	≤114	34	345	140	NP	316 (Cl. 3 only)	NP	NP	NFC-4	G5, G14

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	56.4	51.9	47.6	...	...	...	...
2	58.6	56.6	54.8	53.6	52.4	51.8	50.5	49.8	48.8	47.8	47.3	46.6	...	...	...	...	...	...
3	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	...	...	...	...	...	...
4	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	...	...	...	...
5	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
6	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	...	...	...	...
7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
8	91.9	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	...	...	...	...
9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
10	91.9	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	...	...	...	...
11	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
12	78.1	75.2	73.3	71.5	70.3	69.1	67.1	66.4	65.4	64.0	63.1	62.5	...	...	...	...	...	...
13	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	...	...	...	...	...	...
14	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	...	...	...	...
15	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
16	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	...	...	...	...
17	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
18	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	...	...	...	...
19	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
20	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	...	...	...	...
21	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
22	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
23	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	...	...	...	...	...	...
24	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
25	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	...	...	...	...	...	...
26	142	142	142	142	142	140	138	136	135	133	131	130	128	126	124	63.0	7.30	...
27	142	142	142	142	142	140	138	136	135	133	131	130	128	126	124	63.0	7.30	...
28	58.6	56.6	54.8	53.6	52.4	51.8	50.5	49.8	48.8	47.8	47.3	46.6	...	...	...	...	...	...
29	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	...	...	...	...	...	...
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	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
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	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
34	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	...	...	...	...
35	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
36	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	...	...	...	...
37	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
38	91.9	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	...	...	...	...
39	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
40	91.9	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	...	...	...	...
41	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
42	91.9	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	...	...	...	...
43	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
44	77.9	75.2	73.3	71.5	70.3	69.1	67.1	66.4	65.4	64.0	63.1	62.5	...	...	...	...	...	...
45	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	Smls. pipe & tube	SB-466	...	C71520	O60
2	...	Smls. pipe & tube	SB-466	...	C71520	O60
3	...	Smls. cond. tube	SB-111	...	C71520	O61
4	...	Smls. cond. tube	SB-111	...	C71520	O61
5	...	Finned tube	SB-359	...	C71520	O61
6	...	Finned tube	SB-359	...	C71520	O61
7	...	Smls. U-bend tube	SB-395	...	C71520	O61
8	...	Smls. U-bend tube	SB-395	...	C71520	O61
9	...	Wld. cond. tube	SB-543	...	C71520	W061
10	...	Wld. cond. tube	SB-543	...	C71520	W061
11	...	Finned wld. cond. tube	SB-956	...	C71520	W061
12	...	Finned wld. cond. tube	SB-956	...	C71520	W061
13	...	Smls. cond. tube	SB-111	...	C71520	HR50
14	...	Smls. U-bend tube	SB-395	...	C71520	HR50
15	...	Smls. cond. tube	SB-111	...	C72200	O61
(25) 16	...	Castings	SB-62	...	C83600	M01
(25) 17	...	Castings	SB-62	...	C83600	M01
(25) 18	...	Castings	SB-61	...	C92200	M01
(25) 19	...	Castings	SB-61	...	C92200	M01
(25) 20	...	Castings	SB-584	...	C92200	M01
(25) 21	...	Castings	SB-584	...	C92200	M01
(25) 22	...	Castings	SB-584	...	C93700	M01
23	...	Castings	SB-584	...	C93700	M01
24	...	Castings	SB-148	...	C95200	M01
25	...	Castings	SB-271	...	C95200	M02
(25) 26	...	Castings	SB-505	...	C95200	M07
27	...	Castings	SB-148	...	C95400	M01
28	...	Castings	SB-271	...	C95400	M02
29	...	Castings	SB-148	...	C95800	M01
30	...	Castings	SB-148	...	C95820	M01
(25) 31	...	Castings	SB-369	...	C96200	M01
32	...	Castings	SB-584	...	C97600	M01
33	...	Castings	SB-584	...	C97600	M01
34	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed
35	99Ni	Smls. & wld. fittings	SB-366	...	N02200	Annealed
36	99Ni	Bar, rod	SB-160	...	N02200	Annealed
37	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed
38	99Ni	Plate, sheet, strip	SB-162	...	N02200	Annealed
39	99Ni	Smls. tube	SB-163	...	N02200	Annealed
40	99Ni	Plate, sheet, strip	SB-162	...	N02200	As rolled
41	99Ni	Bar, rod	SB-160	...	N02200	Hot rolled
42	99Ni	Smls. pipe & tube	SB-161	...	N02200	Stress rel.
43	99Ni	Smls. tube	SB-163	...	N02200	Stress rel.
44	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
45	99Ni-Low C	Smls. & wld. fittings	SB-366	...	N02201	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	34	360	125	NP	371	371	343	NFC-4	...
2	...	34	360	125	NP	371	371	343	NFC-4	G5
3	...	34	360	125	371	371	371	343	NFC-4	G1, W10
4	...	34	360	125	371	371	371	343	NFC-4	G1, G5, W10
5	...	34	360	125	NP	371 (Cl. 3 only)	371	NP	NFC-4	G1, W10
6	...	34	360	125	NP	371 (Cl. 3 only)	371	NP	NFC-4	G1, G5, W10
7	...	34	360	125	NP	371 (Cl. 3 only)	371	343	NFC-4	...
8	...	34	360	125	NP	371 (Cl. 3 only)	371	343	NFC-4	G5
9	...	34	360	125	NP	316 (Cl. 3 only)	316	316	NFC-4	G14
10	...	34	360	125	NP	316 (Cl. 3 only)	316	316	NFC-4	G5, G14
11	...	34	360	125	NP	NP	316	NP	NFC-4	G14
12	...	34	360	125	NP	NP	316	NP	NFC-4	G5, G14
13	≤79	34	495	345	NP	371	427	343	NFC-4	T9, W9
14	...	34	495	345	NP	371	427	343	NFC-8	T9, W9
15	...	34	310	110	NP	NP	66	66	NFC-3	G43
16	...	...	205	95	232	232 (Cl. 3 only)	232	232	NFC-1	G3, G15, T23, W14
17	...	...	205	95	232	232 (Cl. 3 only)	232	232	NFC-1	G3, G5, G15, T23, W14
18	...	...	235	110	288	260 (Cl. 3 only)	288	288	NFC-1	G3, G15, T5, W14
19	...	...	235	110	288	260 (Cl. 3 only)	288	288	NFC-1	G3, G5, G15, T5, W14
20	...	...	234	110	NP	260 (Cl. 3 only)	288	288	NFC-1	G15, T5
21	...	...	234	110	NP	260 (Cl. 3 only)	288	288	NFC-1	G5, G15, T5
22	...	...	207	83	NP	204 (SPT)	204	204	NFC-1	G15, W8
23	...	...	207	83	NP	204 (SPT)	204	204	NFC-1	G5, G15, W8
24	...	35	450	170	288	260 (Cl. 3 only)	316	316	NFC-4	G15, T6
25	...	35	450	170	NP	260 (Cl. 3 only)	316	316	NFC-4	G15, T6
26	...	35	469	179	NP	260 (Cl. 3 only)	NP	NP	NFC-4	G15
27	...	35	515	205	288	204 (Cl. 3 only)	316	316	NFC-4	G15, T21
28	...	35	515	205	NP	204 (Cl. 3 only)	NP	NP	NFC-4	G15, T21
29	...	35	585	240	NP	204 (Cl. 3 only)	NP	204	NFC-4	G15
30	...	35	650	270	NP	NP	204	204	NFC-4	G15
31	...	34	310	170	NP	93 (Cl. 3 only)	NP	NP	NFC-3	G15
32	...	...	276	117	NP	NP	149	149	NFC-1	G15, W8
33	...	...	276	117	NP	NP	149	149	NFC-1	G5, G15, W8
34	>125 O.D.	41	380	83	NP	316 (Cl. 3 only)	316	316	NFN-2	...
35	...	41	380	83	NP	NP	316	316	NFN-2	W12
36	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN-2	...
37	≤125 O.D.	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN-2	...
38	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN-2	...
39	...	41	380	100	NP	316 (Cl. 3 only)	316	316	NFN-2	...
40	...	41	380	140	NP	316 (Cl. 3 only)	316	316	NFN-2	G20
41	...	41	415	100	NP	316 (Cl. 3 only)	316	316	NFN-2	...
42	...	41	450	275	NP	316 (Cl. 3 only)	316	316	NFN-25	G33
43	...	41	450	275	NP	316 (Cl. 3 only)	316	316	NFN-25	G33
44	>125 O.D.	41	345	69	NP	427 (Cl. 3 only)	649	343	NFN-1	T10
45	...	41	345	69	NP	427 (Cl. 3 only)	621	343	NFN-1	T10, W5, W12

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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	...	...	...	...
2	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
3	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	...	...	...	...
4	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
5	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	...	...	...	...
6	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
7	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	...	...	...	...
8	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
9	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
10	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	...	...	...	...	...	...
11	70.3	67.6	65.9	64.6	63.4	62.1	60.9	59.7	58.4	57.5	56.9	56.3	...	...	...	...	...	...
12	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	...	...	...	...	...	...
13	142	142	142	142	142	140	138	136	135	133	131	130	128	126	124	63.0	7.30	...
14	142	142	142	142	142	140	138	136	135	133	131	130	128	126	124	63.0	7.30	...
15	73.8	71.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	59.1	59.1	57.3	55.5	53.9	52.2	50.6	48.9	43.4	...	...	...	...	...	...	...	...	...
17	59.1	59.1	59.1	58.7	57.6	56.7	55.9	55.2	43.4	...	...	...	...	...	...	...	...	...
18	67.0	67.0	65.2	63.2	62.0	61.2	60.8	60.4	59.9	42.2	27.1	...	...	...	...	...	...	...
19	67.0	67.0	67.0	67.0	67.0	67.0	65.6	63.3	59.9	42.2	27.1	...	...	...	...	...	...	...
20	67.0	67.0	65.2	63.2	62.0	61.2	60.8	60.4	59.9	42.2	27.1	...	...	...	...	...	...	...
21	67.0	67.0	67.0	67.0	67.0	67.0	65.6	63.3	59.9	42.2	27.1	...	...	...	...	...	...	...
22	55.2	51.0	48.8	47.8	47.1	46.6	46.1	45.7	...	...	...	...	...	...	...	...	...	...
23	55.2	55.2	55.2	55.2	54.4	52.8	51.4	50.0	...	...	...	...	...	...	...	...	...	...
24	115	108	104	102	99.9	98.7	98.0	97.9	97.9	91.4	68.1	40.8	...	...	...	...	...	...
25	115	108	104	102	99.9	98.7	98.0	97.9	97.9	91.4	68.1	40.8	...	...	...	...	...	...
26	119	112	108	106	104	103	102	101	101	101	...	...	...	...	...	...	...	...
27	138	135	134	133	133	133	133	116	101	85.4	67.8	52.9	...	...	...	...	...	...
28	138	135	134	133	133	133	133	116	...	...	...	...	...	...	...	...	...	...
29	161	159	158	157	156	155	152	149	...	...	...	...	...	...	...	...	...	...
30	179	177	176	175	174	171	168	165	...	...	...	...	...	...	...	...	...	...
31	88.6	88.6	87.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	78.1	70.3	65.0	62.2	60.2	...	...	...	...	...	...	...	...	...	...	...	...	...
33	78.1	78.1	77.5	76.5	75.8	...	...	...	...	...	...	...	...	...	...	...	...	...
34	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
35	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
36	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
37	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
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	91.7	91.7	91.7	91.7	91.7	91.7	91.7	90.7	88.1	84.9	81.4	78.0	...	...	...	...	...	...
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	128	128	128	128	128	128	128	128	127	125	123	121	...	...	...	...	...	...
43	128	128	128	128	128	128	128	128	127	125	123	121	...	...	...	...	...	...
44	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
45	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

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	27.0	23.0	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...
45	27.0	23.0	18.7	15.6	13.0	9.96	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	99Ni-Low C	Bar, rod	SB-160	...	N02201	Hot rolled/ann.
2	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
3	99Ni-Low C	Smls. tube	SB-163	...	N02201	Annealed
4	99Ni-Low C	Plate, sheet, strip	SB-162	...	N02201	Hot rolled/ann.
5	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Stress rel.
6	99Ni-Low C	Smls. pipe & tube	SB-163	...	N02201	Stress rel.
7	67Ni-30Cu	Bar, rod	SB-164	...	N04400	HW or CW ann.
8	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
9	67Ni-30Cu	Forgings	SB-564	...	N04400	Annealed
10	67Ni-30Cu	Plate	SB-127	...	N04400	Annealed
11	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Annealed
12	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
13	67Ni-30Cu	Smls. & wld. fittings	SB-366	...	N04400	Annealed
14	67Ni-30Cu	Hexagons, rings, discs	SB-164	...	N04400	Hot worked
15	67Ni-30Cu	Plate	SB-127	...	N04400	As rolled
16	67Ni-30Cu	Rounds, squares, rectangles	SB-164	...	N04400	Hot worked
17	67Ni-30Cu	Rounds, squares, rectangles	SB-164	...	N04400	Hot worked
18	67Ni-30Cu	Hexagons	SB-164	...	N04400	Hot worked
19	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Stress rel.
20	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Stress rel.
21	67Ni-30Cu-S	Bar	SB-164	...	N04405	Annealed
22	67Ni-30Cu-S	Bar	SB-164	...	N04405	Hot worked
23	47Ni-22Cr-9Mo-18Fe	Plate, sheet, strip	SB-435	...	N06002	Annealed
24	47Ni-22Cr-9Mo-18Fe	Plate, sheet, strip	SB-435	...	N06002	Annealed
25	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...	N06002	Annealed
26	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...	N06002	Annealed
27	47Ni-22Cr-9Mo-18Fe	Smls. & wld. fittings	SB-366	...	N06002	Annealed
28	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.
29	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.
30	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...	N06002	Solution ann.
31	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...	N06002	Solution ann.
32	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.
33	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.
34	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
35	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
36	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
37	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
38	47Ni-22Cr-19Fe-6Mo	Smls. & wld. fittings	SB-366	...	N06007	Annealed
39	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
40	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
41	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
42	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
43	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...	N06007	Solution ann.
44	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...	N06007	Solution ann.
45	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...	N06007	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	41	345	69	NP	427 (Cl. 3 only)	649	343	NFN-1	T10
2	≤125 O.D.	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN-1	T9
3	...	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN-1	T9
4	...	41	345	83	NP	427 (Cl. 3 only)	649	343	NFN-1	T9
5	...	41	415	205	NP	316 (Cl. 3 only)	316	316	NFN-1	...
6	...	41	415	205	NP	427 (Cl. 3 only)	482	343	NFN-1	...
7	All	42	480	170	NP	427	482	343	NFN-3	T19
8	>125 O.D.	42	485	170	NP	427	482	343	NFN-3	T19
9	...	42	485	170	NP	427	482	343	NFN-3	T19
10	...	42	485	195	NP	427	482	343	NFN-3	T19
11	≤75	42	485	195	NP	427	482	343	NFN-3	T19
12	≤125 O.D.	42	485	195	NP	427	482	343	NFN-3	T19
13	...	42	485	195	NP	427	482	343	NFN-3	T19, W5, W12
14	54 < t ≤ 102	42	517	207	NP	427	482	343	NFN-3	T9
15	...	42	515	275	NP	427	482	343	NFN-3	G12, G20, T9
16	305 < t ≤ 356	42	517	276	NP	NP	482	343	NFN-3	T9
17	≤305	42	552	276	NP	427 (Cl. 3 only)	482	343	NFN-3	T9
18	≤54	42	552	276	NP	427 (Cl. 3 only)	482	343	NFN-3	T9
19	...	42	585	380	NP	427	427	343	NFN-3	G11, T8
20	...	42	585	380	NP	427	260	260	NFN-3	G5, G21, T8
21	...	42	485	170	NP	427	482	343	NFN-3	T10
22	...	42	515	240	NP	427	482	343	NFN-3	T10
23	...	43	655	240	NP	427	899	343	NFN-15	G4, G5, T15
24	...	43	655	240	NP	NP	899	343	NFN-15	G4, T16
25	...	43	655	240	NP	427	899	343	NFN-15	G4, G5, G13, T15
26	...	43	655	240	NP	NP	899	343	NFN-15	G4, G13, T16
27	...	43	690	275	NP	427	899	343	NFN-15	G4, G5, T15, W5, W12
28	...	43	690	275	NP	427	899	343	NFN-15	G4, G5, G14, T14, W5
29	...	43	690	275	NP	NP	899	343	NFN-15	G4, G14, T16
30	...	43	690	275	NP	427	899	343	NFN-15	G4, G5, T14
31	...	43	690	275	NP	NP	899	343	NFN-15	G4, T16
32	...	43	690	275	NP	427	899	343	NFN-15	G4, G5, G14, T14, W5
33	...	43	690	275	NP	NP	899	343	NFN-15	G4, G14, T16
34	>19	45	585	205	NP	NP	538	343	NFN-11	...
35	>19	45	585	205	NP	NP	538	343	NFN-11	G5
36	>19	45	585	205	NP	NP	538	343	NFN-11	...
37	>19	45	585	205	NP	NP	538	343	NFN-11	G5
38	...	45	620	240	NP	NP	538	343	NFN-11	G5, W12
39	≤19	45	620	240	NP	NP	538	343	NFN-11	...
40	≤19	45	620	240	NP	NP	538	343	NFN-11	G5
41	≤19	45	620	240	NP	NP	538	343	NFN-11	...
42	≤19	45	620	240	NP	NP	538	343	NFN-11	G5
43	...	45	620	240	NP	NP	538	343	NFN-11	G14
44	...	45	620	240	NP	NP	538	343	NFN-11	G5, G14
45	...	45	620	240	NP	NP	538	343	NFN-11	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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
2	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
3	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
4	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
5	118	118	118	118	117	117	117	117	116	115	114	107	...	...	...	...	...	...
6	118	118	118	118	117	117	117	117	116	115	114	107	95.4	91.8	88.1	83.7	81.1	77.7
7	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
8	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
9	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
10	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	79.9	60.2
11	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	79.9	60.2
12	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	79.9	60.2
13	129	121	112	108	105	103	101	101	101	101	101	101	101	101	100	99.3	79.9	60.2
14	138	136	133	131	128	126	124	122	122	121	120	119	118	117	116	102	65.2	34.9
15	148	148	148	148	148	148	148	148	148	148	148	148	147	141	127	102	64.9	35.0
16	148	148	148	148	148	148	148	148	148	148	148	148	147	141	127	102	64.9	35.0
17	158	158	158	158	158	158	158	158	158	158	158	158	157	149	127	102	65.0	35.0
18	158	158	158	158	158	158	158	158	158	158	158	158	157	149	127	102	65.0	35.0
19	168	168	168	168	168	168	168	168	168	167	166	164	162	154	123	89.7	56.9	...
20	168	168	168	168	168	168	168	168	168	167	166	164	162	154	123	89.7	56.9	...
21	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
22	148	148	148	148	148	146	144	143	142	141	140	139	138	136	127	102	64.9	35.1
23	161	161	161	161	161	161	161	159	155	152	148	145	142	140	139	137	136	135
24	161	153	143	137	132	127	123	119	115	112	110	107	105	104	103	101	101	100
25	161	161	161	161	161	161	161	159	155	152	148	145	142	140	139	137	136	135
26	161	153	143	137	132	127	123	119	115	112	110	107	105	104	103	101	101	100
27	184	184	184	184	184	184	184	182	178	173	169	166	163	160	158	157	155	155
28	157	157	157	157	157	157	157	155	151	147	143	140	138	136	134	133	132	131
29	157	148	139	134	129	124	119	116	112	109	106	104	102	100	99.2	98.6	98.0	97.4
30	184	184	184	184	184	184	184	182	178	173	169	166	163	160	158	157	155	155
31	184	175	164	157	151	146	141	136	132	128	125	122	120	118	117	116	115	115
32	157	157	157	157	157	157	157	155	151	147	143	140	138	136	134	133	132	131
33	157	148	139	134	129	124	119	116	112	109	106	104	102	100	99.2	98.6	98.0	97.4
34	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
35	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129	128	128
36	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
37	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129	128	128
38	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
39	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110
40	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
41	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110
42	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150	150	149
43	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
44	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128	127	126
45	161	152	143	138	134	130	127	124	121	119	117	115	114	113	112	112	111	110

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	27.0	23.0	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...
2	27.3	22.9	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...
3	27.3	22.9	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...
4	27.3	22.9	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	42.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	42.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	42.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	42.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	8.09	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	8.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	8.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	8.04	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	8.04	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	8.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	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
24	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
25	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
26	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
27	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
28	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
29	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
30	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
31	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
32	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
33	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
34	94.0	93.8	93.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	127	126	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	94.0	93.8	93.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	127	126	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	149	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	93.3	93.1	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	126	126	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...	N06007	Solution ann.
2	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...	N06007	Solution ann.
3	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...	N06007	Solution ann.
4	55Ni-21Cr-13.5Mo	Smls. & wld. fittings	SB-366	...	N06022	Solution ann.
5	55Ni-21Cr-13.5Mo	Forgings	SB-462	...	N06022	Solution ann.
6	55Ni-21Cr-13.5Mo	Forgings	SB-462	...	N06022	Solution ann.
7	55Ni-21Cr-13.5Mo	Forgings	SB-564	...	N06022	Solution ann.
8	55Ni-21Cr-13.5Mo	Forgings	SB-564	...	N06022	Solution ann.
9	55Ni-21Cr-13.5Mo	Rod	SB-574	...	N06022	Solution ann.
10	55Ni-21Cr-13.5Mo	Rod	SB-574	...	N06022	Solution ann.
11	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...	N06022	Solution ann.
12	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...	N06022	Solution ann.
13	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...	N06022	Solution ann.
14	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...	N06022	Solution ann.
15	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...	N06022	Solution ann.
16	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...	N06022	Solution ann.
17	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...	N06022	Solution ann.
18	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...	N06022	Solution ann.
19	60Ni-25Cr-9.5Fe-2.1Al	Smls. tube	SB-163	...	N06025	Annealed
20	60Ni-25Cr-9.5Fe-2.1Al	Smls. tube	SB-163	...	N06025	Annealed
21	60Ni-25Cr-9.5Fe-2.1Al	Plate, sheet, strip	SB-168	...	N06025	Annealed
22	60Ni-25Cr-9.5Fe-2.1Al	Plate, sheet, strip	SB-168	...	N06025	Annealed
23	60Ni-25Cr-9.5Fe-2.1Al	Wrought fittings	SB-366	...	N06025	Annealed
24	60Ni-25Cr-9.5Fe-2.1Al	Wrought fittings	SB-366	...	N06025	Annealed
25	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-462	...	N06025	Annealed
26	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-462	...	N06025	Annealed
27	60Ni-25Cr-9.5Fe-2.1Al	Wld. tube	SB-516	...	N06025	Annealed
28	60Ni-25Cr-9.5Fe-2.1Al	Wld. tube	SB-516	...	N06025	Annealed
29	60Ni-25Cr-9.5Fe-2.1Al	Wld. pipe	SB-517	...	N06025	Annealed
30	60Ni-25Cr-9.5Fe-2.1Al	Wld. pipe	SB-517	...	N06025	Annealed
31	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-564	...	N06025	Annealed
32	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-564	...	N06025	Annealed
33	60Ni-25Cr-9.5Fe-2.1Al	Bar	SB-166	...	N06025	HW or CW ann.
34	60Ni-25Cr-9.5Fe-2.1Al	Bar	SB-166	...	N06025	HW or CW ann.
35	60Ni-25Cr-9.5Fe-2.1Al	Smls. pipe & tube	SB-167	...	N06025	HW or CW ann.
36	60Ni-25Cr-9.5Fe-2.1Al	Smls. pipe & tube	SB-167	...	N06025	HW or CW ann.
37	40Ni-29Cr-15Fe-5Mo	Smls. & wld. fittings	SB-366	...	N06030	Solution ann.
38	40Ni-29Cr-15Fe-5Mo	Forgings	SB-462	...	N06030	Solution ann.
39	40Ni-29Cr-15Fe-5Mo	Forgings	SB-462	...	N06030	Solution ann.
40	40Ni-29Cr-15Fe-5Mo	Rod	SB-581	...	N06030	Solution ann.
41	40Ni-29Cr-15Fe-5Mo	Rod	SB-581	...	N06030	Solution ann.
42	40Ni-29Cr-15Fe-5Mo	Plate, sheet, strip	SB-582	...	N06030	Solution ann.
43	40Ni-29Cr-15Fe-5Mo	Plate, sheet, strip	SB-582	...	N06030	Solution ann.
44	40Ni-29Cr-15Fe-5Mo	Wld. pipe	SB-619	...	N06030	Solution ann.
45	40Ni-29Cr-15Fe-5Mo	Wld. pipe	SB-619	...	N06030	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	620	240	NP	NP	538	343	NFN-11	G5
2	...	45	620	240	NP	NP	538	343	NFN-11	G14
3	...	45	620	240	NP	NP	538	343	NFN-11	G5, G14
4	...	43	690	310	677	427	677	343	NFN-10	G5, G27, G28, T15, W5, W12
5	...	43	690	310	677	NP	677	NP	NFN-10	G5, G27, G28, T15
6	...	43	690	310	677	NP	677	NP	NFN-10	G27, G28, T15
7	...	43	690	310	677	427	677	343	NFN-10	G5, G27, G28, T15
8	...	43	690	310	677	NP	677	343	NFN-10	G27, G28, T15
9	...	43	690	310	677	427	677	343	NFN-10	G5, G27, G28, T15
10	...	43	690	310	677	NP	677	343	NFN-10	G27, G28, T15
11	...	43	690	310	677	427	677	343	NFN-10	G5, G27, G28, T15
12	...	43	690	310	677	NP	677	343	NFN-10	G27, G28, T15
13	...	43	690	310	677	427	677	343	NFN-10	G5, G14, G27, G28, T15, W6
14	...	43	690	310	677	NP	677	343	NFN-10	G14, G27, G28, T15
15	...	43	690	310	677	427	677	343	NFN-10	G5, G27, G28, T15
16	...	43	690	310	677	NP	677	343	NFN-10	G27, G28, T15
17	...	43	690	310	677	427	677	343	NFN-10	G5, G14, G27, G28, T15, W6
18	...	43	690	310	677	NP	677	343	NFN-10	G14, G27, G28, T15
19	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
20	...	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
21	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
22	...	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
23	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
24	...	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
25	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
26	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
27	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G14, G34, G35, G36, G38, T12
28	...	43	676	269	899	NP	982	NP	NFN-13	G4, G14, G34, G35, G36, G38, T13
29	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G14, G34, G35, G36, G38, T12
30	...	43	676	269	899	NP	982	NP	NFN-13	G4, G14, G34, G35, G36, G38, T13
31	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
32	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
33	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
34	$t \leq 102$	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
35	...	43	676	269	899	NP	982	NP	NFN-13	G4, G5, G34, G35, G36, G37, T12
36	...	43	676	269	899	NP	982	NP	NFN-13	G4, G34, G35, G36, G37, T13
37	...	45	585	240	NP	427	427	343	NFN-19	G5, W5, W12
38	...	45	585	240	NP	NP	427	NP	NFN-19	G5
39	...	45	585	240	NP	NP	427	NP	NFN-19	...
40	...	45	585	240	NP	427	427	343	NFN-19	G5
41	...	45	585	240	NP	NP	427	343	NFN-19	...
42	...	45	585	240	NP	427	427	343	NFN-19	G5
43	...	45	585	240	NP	NP	427	343	NFN-19	...
44	...	45	585	240	NP	427	427	343	NFN-19	G5, G14, W6
45	...	45	585	240	NP	NP	427	343	NFN-19	G14

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	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	161	161	160	158	156	154	153	152	150	150	149
2	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
3	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128	127	126
4	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
5	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
6	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
7	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
8	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
9	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
10	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
11	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
12	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
13	168	168	167	166	165	162	160	158	156	155	153	152	151	150	149	148	147	146
14	168	162	155	149	144	139	134	131	127	124	122	119	117	115	113	112	111	109
15	197	197	197	196	194	191	188	185	183	182	180	179	178	176	175	174	173	172
16	197	191	182	176	169	164	159	154	150	146	142	140	137	135	133	131	130	129
17	168	168	167	166	165	162	160	158	156	155	153	152	151	150	149	148	147	146
18	168	162	155	149	144	139	134	131	127	124	122	119	117	115	113	112	111	109
19	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
20	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
21	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
22	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
23	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
24	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
25	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
26	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
27	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152
28	152	152	151	148	146	142	139	136	133	130	127	125	123	121	120	119	118	117
29	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152
30	152	152	151	148	146	142	139	136	133	130	127	125	123	121	120	119	118	117
31	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
32	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
33	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
34	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
35	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
36	179	179	177	175	171	168	164	160	156	153	150	147	145	143	141	139	138	137
37	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
38	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
39	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
40	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
41	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
42	161	161	161	161	161	159	156	153	152	150	148	146	143	141	138	136	134	...
43	161	148	136	130	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
44	137	137	137	137	136	135	132	130	129	128	126	124	121	120	118	116	114	...
45	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	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	148	148	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	93.3	93.1	93.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	126	126	125	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
5	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
6	128	127	126	124	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
7	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
8	128	127	126	124	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
9	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
10	128	127	126	124	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
11	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
12	128	127	126	124	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
13	145	144	142	126	98.4	71.4	56.1	45.5	35.0	...	...	...	...	...	...	...	...
14	108	108	108	105	98.4	71.4	56.1	45.5	35.0	...	...	...	...	...	...	...	...
15	171	169	167	148	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
16	128	127	126	124	116	83.9	65.6	53.2	40.9	...	...	...	...	...	...	...	...
17	145	144	142	126	98.4	71.4	56.1	45.5	35.0	...	...	...	...	...	...	...	...
18	108	108	108	105	98.4	71.4	56.1	45.5	35.0	...	...	...	...	...	...	...	...
19	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
20	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
21	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
22	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
23	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
24	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
25	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
26	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
27	152	152	127	105	86.6	71.7	59.3	49.1	40.6	33.6	27.8	16.8	8.8	7.3	6.0	5.0	4.1
28	116	116	115	105	86.6	71.7	59.3	49.1	40.6	33.6	27.8	16.8	8.8	7.3	6.0	5.0	4.1
29	152	152	127	105	86.6	71.7	59.3	49.1	40.6	33.6	27.8	16.8	8.8	7.3	6.0	5.0	4.1
30	116	116	115	105	86.6	71.7	59.3	49.1	40.6	33.6	27.8	16.8	8.8	7.3	6.0	5.0	4.1
31	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
32	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
33	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
34	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
35	179	179	149	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
36	137	136	135	123	102	84.3	69.7	57.7	47.7	39.5	32.7	19.8	10.4	8.5	7.1	5.8	4.8
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	40Ni-29Cr-15Fe-5Mo	Smls. pipe & tube	SB-622	...	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	40Ni-29Cr-15Fe-5Mo	Wld. tube	SB-626	...	N06030	Solution ann.
5	58Ni-33Cr-8Mo	Smls. & wld. fittings	SB-366	...	N06035	Solution ann.
6	58Ni-33Cr-8Mo	Forgings	SB-462	...	N06035	Solution ann.
7	58Ni-33Cr-8Mo	Forgings	SB-462	...	N06035	Solution ann.
8	58Ni-33Cr-8Mo	Forgings	SB-564	...	N06035	Solution ann.
9	58Ni-33Cr-8Mo	Forgings	SB-564	...	N06035	Solution ann.
10	58Ni-33Cr-8Mo	Rod	SB-574	...	N06035	Solution ann.
11	58Ni-33Cr-8Mo	Rod	SB-574	...	N06035	Solution ann.
12	58Ni-33Cr-8Mo	Plate, sheet, strip	SB-575	...	N06035	Solution ann.
13	58Ni-33Cr-8Mo	Plate, sheet, strip	SB-575	...	N06035	Solution ann.
14	58Ni-33Cr-8Mo	Wld. pipe	SB-619	...	N06035	Solution ann.
15	58Ni-33Cr-8Mo	Wld. pipe	SB-619	...	N06035	Solution ann.
16	58Ni-33Cr-8Mo	Smls. pipe & tube	SB-622	...	N06035	Solution ann.
17	58Ni-33Cr-8Mo	Smls. pipe & tube	SB-622	...	N06035	Solution ann.
18	58Ni-33Cr-8Mo	Wld. tube	SB-626	...	N06035	Solution ann.
19	58Ni-33Cr-8Mo	Wld. tube	SB-626	...	N06035	Solution ann.
20	46Ni-27Cr-23Fe-2.75Si	Rod	SB-166	...	N06045	Solution ann.
21	46Ni-27Cr-23Fe-2.75Si	Rod	SB-166	...	N06045	Solution ann.
22	46Ni-27Cr-23Fe-2.75Si	Smls. pipe & tube	SB-167	...	N06045	Solution ann.
23	46Ni-27Cr-23Fe-2.75Si	Smls. pipe & tube	SB-167	...	N06045	Solution ann.
24	46Ni-27Cr-23Fe-2.75Si	Plate, sheet, strip	SB-168	...	N06045	Solution ann.
25	46Ni-27Cr-23Fe-2.75Si	Plate, sheet, strip	SB-168	...	N06045	Solution ann.
26	46Ni-27Cr-23Fe-2.75Si	Smls. & wld. fittings	SB-366	...	N06045	Solution ann.
27	46Ni-27Cr-23Fe-2.75Si	Forged fittings	SB-462	...	N06045	Solution ann.
28	46Ni-27Cr-23Fe-2.75Si	Forged fittings	SB-462	...	N06045	Solution ann.
29	46Ni-27Cr-23Fe-2.75Si	Wld. tube	SB-516	...	N06045	Solution ann.
30	46Ni-27Cr-23Fe-2.75Si	Wld. tube	SB-516	...	N06045	Solution ann.
31	46Ni-27Cr-23Fe-2.75Si	Wld. pipe	SB-517	...	N06045	Solution ann.
32	46Ni-27Cr-23Fe-2.75Si	Wld. pipe	SB-517	...	N06045	Solution ann.
33	46Ni-27Cr-23Fe-2.75Si	Forgings	SB-564	...	N06045	Solution ann.
34	46Ni-27Cr-23Fe-2.75Si	Forgings	SB-564	...	N06045	Solution ann.
35	59Ni-23Cr-16Mo	Fittings	SB-366	CR5923	N06059	Annealed
36	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923	N06059	Annealed
37	59Ni-23Cr-16Mo	Wld. fittings	SB-366	WP5923W	N06059	Annealed
38	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923WX	N06059	Annealed
39	59Ni-23Cr-16Mo	Forged fittings	SB-462	...	N06059	Solution ann.
40	59Ni-23Cr-16Mo	Forged fittings	SB-462	...	N06059	Solution ann.
41	59Ni-23Cr-16Mo	Forgings	SB-564	...	N06059	Solution ann.
42	59Ni-23Cr-16Mo	Forgings	SB-564	...	N06059	Solution ann.
43	59Ni-23Cr-16Mo	Rod	SB-574	...	N06059	Solution ann.
44	59Ni-23Cr-16Mo	Rod	SB-574	...	N06059	Solution ann.
45	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...	N06059	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
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, G14, W6
4	...	45	585	240	NP	NP	427	343	NFN-19	G14
5	...	43	586	241	NP	NP	427	NP	NFN-27	G5, W12
6	...	43	586	241	NP	NP	427	NP	NFN-27	G5
7	...	43	586	241	NP	NP	427	NP	NFN-27	...
8	...	43	586	241	NP	NP	427	NP	NFN-27	G5
9	...	43	586	241	NP	NP	427	NP	NFN-27	...
10	...	43	586	241	NP	NP	427	NP	NFN-27	G5
11	...	43	586	241	NP	NP	427	NP	NFN-27	...
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, G14
15	...	43	586	241	NP	NP	427	NP	NFN-27	G14
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, G14
19	...	43	586	241	NP	NP	427	NP	NFN-27	G14
20	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11
21	...	46	620	240	816	NP	816	NP	NFN-8	T11
22	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11
23	...	46	620	240	816	NP	816	NP	NFN-8	T11
24	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11
25	...	46	620	240	816	NP	816	NP	NFN-8	T11
26	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11, W12
27	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11
28	...	46	620	240	816	NP	816	NP	NFN-8	T11
29	...	46	620	240	816	NP	816	NP	NFN-8	G5, G14, T11
30	...	46	620	240	816	NP	816	NP	NFN-8	G14, T11
31	...	46	620	240	816	NP	816	NP	NFN-8	G5, G14, T11
32	...	46	620	240	816	NP	816	NP	NFN-8	G14, T11
33	...	46	620	240	816	NP	816	NP	NFN-8	G5, T11
34	...	46	620	240	816	NP	816	NP	NFN-8	T11
35	...	43	690	310	NP	427	760	343	NFN-14	G5, G14, G23, T16
36	...	43	690	310	NP	427	760	343	NFN-14	G5, G23, T16
37	...	43	690	310	NP	427	760	343	NFN-14	G5, G14, G23, T16
38	...	43	690	310	NP	427	760	343	NFN-14	G5, G23, T16
39	...	43	690	310	NP	NP	760	343	NFN-14	G23, T16
40	...	43	690	310	NP	NP	760	343	NFN-14	G5, G23, T16
41	...	43	690	310	NP	427	760	343	NFN-14	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	G23, T16
44	...	43	690	310	NP	427	760	343	NFN-14	G5, G23, T16
45	...	43	690	310	NP	427	760	343	NFN-14	G23, T16

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	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	137	137	137	137	136	135	132	130	129	128	126	124	121	120	118	116	114	...
4	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	...
5	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
6	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
7	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
8	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
9	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
10	161	161	161	161	161	161	154	149	144	140	137	135	133	132	131	129	128	...
11	161	149	139	132	125	119	114	110	107	104	102	100	98.8	97.8	96.9	95.8	94.7	...
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	137	137	137	137	137	137	131	127	122	119	116	115	113	112	111	110	109	...
15	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	...
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	137	137	137	137	137	137	131	127	122	119	116	115	113	112	111	110	109	...
19	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	...
20	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
21	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
22	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
23	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
24	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
25	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
26	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
27	161	161	161	161	161	161	161	160	157	155	153	152	151	149	149	148	146	121
28	161	152	142	137	133	129	125	123	121	119	118	117	116	116	115	115	114	113
29	137	137	137	137	137	137	137	135	133	131	130	129	128	127	127	126	124	102
30	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
31	137	137	137	137	137	137	137	135	133	131	130	129	128	127	127	126	124	102
32	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
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	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
36	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
37	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
38	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
39	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
40	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
41	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
42	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
43	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
44	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
45	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
21	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	...	...	...
22	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	...	...	...
23	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	...	...	...
24	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	...	...	...
25	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	...	...	...
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	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	...	...	...
30	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	...	...	...
31	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	...	...	...
32	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	...	...	...
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	140	137	134	128	104	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
36	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
37	140	137	134	128	104	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
38	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
39	122	119	117	115	112	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
40	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
41	122	119	117	115	112	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
42	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
43	122	119	117	115	112	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
44	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
45	122	119	117	115	112	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...	N06059	Solution ann.
2	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.
3	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.
4	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...	N06059	Solution ann.
5	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...	N06059	Solution ann.
6	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.
7	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.
8	59Ni-23Cr-16Mo-1.6Cu	Smls. & wld. fittings	SB-366	...	N06200	Solution ann.
9	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-462	...	N06200	Solution ann.
10	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-462	...	N06200	Solution ann.
11	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-564	...	N06200	Solution ann.
12	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-564	...	N06200	Solution ann.
13	59Ni-23Cr-16Mo-1.6Cu	Rod	SB-574	...	N06200	Solution ann.
14	59Ni-23Cr-16Mo-1.6Cu	Rod	SB-574	...	N06200	Solution ann.
15	59Ni-23Cr-16Mo-1.6Cu	Plate, sheet, strip	SB-575	...	N06200	Solution ann.
16	59Ni-23Cr-16Mo-1.6Cu	Plate, sheet, strip	SB-575	...	N06200	Solution ann.
17	59Ni-23Cr-16Mo-1.6Cu	Wld. pipe	SB-619	...	N06200	Solution ann.
18	59Ni-23Cr-16Mo-1.6Cu	Wld. pipe	SB-619	...	N06200	Solution ann.
19	59Ni-23Cr-16Mo-1.6Cu	Smls. pipe & tube	SB-622	...	N06200	Solution ann.
20	59Ni-23Cr-16Mo-1.6Cu	Smls. pipe & tube	SB-622	...	N06200	Solution ann.
21	59Ni-23Cr-16Mo-1.6Cu	Wld. tube	SB-626	...	N06200	Solution ann.
22	59Ni-23Cr-16Mo-1.6Cu	Wld. tube	SB-626	...	N06200	Solution ann.
23	60Ni-19Cr-19Mo-1.8Ta	Smls. & wld. fittings	SB-366	...	N06210	Solution ann.
24	60Ni-19Cr-19Mo-1.8Ta	Forgings	SB-564	...	N06210	Solution ann.
25	60Ni-19Cr-19Mo-1.8Ta	Forgings	SB-564	...	N06210	Solution ann.
26	60Ni-19Cr-19Mo-1.8Ta	Rod	SB-574	...	N06210	Solution ann.
27	60Ni-19Cr-19Mo-1.8Ta	Rod	SB-574	...	N06210	Solution ann.
28	60Ni-19Cr-19Mo-1.8Ta	Plate, sheet, strip	SB-575	...	N06210	Solution ann.
29	60Ni-19Cr-19Mo-1.8Ta	Plate, sheet, strip	SB-575	...	N06210	Solution ann.
30	60Ni-19Cr-19Mo-1.8Ta	Wld. pipe	SB-619	...	N06210	Solution ann.
31	60Ni-19Cr-19Mo-1.8Ta	Wld. pipe	SB-619	...	N06210	Solution ann.
32	60Ni-19Cr-19Mo-1.8Ta	Smls. pipe & tube	SB-622	...	N06210	Solution ann.
33	60Ni-19Cr-19Mo-1.8Ta	Smls. pipe & tube	SB-622	...	N06210	Solution ann.
34	60Ni-19Cr-19Mo-1.8Ta	Wld. tube	SB-626	...	N06210	Solution ann.
35	60Ni-19Cr-19Mo-1.8Ta	Wld. tube	SB-626	...	N06210	Solution ann.
36	57Ni-22Cr-14W-2Mo-La	Smls. & wld. fittings	SB-366	...	N06230	Solution ann.
37	57Ni-22Cr-14W-2Mo-La	Plate, sheet, strip	SB-435	...	N06230	Solution ann.
38	57Ni-22Cr-14W-2Mo-La	Plate, sheet, strip	SB-435	...	N06230	Solution ann.
39	57Ni-22Cr-14W-2Mo-La	Forgings	SB-564	...	N06230	Solution ann.
40	57Ni-22Cr-14W-2Mo-La	Forgings	SB-564	...	N06230	Solution ann.
41	57Ni-22Cr-14W-2Mo-La	Bar	SB-572	...	N06230	Solution ann.
42	57Ni-22Cr-14W-2Mo-La	Bar	SB-572	...	N06230	Solution ann.
43	57Ni-22Cr-14W-2Mo-La	Wld. pipe	SB-619	...	N06230	Solution ann.
44	57Ni-22Cr-14W-2Mo-La	Wld. pipe	SB-619	...	N06230	Solution ann.
45	57Ni-22Cr-14W-2Mo-La	Smls. pipe & tube	SB-622	...	N06230	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	43	690	310	NP	427	760	343	NFN-14	G5, G23, T16
2	...	43	690	310	NP	427	760	343	NFN-14	G14, G23, T16
3	...	43	690	310	NP	427	760	343	NFN-14	G5, G14, G23, T16
4	...	43	690	310	NP	427	760	343	NFN-14	G23, T16
5	...	43	690	310	NP	427	760	343	NFN-14	G5, G23, T16
6	...	43	690	310	NP	427	760	343	NFN-14	G14, G23, T16
7	...	43	690	310	NP	427	760	343	NFN-14	G5, G14, G23, T16
8	...	43	690	310	NP	NP	427	NP	NFN-10	G5, W12
9	...	43	690	310	NP	NP	427	NP	NFN-10	...
10	...	43	690	310	NP	NP	427	NP	NFN-10	G5
11	...	43	690	310	NP	NP	427	NP	NFN-10	...
12	...	43	690	310	NP	NP	427	NP	NFN-10	G5
13	...	43	690	310	NP	NP	427	NP	NFN-10	...
14	...	43	690	310	NP	NP	427	NP	NFN-10	G5
15	...	43	690	310	NP	NP	427	NP	NFN-10	...
16	...	43	690	310	NP	NP	427	NP	NFN-10	G5
17	...	43	690	310	NP	NP	427	NP	NFN-10	G14
18	...	43	690	310	NP	NP	427	NP	NFN-10	G5, G14
19	...	43	690	310	NP	NP	427	NP	NFN-10	...
20	...	43	690	310	NP	NP	427	NP	NFN-10	G5
21	...	43	690	310	NP	NP	427	NP	NFN-10	G14
22	...	43	690	310	NP	NP	427	NP	NFN-10	G5, G14
23	...	43	690	310	NP	NP	427	NP	NFN-14	G5, W12
24	...	43	690	310	NP	NP	427	NP	NFN-14	...
25	...	43	690	310	NP	NP	427	NP	NFN-14	G5
26	...	43	690	310	NP	NP	427	NP	NFN-14	...
27	...	43	690	310	NP	NP	427	NP	NFN-14	G5
28	...	43	690	310	NP	NP	427	NP	NFN-14	...
29	...	43	690	310	NP	NP	427	NP	NFN-14	G5
30	...	43	690	310	NP	NP	427	NP	NFN-14	G14
31	...	43	690	310	NP	NP	427	NP	NFN-14	G5, G14
32	...	43	690	310	NP	NP	427	NP	NFN-14	...
33	...	43	690	310	NP	NP	427	NP	NFN-14	G5
34	...	43	690	310	NP	NP	427	NP	NFN-14	G14
35	...	43	690	310	NP	NP	427	NP	NFN-14	G5, G14
36	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G31, T15, W12
37	...	43	760	310	899	NP	982	343	NFN-24	G4, G31, T16
38	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G31, T15
39	...	43	760	310	899	NP	982	343	NFN-24	G4, G31, T16
40	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G31, T15
41	...	43	760	310	899	NP	982	343	NFN-24	G4, G31, T16
42	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G31, T15
43	...	43	760	310	899	NP	982	343	NFN-24	G4, G14, G32, T16
44	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G14, G32, T15
45	...	43	760	310	899	NP	982	343	NFN-24	G4, G31, T16

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
2	168	163	157	152	147	143	140	137	134	131	127	124	121	118	115	112	109	106
3	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
4	197	191	184	179	174	169	165	161	157	154	150	146	142	139	135	132	128	125
5	197	197	197	197	197	196	194	191	187	184	181	178	176	173	172	170	168	167
6	168	163	157	152	147	143	140	137	134	131	127	124	121	118	115	112	109	106
7	168	168	168	168	168	166	164	162	160	157	154	152	150	147	146	144	143	142
8	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
9	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
10	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
11	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
12	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
13	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
14	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
15	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
16	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
17	167	...	156	...	145	...	135	...	126	...	118	116	113	112	110	109	109	...
18	167	...	167	...	167	...	162	...	158	...	154	153	152	151	149	148	146	...
19	197	...	184	...	171	...	159	...	148	...	139	136	133	131	130	129	128	...
20	197	...	197	...	197	...	191	...	185	...	182	180	179	177	175	174	172	...
21	167	...	156	...	145	...	135	...	126	...	118	116	113	112	110	109	109	...
22	167	...	167	...	167	...	162	...	158	...	154	153	152	151	149	148	146	...
23	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
24	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
25	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
26	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
27	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
28	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
29	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
30	167	163	155	149	143	...	133	...	124	...	117	113	110	107	105	102	101	...
31	167	167	167	167	167	...	162	...	158	...	155	153	149	145	141	138	136	...
32	197	192	182	175	169	...	157	...	146	...	137	133	129	126	123	121	118	...
33	197	197	197	197	196	...	191	...	186	...	183	180	175	170	166	163	160	...
34	167	163	155	149	143	...	133	...	124	...	117	113	110	107	105	102	101	...
35	167	167	167	167	167	...	162	...	158	...	155	153	149	145	141	138	136	...
36	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
37	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
38	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
39	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
40	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
41	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144
42	207	207	207	207	207	207	207	207	207	206	206	203	200	197	196	195	195	195
43	176	170	164	159	155	150	145	141	137	133	130	128	126	124	123	123	122	122
44	176	176	176	176	176	176	176	176	176	176	176	173	170	167	167	166	166	166
45	207	200	193	188	182	176	171	166	161	157	153	150	148	146	145	144	144	144

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
2	104	101	99.3	97.9	95.1	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
3	140	137	134	128	104	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
4	122	119	117	115	112	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
5	165	161	158	150	122	97.8	79.3	65.7	53.1	43.0	35.7	29.0	...	...	...	...	...
6	104	101	99.3	97.9	95.1	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
7	140	137	134	128	104	83.1	67.7	55.9	45.2	36.5	30.4	25.0	...	...	...	...	...
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	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
37	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
38	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
39	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
40	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
41	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
42	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
43	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
44	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
45	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

Table 1B (Cont'd)
Section I; Section III, Division 1, 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. pipe & tube	SB-622	...	N06230	Solution ann.
2	57Ni-22Cr-14W-2Mo-La	Wld. tube	SB-626	...	N06230	Solution ann.
3	57Ni-22Cr-14W-2Mo-La	Wld. tube	SB-626	...	N06230	Solution ann.
4	61Ni-16Mo-16Cr	Smls. & wld. fittings	SB-366	...	N06455	Annealed
5	61Ni-16Mo-16Cr	Rod	SB-574	...	N06455	Solution ann.
6	61Ni-16Mo-16Cr	Rod	SB-574	...	N06455	Solution ann.
7	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...	N06455	Solution ann.
8	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...	N06455	Solution ann.
9	61Ni-16Mo-16Cr	Wld. pipe	SB-619	...	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	Smls. pipe & tube	SB-622	...	N06455	Solution ann.
13	61Ni-16Mo-16Cr	Wld. tube	SB-626	...	N06455	Solution ann.
14	61Ni-16Mo-16Cr	Wld. tube	SB-626	...	N06455	Solution ann.
15	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
16	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
17	72Ni-15Cr-8Fe	Smls. & wld. fittings	SB-366	...	N06600	Annealed
18	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
19	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
20	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
21	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
22	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed
23	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed
24	72Ni-15Cr-8Fe	Bar	SB-166	...	N06600	Annealed
25	72Ni-15Cr-8Fe	Bar	SB-166	...	N06600	Annealed
26	72Ni-15Cr-8Fe	Plate	SB-168	...	N06600	Annealed
27	72Ni-15Cr-8Fe	Plate, sheet, strip	SB-168	...	N06600	Annealed
28	72Ni-15Cr-8Fe	Wld. tube	SB-516	...	N06600	Annealed
29	72Ni-15Cr-8Fe	Wld. tube	SB-516	...	N06600	Annealed
30	72Ni-15Cr-8Fe	Forgings	SB-564	...	N06600	...
31	72Ni-15Cr-8Fe	Forgings	SB-564	...	N06600	Annealed
32	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
33	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
34	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...	N06600	Cold drawn/ann.
35	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...	N06600	Cold drawn/ann.
36	72Ni-15Cr-8Fe	Bar, rod	SB-166	...	N06600	Hot fin.
37	72Ni-15Cr-8Fe	Bar, rod	SB-166	...	N06600	Hot fin.
38	72Ni-15Cr-8Fe	Plate, sheet, strip	SB-168	...	N06600	Hot rolled
39	72Ni-15Cr-8Fe	Plate, sheet, strip	SB-168	...	N06600	Hot rolled
40	60Ni-23Cr-Fe	Smls. tube	SB-163	...	N06601	Annealed
41	60Ni-23Cr-Fe	Smls. tube	SB-163	...	N06601	Annealed
42	60Ni-23Cr-Fe	Bar	SB-166	...	N06601	Annealed
43	60Ni-23Cr-Fe	Bar	SB-166	...	N06601	Annealed
44	60Ni-23Cr-Fe	Smls. pipe & tube	SB-167	...	N06601	Annealed
45	60Ni-23Cr-Fe	Smls. pipe & tube	SB-167	...	N06601	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G31, T15
2	...	43	760	310	899	NP	982	343	NFN-24	G4, G14, G32, T16
3	...	43	760	310	899	NP	982	343	NFN-24	G4, G5, G14, G32, T15
4	...	43	690	275	NP	NP	427	343	NFN-14	G5, W12
5	...	43	690	275	NP	NP	427	343	NFN-14	...
6	...	43	690	275	NP	NP	427	343	NFN-14	G5
7	...	43	690	275	NP	NP	427	343	NFN-14	...
8	...	43	690	275	NP	NP	427	343	NFN-14	G5
9	...	43	690	275	NP	NP	427	343	NFN-14	G14
10	...	43	690	275	NP	NP	427	343	NFN-14	G5, G14
11	...	43	690	275	NP	NP	427	343	NFN-14	...
12	...	43	690	275	NP	NP	427	343	NFN-14	G5
13	...	43	690	275	NP	NP	427	343	NFN-14	G14
14	...	43	690	275	NP	NP	427	343	NFN-14	G5, G14
15	>125	43	515	170	NP	427	649	343	NFN-4	T12
16	>125	43	515	170	NP	427	649	343	NFN-4	G5, T11
17	...	43	550	205	NP	427	649	343	NFN-4	G5, T11, W5, W12
18	>125	43	550	205	NP	427 (Cl. 3 only)	649	343	NFN-4	T12
19	>125	43	550	205	NP	427 (Cl. 3 only)	649	343	NFN-4	G5, T11
20	≤125	43	550	205	NP	427	649	343	NFN-4	G5, T11
21	≤125	43	550	205	NP	NP	649	343	NFN-4	T12
22	≤75	43	550	240	649	427	649	343	NFN-4	G5, T11
23	≤75	43	550	240	649	NP	649	343	NFN-4	T11
24	...	43	550	240	649	427	649	343	NFN-4	G5, T11
25	...	43	550	240	649	NP	649	343	NFN-4	T11
26	...	43	550	240	649	427	649	343	NFN-4	G5, T11
27	...	43	550	240	649	NP	649	343	NFN-4	T11
28	...	43	550	240	NP	NP	649	343	NFN-4	G14, T11
29	...	43	550	240	NP	NP	649	343	NFN-4	G5, G14, T11
30	...	43	550	240	NP	427	NP	NP	NFN-4	G5
31	...	43	550	240	NP	NP	649	343	NFN-4	T11
32	≤125	43	550	240	649	427 (Cl. 3 only)	649	343	NFN-4	T11
33	≤125	43	550	240	649	427	649	343	NFN-4	G5, T11
34	...	43	550	240	NP	NP	649	343	NFN-4	G14, T11
35	...	43	550	240	NP	NP	649	343	NFN-4	G5, G14, T11
36	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN-4	T13
37	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN-4	G5, T12
38	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN-4	G20, T13
39	...	43	585	240	649	427 (Cl. 3 only)	649	343	NFN-4	G5, G20, T12
40	≤75 O.D.	43	552	207	899	NP	899	NP	NFN-4	G4, T14
41	≤75 O.D.	43	552	207	899	NP	899	NP	NFN-4	G4, G5, T13
42	...	43	552	207	899	NP	899	NP	NFN-4	G4, T14
43	...	43	552	207	899	NP	899	NP	NFN-4	G4, G5, T13
44	...	43	552	207	899	NP	899	NP	NFN-4	G4, T14
45	...	43	552	207	899	NP	899	NP	NFN-4	G4, G5, T13

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	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	176	170	164	159	155	150	145	141	137	133	130	128	126	124	123	123	122	122
3	176	176	176	176	176	176	176	176	176	176	176	173	170	167	167	166	166	166
4	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
5	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
6	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
7	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
8	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
9	157	150	143	138	134	131	128	125	123	121	119	117	116	115	114	112	110	...
10	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151	149	...
11	184	177	168	163	158	154	150	147	144	142	140	138	137	135	134	132	130	...
12	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
13	157	150	143	138	134	131	128	125	123	121	119	117	116	115	114	112	110	...
14	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151	149	...
15	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
16	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
17	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
18	138	135	131	129	126	124	121	119	117	115	113	111	109	108	107	105	104	103
19	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
20	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	120
21	138	135	131	129	126	124	121	119	117	115	113	111	109	108	107	105	104	103
22	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
23	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
24	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
25	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
26	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
27	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
28	134	129	124	123	122	121	120	119	119	118	117	116	116	115	114	112	110	99.9
29	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	132	106
30	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	...
31	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
32	158	152	146	144	143	142	142	141	140	139	138	137	136	135	134	132	130	118
33	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	156	124
34	134	129	124	123	122	121	120	119	119	118	117	116	116	115	114	112	110	99.9
35	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	132	106
36	161	156	152	150	148	147	147	147	147	147	146	146	145	145	143	141	139	137
37	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
38	161	156	152	150	148	147	147	147	147	147	146	146	145	145	143	141	139	137
39	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
40	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
41	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
42	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
43	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
44	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
45	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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
3	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
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	79.7	59.8	40.1	26.9	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
16	87.5	59.8	40.1	26.9	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
17	86.1	58.3	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
18	86.1	58.3	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
19	86.1	58.3	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
20	86.1	58.3	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
21	86.1	58.3	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
22	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
23	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
24	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
25	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
26	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
27	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
28	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
29	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	86.5	58.7	40.0	26.8	19.0	14.8	13.8	...	...	...	...	...	...	...	...	...	...
32	86.5	58.7	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	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
35	73.4	50.1	34.1	22.7	16.5	12.7	11.7	...	...	...	...	...	...	...	...	...	...
36	134	118	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
37	151	119	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
38	134	118	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
39	151	119	85.6	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...
40	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
41	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
42	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
43	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
44	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
45	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

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Class/Condition/ Temper	
					Desig./UNS No.		
1	60Ni-23Cr-Fe	Plate, sheet, strip	SB-168	...	N06601	Annealed	
2	60Ni-23Cr-Fe	Plate, sheet, strip	SB-168	...	N06601	Annealed	
3	52Ni-22Cr-13Co-9Mo	Bar, rod	SB-166	...	N06617	Annealed	
4	52Ni-22Cr-13Co-9Mo	Bar, rod	SB-166	...	N06617	Annealed	
5	52Ni-22Cr-13Co-9Mo	Smls. pipe & tube	SB-167	...	N06617	Annealed	
6	52Ni-22Cr-13Co-9Mo	Smls. pipe & tube	SB-167	...	N06617	Annealed	
7	52Ni-22Cr-13Co-9Mo	Wld. tube	SB-626	...	N06617	Solution ann.	
8	52Ni-22Cr-13Co-9Mo	Wld. tube	SB-626	...	N06617	Solution ann.	
9	52Ni-22Cr-13Co-9Mo	Plate, sheet, strip	SB-168	...	N06617	Annealed	
10	52Ni-22Cr-13Co-9Mo	Plate, sheet, strip	SB-168	...	N06617	Annealed	
11	52Ni-22Cr-13Co-9Mo	Forgings	SB-564	...	N06617	Annealed	
12	52Ni-22Cr-13Co-9Mo	Forgings	SB-564	...	N06617	Annealed	
13	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet, strip	SB-443	2	N06625	Cold rolled/solution ann.	
14	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet	SB-443	2	N06625	Hot rolled/solution ann.	
15	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe & tube	SB-444	2	N06625	Solution ann.	
16	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe & tube	SB-444	2	N06625	Solution ann.	
17	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	2	N06625	Solution ann.	
18	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	2	N06625	Solution ann.	
19	60Ni-22Cr-9Mo-3.5Cb	Smls. & wld. fittings	SB-366	...	N06625	Annealed	
20	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	1	N06625	Annealed	
(25)	21	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1	N06625	Annealed
	22	60Ni-22Cr-9Mo-3.5Cb	Plate	SB-443	1	N06625	Cold rolled/ann.
	23	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet	SB-443	1	N06625	Hot rolled/ann.
	24	60Ni-22Cr-9Mo-3.5Cb	Sheet, strip	SB-443	1	N06625	Cold rolled/ann.
	25	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe	SB-444	1	N06625	Annealed
(25)	26	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	1	N06625	Annealed
	27	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1	N06625	Annealed
	28	60Ni-22Cr-9Mo-3.5Cb	Wld. tube	SB-704	...	N06625	Annealed
	29	60Ni-22Cr-9Mo-3.5Cb	Wld. pipe	SB-705	1	N06625	Annealed
	30	Ni-Cr-Mo-W	Forged fittings	SB-462	...	N06686	Solution ann.
31	Ni-Cr-Mo-W	Forged fittings	SB-462	...	N06686	Solution ann.	
32	Ni-Cr-Mo-W	Forgings	SB-564	...	N06686	Solution ann.	
33	Ni-Cr-Mo-W	Forgings	SB-564	...	N06686	Solution ann.	
34	Ni-Cr-Mo-W	Rod	SB-574	...	N06686	Solution ann.	
35	Ni-Cr-Mo-W	Rod	SB-574	...	N06686	Solution ann.	
36	Ni-Cr-Mo-W	Plate, sheet, strip	SB-575	...	N06686	Solution ann.	
37	Ni-Cr-Mo-W	Plate, sheet, strip	SB-575	...	N06686	Solution ann.	
38	Ni-Cr-Mo-W	Wld. pipe	SB-619	...	N06686	Solution ann.	
39	Ni-Cr-Mo-W	Wld. pipe	SB-619	...	N06686	Solution ann.	
40	Ni-Cr-Mo-W	Smls. pipe & tube	SB-622	...	N06686	Solution ann.	
41	Ni-Cr-Mo-W	Smls. pipe & tube	SB-622	...	N06686	Solution ann.	
42	Ni-Cr-Mo-W	Wld. tube	SB-626	...	N06686	Solution ann.	
43	Ni-Cr-Mo-W	Wld. tube	SB-626	...	N06686	Solution ann.	
44	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Annealed	
45	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Annealed	

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	43	552	207	899	NP	899	NP	NFN-4	G4, T14
2	...	43	552	207	899	NP	899	NP	NFN-4	G4, G5, T13
3	...	43	655	240	899	NP	982	NP	NFN-4	G4, G29, T18
4	...	43	655	240	899	NP	982	NP	NFN-4	G4, G5, G29, T17
5	...	43	655	240	899	NP	982	NP	NFN-4	G4, G29, T18
6	...	43	655	240	899	NP	982	NP	NFN-4	G4, G5, G29, T17
7	...	43	655	240	899	NP	982	NP	NFN-4	G4, G14, G44, T18
8	...	43	655	240	899	NP	982	NP	NFN-4	G4, G5, G14, G44, T17
9	...	43	655	240	899	NP	982	NP	NFN-4	G4, G29, T18
10	...	43	655	240	899	NP	982	NP	NFN-4	G4, G5, G29, T17
11	...	43	655	240	899	NP	982	NP	NFN-4	G4, G29, T18
12	...	43	655	240	899	NP	982	NP	NFN-4	G4, G5, G29, T17
13	...	43	690	276	593	NP	871	343	NFN-22	G4, G5, G23, T17, W13
14	...	43	690	276	593	NP	871	343	NFN-22	G4, G23, T18, W13
15	...	43	690	275	593	NP	871	343	NFN-22	G4, G5, G23, T17, W13
16	...	43	690	275	593	NP	871	343	NFN-22	G4, G23, T18, W13
17	...	43	690	275	593	NP	871	343	NFN-22	G4, G5, G23, T17, W13
18	...	43	690	275	593	NP	871	343	NFN-22	G4, G23, T18, W13
19	...	43	760	345	593	427	649	343	NFN-17	G23, T16, W5, W12
20	100 < t ≤ 250	43	760	345	593	427	649	343	NFN-17	G23, T16
21	100 < t ≤ 250	43	760	345	593	427	649	343	NFN-17	G23, T16
22	≤9.5	43	758	379	593	427	649	343	NFN-17	G23, T16
23	≤70	43	758	379	593	427	649	343	NFN-17	G23, T16
24	...	43	827	414	593	NP	649	343	NFN-17	G22, G23, T16
25	...	43	825	415	593	427	649	343	NFN-17	G22, G23, T16
26	≤100	43	825	415	593	427	649	343	NFN-17	G22, G23, T16
27	≤100	43	825	415	593	427	649	343	NFN-17	G22, G23, T16
28	...	43	825	415	593	427	649	343	NFN-17	G14, G22, G23, T16
29	...	43	825	415	593	NP	649	343	NFN-17	G14, G22, G23, T16
30	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	G5
31	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	...
32	...	43	689	310	NP	NP	427	NP	NFN-10	G5
33	...	43	689	310	NP	NP	427	NP	NFN-10	...
34	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	G5
35	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	...
36	...	43	689	310	NP	NP	427	NP	NFN-10	G5
37	...	43	689	310	NP	NP	427	NP	NFN-10	...
38	≤203.2	43	689	310	NP	NP	427	NP	NFN-10	G5, G14
39	≤203.2	43	689	310	NP	NP	427	NP	NFN-10	G14
40	...	43	689	310	NP	NP	427	NP	NFN-10	G5
41	...	43	689	310	NP	NP	427	NP	NFN-10	...
42	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	G5, G14
43	≤88.9	43	689	310	NP	NP	427	NP	NFN-10	G14
44	...	43	585	240	NP	NP	454	343	NFN-4	...
45	...	43	585	240	NP	NP	454	343	NFN-4	G5

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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
2	138	138	138	138	138	138	138	138	138	136	133	132	130	129	129	128	128	128
3	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
4	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
5	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
6	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
7	137	129	121	116	112	110	106	104	102	99.5	97.8	96.9	96.1	94.4	93.5	93.5	92.7	91.8
8	137	137	137	137	137	137	137	137	137	136	133	131	129	128	128	126	125	124
9	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
10	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
11	161	152	142	136	132	129	125	122	120	117	115	114	113	111	110	110	109	108
12	161	161	161	161	161	161	161	161	161	160	157	154	152	151	150	148	147	146
13	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
14	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
15	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
16	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
17	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
18	184	175	169	165	161	158	155	153	150	148	146	144	143	141	140	139	138	137
19	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
20	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
21	217	217	217	217	215	212	209	206	204	201	199	197	194	192	191	189	187	186
22	217	217	217	217	217	217	217	217	217	207	205	204	202	201	199	197	196	194
23	217	217	217	217	217	217	217	217	217	207	205	204	202	201	199	197	196	194
24	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
25	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
26	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
27	236	236	236	236	236	234	232	230	228	226	224	222	221	219	217	215	213	212
28	201	201	201	201	201	199	197	195	194	192	190	189	188	186	185	183	182	180
29	201	201	201	201	201	199	197	195	194	192	191	189	188	186	185	183	181	180
30	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
31	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
32	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
33	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
34	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
35	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
36	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
37	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
38	167	167	167	...	165	...	160	...	156	...	153	151	150	149	148	146	144	...
39	167	154	144	...	137	...	132	...	128	...	123	121	119	118	117	116	116	...
40	197	197	197	...	194	...	188	...	183	...	180	178	177	175	174	172	170	...
41	197	182	170	...	161	...	155	...	150	...	145	142	140	139	137	137	137	...
42	167	167	167	...	165	...	160	...	156	...	153	151	150	149	148	146	144	...
43	167	154	144	...	137	...	132	...	128	...	123	121	119	118	117	116	116	...
44	161	153	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
45	161	161	161	161	161	161	161	160	160	159	158	158	158	157	156	156	155	155

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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
2	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
3	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
4	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
5	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
6	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
7	91.8	91.0	90.1	90.1	90.1	89.3	89.3	85.9	68.9	54.5	42.8	33.6	26.6	20.9	16.5	13.0	10.5
8	123	122	122	122	122	121	105	85.9	68.9	54.5	42.8	33.6	26.6	20.9	16.5	13.0	10.5
9	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
10	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
11	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
12	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
13	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
14	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
15	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
16	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
17	184	183	182	181	178	173	136	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
18	136	135	135	134	134	133	133	105	84.3	63.6	50.2	39.3	30.3	23.4	16.5	12.5	...
19	185	184	183	182	178	137	88.8	...	...	...	...	...	...	...	...	...	...
20	185	184	183	182	178	137	88.9	...	...	...	...	...	...	...	...	...	...
21	185	184	183	182	178	137	88.9	...	...	...	...	...	...	...	...	...	... (25)
22	192	190	188	185	179	137	88.9	...	...	...	...	...	...	...	...	...	...
23	192	190	188	185	179	137	88.9	...	...	...	...	...	...	...	...	...	...
24	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
25	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
26	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	...
27	210	207	205	202	192	136	89.0	...	...	...	...	...	...	...	...	...	... (25)
28	178	176	174	172	164	116	75.5	...	...	...	...	...	...	...	...	...	...
29	178	176	174	172	164	116	75.5	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	58Ni-29Cr-9Fe	Plate, sheet, strip	SB-168	...	N06690	Annealed
2	58Ni-29Cr-9Fe	Plate, sheet, strip	SB-168	...	N06690	Annealed
3	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold drawn/ann.
4	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold drawn/ann.
5	49Ni-25Cr-18Fe-6Mo	Plate, sheet, strip	SB-582	...	N06975	Solution ann.
6	49Ni-25Cr-18Fe-6Mo	Plate, sheet, strip	SB-582	...	N06975	Solution ann.
7	49Ni-25Cr-18Fe-6Mo	Wld. pipe	SB-619	...	N06975	Solution ann.
8	49Ni-25Cr-18Fe-6Mo	Wld. pipe	SB-619	...	N06975	Solution ann.
9	49Ni-25Cr-18Fe-6Mo	Smls. pipe & tube	SB-622	...	N06975	Solution ann.
10	49Ni-25Cr-18Fe-6Mo	Smls. pipe & tube	SB-622	...	N06975	Solution ann.
11	49Ni-25Cr-18Fe-6Mo	Wld. tube	SB-626	...	N06975	Solution ann.
12	49Ni-25Cr-18Fe-6Mo	Wld. tube	SB-626	...	N06975	Solution ann.
13	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
14	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
15	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
16	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
17	47Ni-22Cr-20Fe-7Mo	Smls. & wld. fittings	SB-366	...	N06985	Annealed
18	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
19	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
20	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
21	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
22	47Ni-22Cr-20Fe-7Mo	Wld. pipe	SB-619	...	N06985	Annealed
23	47Ni-22Cr-20Fe-7Mo	Wld. pipe	SB-619	...	N06985	Annealed
24	47Ni-22Cr-20Fe-7Mo	Smls. pipe & tube	SB-622	...	N06985	Annealed
25	47Ni-22Cr-20Fe-7Mo	Smls. pipe & tube	SB-622	...	N06985	Annealed
26	47Ni-22Cr-20Fe-7Mo	Wld. tube	SB-626	...	N06985	Annealed
27	47Ni-22Cr-20Fe-7Mo	Wld. tube	SB-626	...	N06985	Annealed
28	35Ni-35Fe-20Cr-Cb	Forgings	SB-462	...	N08020	Annealed
29	35Ni-35Fe-20Cr-Cb	Forgings	SB-462	...	N08020	Annealed
30	35Ni-35Fe-20Cr-Cb	Plate	SB-463	...	N08020	Annealed
31	35Ni-35Fe-20Cr-Cb	Plate	SB-463	...	N08020	Annealed
32	35Ni-35Fe-20Cr-Cb	Bar	SB-473	...	N08020	Annealed
33	35Ni-35Fe-20Cr-Cb	Bar	SB-473	...	N08020	Annealed
34	35Ni-35Fe-20Cr-Cb	Smls. pipe & tube	SB-729	...	N08020	Annealed
35	35Ni-35Fe-20Cr-Cb	Smls. pipe & tube	SB-729	...	N08020	Annealed
36	35Ni-35Fe-20Cr-Cb	Wld. pipe	SB-464	...	N08020	Wld. ann.
37	35Ni-35Fe-20Cr-Cb	Wld. pipe	SB-464	...	N08020	Wld. ann.
38	35Ni-35Fe-20Cr-Cb	Wld. pipe	SB-464	...	N08020	Wld. ann.
39	35Ni-35Fe-20Cr-Cb	Wld. tube	SB-468	...	N08020	Wld. ann.
40	35Ni-35Fe-20Cr-Cb	Wld. tube	SB-468	...	N08020	Wld. ann.
41	35Ni-35Fe-20Cr-Cb	Wld. tube	SB-468	...	N08020	Wld. ann.
42	35Ni-35Fe-20Cr-Cb	Smls. & wld. fittings	SB-366	...	N08020	Annealed
43	37Ni-33Fe-23Cr-4Mo-Cu	Wld. pipe	SB-464	...	N08024	Wld. ann.
44	37Ni-33Fe-23Cr-4Mo-Cu	Wld. pipe	SB-464	...	N08024	Wld. ann.
45	37Ni-33Fe-23Cr-4Mo-Cu	Wld. tube	SB-468	...	N08024	Wld. ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	43	585	240	NP	NP	454	343	NFN-4	...
2	...	43	585	240	NP	NP	454	343	NFN-4	G5
3	...	43	585	240	649	NP	454	343	NFN-4	H3, T12
4	...	43	585	240	649	NP	454	343	NFN-4	G5, H3, T11
5	...	45	585	220	NP	NP	427	343	NFN-11	...
6	...	45	585	220	NP	NP	427	343	NFN-11	G5
7	...	45	585	220	NP	NP	427	343	NFN-11	G14
8	...	45	585	220	NP	NP	427	343	NFN-11	G5, G14
9	...	45	585	220	NP	NP	427	343	NFN-11	...
10	...	45	585	220	NP	NP	427	343	NFN-11	G5
11	...	45	585	220	NP	NP	427	343	NFN-11	G14
12	...	45	585	220	NP	NP	427	343	NFN-11	G5, G14
13	>19	45	585	205	NP	NP	427	343	NFN-19	...
14	>19	45	585	205	NP	NP	427	343	NFN-19	G5
15	>19	45	585	205	NP	NP	427	343	NFN-19	...
16	>19	45	585	205	NP	NP	427	343	NFN-19	G5
17	...	45	620	240	NP	NP	427	343	NFN-18	G5, W12
18	≤19	45	620	240	NP	NP	427	343	NFN-18	...
19	≤19	45	620	240	NP	NP	427	343	NFN-18	G5
20	≤19	45	620	240	NP	NP	427	343	NFN-18	...
21	≤19	45	620	240	NP	NP	427	343	NFN-18	G5
22	...	45	620	240	NP	NP	427	343	NFN-18	G14
23	...	45	620	240	NP	NP	427	343	NFN-18	G5, G14
24	...	45	620	240	NP	NP	427	343	NFN-18	...
25	...	45	620	240	NP	NP	427	343	NFN-18	G5
26	...	45	620	240	NP	NP	427	343	NFN-18	G14
27	...	45	620	240	NP	NP	427	343	NFN-18	G5, G14
28	...	45	550	240	NP	427	427	343	NFN-12	G5
29	...	45	550	240	NP	NP	427	343	NFN-12	...
30	...	45	550	240	NP	NP	427	343	NFN-12	...
31	...	45	550	240	NP	427	427	343	NFN-12	G5
32	...	45	550	240	NP	427	427	343	NFN-12	G5
33	...	45	550	240	NP	NP	427	343	NFN-12	...
34	...	45	550	240	NP	NP	427	343	NFN-12	...
35	...	45	550	240	NP	NP	427	343	NFN-12	G5
36	...	45	550	240	NP	427	NP	NP	NFN-12	G5, W5
37	...	45	550	240	NP	NP	427	343	NFN-12	G14
38	...	45	550	240	NP	NP	427	343	NFN-12	G5, G14
39	...	45	550	240	NP	427	NP	NP	NFN-12	G5, W5
40	...	45	550	240	NP	NP	427	343	NFN-12	G14
41	...	45	550	240	NP	NP	427	343	NFN-12	G5, G14
42	...	45	585	275	NP	427	427	343	NFN-12	G5, W5, W12
43	...	45	550	240	NP	NP	NP	343	NFN-13	G14
44	...	45	550	240	NP	NP	NP	343	NFN-13	G5, G14
45	...	45	550	240	NP	NP	NP	343	NFN-13	G14

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	161	153	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
2	161	161	161	161	161	161	161	160	160	159	158	158	158	157	156	156	155	155
3	161	151	144	140	137	134	132	130	129	128	127	127	127	127	127	127	127	127
4	161	161	161	161	161	161	161	160	159	159	158	158	158	157	157	156	155	154
5	147	140	133	130	127	124	121	118	115	112	109	107	105	103	102	101	101	...
6	147	147	147	147	147	147	147	147	147	147	146	145	141	139	138	137	135	...
7	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	...
8	125	125	125	125	125	125	125	125	125	125	124	123	120	118	117	116	115	...
9	147	140	133	130	127	124	121	118	115	112	109	107	105	103	102	101	101	...
10	147	147	147	147	147	147	147	147	147	147	146	145	141	139	138	137	135	...
11	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	...
12	125	125	125	125	125	125	125	125	125	125	124	123	120	118	117	116	115	...
13	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	...
14	138	138	138	138	138	138	138	136	132	127	124	121	119	116	114	112	110	...
15	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	...
16	138	138	138	138	138	138	138	136	132	127	124	121	119	116	114	112	110	...
17	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
18	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
19	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
20	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
21	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
22	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	...
23	137	137	137	137	137	137	137	135	130	126	123	120	117	115	113	111	109	...
24	161	152	142	135	130	125	121	117	113	110	107	104	102	100	98.5	96.6	94.8	...
25	161	161	161	161	161	161	161	158	153	148	145	142	138	135	133	130	128	...
26	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	...
27	137	137	137	137	137	137	137	135	130	126	123	120	117	115	113	111	109	...
28	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
29	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
30	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
31	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
32	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
33	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
34	158	149	141	138	136	133	131	128	126	124	123	122	120	120	119	116	114	...
35	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
36	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
37	134	127	120	117	115	113	111	109	108	106	104	103	103	102	101	98.7	96.9	...
38	134	134	134	133	132	131	130	130	130	130	130	129	129	128	128	128	128	...
39	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
40	134	127	120	117	115	113	111	109	108	106	104	103	103	102	101	98.7	96.9	...
41	134	134	134	133	132	131	130	130	130	130	130	129	129	128	128	128	128	...
42	158	158	158	157	156	154	153	153	152	152	152	152	152	151	150	150	150	...
43	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	...
44	134	134	134	133	132	131	129	127	126	125	123	122	120	119	117	115	113	...
45	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	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	126	95.0	71.4	54.3	41.4	30.6	19.7	...	...	...	...	...	...	...	...	...	...
4	127	95.0	71.4	54.3	41.4	30.6	19.7	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	37Ni-33Fe-23Cr-4Mo-Cu	Wld. tube	SB-468	...	N08024	Wld. ann.
2	35Ni-30Fe-24Cr-6Mo-Cu	Wld. pipe	SB-464	...	N08026	Wld. ann.
3	35Ni-30Fe-24Cr-6Mo-Cu	Wld. pipe	SB-464	...	N08026	Wld. ann.
4	35Ni-30Fe-24Cr-6Mo-Cu	Wld. tube	SB-468	...	N08026	Wld. ann.
5	35Ni-30Fe-24Cr-6Mo-Cu	Wld. tube	SB-468	...	N08026	Wld. ann.
6	31Ni-31Fe-29Cr-Mo	Smls. tube	SB-668	...	N08028	Annealed
7	31Ni-31Fe-29Cr-Mo	Smls. tube	SB-668	...	N08028	Annealed
8	31Ni-31Fe-29Cr-Mo	Plate, sheet, strip	SB-709	...	N08028	Annealed
9	31Ni-31Fe-29Cr-Mo	Plate, sheet, strip	SB-709	...	N08028	Annealed
10	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. & wld. fittings	SB-366	...	N08031	Solution ann.
11	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forged fittings	SB-462	...	N08031	Solution ann.
12	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forged fittings	SB-462	...	N08031	Solution ann.
13	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forgings	SB-564	...	N08031	Solution ann.
14	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forgings	SB-564	...	N08031	Solution ann.
15	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Rod	SB-581	...	N08031	Solution ann.
16	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Rod	SB-581	...	N08031	Solution ann.
17	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. pipe	SB-619	...	N08031	Solution ann.
18	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. pipe	SB-619	...	N08031	Solution ann.
19	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. pipe & tube	SB-622	...	N08031	Solution ann.
20	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. pipe & tube	SB-622	...	N08031	Solution ann.
21	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Plate, sheet, strip	SB-625	...	N08031	Solution ann.
22	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Plate, sheet, strip	SB-625	...	N08031	Solution ann.
23	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. tube	SB-626	...	N08031	Solution ann.
24	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. tube	SB-626	...	N08031	Solution ann.
25	37Ni-33Fe-25Cr	Condenser tubes	SB-163	...	N08120	Solution ann.
26	37Ni-33Fe-25Cr	Condenser tubes	SB-163	...	N08120	Solution ann.
27	37Ni-33Fe-25Cr	Smls. & wld. fittings	SB-366	...	N08120	Solution ann.
28	37Ni-33Fe-25Cr	Smls. pipe & tube	SB-407	...	N08120	Solution ann.
29	37Ni-33Fe-25Cr	Smls. pipe & tube	SB-407	...	N08120	Solution ann.
30	37Ni-33Fe-25Cr	Bar, rod	SB-408	...	N08120	Solution ann.
31	37Ni-33Fe-25Cr	Bar, rod	SB-408	...	N08120	Solution ann.
32	37Ni-33Fe-25Cr	Plate, sheet, strip	SB-409	...	N08120	Solution ann.
33	37Ni-33Fe-25Cr	Plate, sheet, strip	SB-409	...	N08120	Solution ann.
34	37Ni-33Fe-25Cr	Wld. pipe	SB-514	...	N08120	Solution ann.
35	37Ni-33Fe-25Cr	Wld. pipe	SB-514	...	N08120	Solution ann.
36	37Ni-33Fe-25Cr	Wld. tube	SB-515	...	N08120	Solution ann.
37	37Ni-33Fe-25Cr	Wld. tube	SB-515	...	N08120	Solution ann.
38	37Ni-33Fe-25Cr	Forgings	SB-564	...	N08120	Solution ann.
39	37Ni-33Fe-25Cr	Forgings	SB-564	...	N08120	Solution ann.
40	26Ni-43Fe-22Cr-5Mo	Wld. pipe	SB-619	...	N08320	Solution ann.
41	26Ni-43Fe-22Cr-5Mo	Wld. pipe	SB-619	...	N08320	Solution ann.
42	26Ni-43Fe-22Cr-5Mo	Plate, sheet, strip	SB-620	...	N08320	Solution ann.
43	26Ni-43Fe-22Cr-5Mo	Plate, sheet, strip	SB-620	...	N08320	Solution ann.
44	26Ni-43Fe-22Cr-5Mo	Rod	SB-621	...	N08320	Solution ann.
45	26Ni-43Fe-22Cr-5Mo	Rod	SB-621	...	N08320	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	550	240	NP	NP	NP	343	NFN-13	G5, G14
2	...	45	550	240	NP	NP	NP	343	NFN-13	G14
3	...	45	550	240	NP	NP	NP	343	NFN-13	G5, G14
4	...	45	550	240	NP	NP	NP	343	NFN-13	G14
5	...	45	550	240	NP	NP	NP	343	NFN-13	G5, G14
6	...	45	505	215	NP	316	454	343	NFN-13	...
7	...	45	505	215	NP	316	454	343	NFN-13	G5
8	...	45	505	215	NP	NP	454	343	NFN-13	...
9	...	45	505	215	NP	NP	454	343	NFN-13	G5
10	...	45	650	275	NP	NP	427	NP	NFN-11	G5, W12
11	...	45	650	275	NP	NP	427	NP	NFN-11	...
12	...	45	650	275	NP	NP	427	NP	NFN-11	G5
13	...	45	650	275	NP	NP	427	NP	NFN-11	...
14	...	45	650	275	NP	NP	427	NP	NFN-11	G5
15	...	45	650	275	NP	NP	427	NP	NFN-11	...
16	...	45	650	275	NP	NP	427	NP	NFN-11	G5
17	...	45	650	275	NP	NP	427	NP	NFN-11	G14
18	...	45	650	275	NP	NP	427	NP	NFN-11	G5, G14
19	...	45	650	275	NP	NP	427	NP	NFN-11	...
20	...	45	650	275	NP	NP	427	NP	NFN-11	G5
21	...	45	650	275	NP	NP	427	NP	NFN-11	...
22	...	45	650	275	NP	NP	427	NP	NFN-11	G5
23	...	45	650	275	NP	NP	427	NP	NFN-11	G14
24	...	45	650	275	NP	NP	427	NP	NFN-11	G5, G14
25	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G14, T16
26	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, G14, T15
27	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, T15, W12
28	...	45	621	276	NP	NP	899	NP	NFN-9	G4, T16
29	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, T15
30	...	45	621	276	NP	NP	899	NP	NFN-9	G4, T16
31	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, T15
32	...	45	621	276	NP	NP	899	NP	NFN-9	G4, T16
33	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, T15
34	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G14, T16
35	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, G14, T15
36	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G14, T16
37	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, G14, T15
38	...	45	621	276	NP	NP	899	NP	NFN-9	G4, T16
39	...	45	621	276	NP	NP	899	NP	NFN-9	G4, G5, T15
40	...	45	515	195	NP	NP	427	343	NFN-13	G14
41	...	45	515	195	NP	NP	427	343	NFN-13	G5, G14
42	...	45	515	195	NP	NP	427	343	NFN-13	...
43	...	45	515	195	NP	NP	427	343	NFN-13	G5
44	...	45	515	195	NP	NP	427	343	NFN-13	...
45	...	45	515	195	NP	NP	427	343	NFN-13	G5

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	134	134	134	133	132	131	129	127	126	125	123	122	120	119	117	115	113	...
2	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	...
3	134	134	134	133	132	130	128	126	125	123	122	120	117	115	112	110	109	...
4	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	...
5	134	134	134	133	132	130	128	126	125	123	122	120	117	115	112	110	109	...
6	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
7	143	143	143	141	138	136	133	131	130	128	126	125	124	122	121	119	116	113
8	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
9	143	143	143	141	138	136	133	131	130	128	126	125	124	122	121	119	116	113
10	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
11	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
12	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
13	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
14	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
15	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
16	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
17	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	...
18	157	157	156	154	151	147	144	141	138	135	132	129	126	125	123	120	118	...
19	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
20	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
21	184	167	149	142	136	131	127	123	120	117	115	112	111	109	107	105	103	...
22	184	184	184	181	178	174	170	166	162	159	155	152	149	146	144	142	139	...
23	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	...
24	157	157	156	154	151	147	144	141	138	135	132	129	126	125	123	120	118	...
25	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
26	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
27	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
28	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
29	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
30	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
31	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
32	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
33	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
34	150	146	138	132	127	122	117	114	111	107	105	103	101	99.5	98.6	97.8	96.9	96.1
35	150	150	150	150	147	145	142	141	139	139	138	138	137	134	133	132	131	130
36	150	146	138	132	127	122	117	114	111	107	105	103	101	99.5	98.6	97.8	96.9	96.1
37	150	150	150	150	147	145	142	141	139	139	138	138	137	134	133	132	131	130
38	177	172	162	155	149	143	138	134	130	126	123	121	119	117	116	115	114	113
39	177	177	177	176	173	170	167	166	164	163	162	162	161	158	157	155	154	153
40	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	...
41	110	110	110	110	110	110	110	110	110	109	109	108	106	104	103	101	98.9	...
42	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	...
43	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...
44	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	...
45	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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
26	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
27	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
28	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
29	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
30	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
31	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
32	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
33	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
34	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
35	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
36	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
37	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
38	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
39	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
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	26Ni-43Fe-22Cr-5Mo	Smls. pipe & tube	SB-622	...	N08320	Solution ann.
2	26Ni-43Fe-22Cr-5Mo	Smls. pipe & tube	SB-622	...	N08320	Solution ann.
3	26Ni-43Fe-22Cr-5Mo	Wld. tube	SB-626	...	N08320	Solution ann.
4	26Ni-43Fe-22Cr-5Mo	Wld. tube	SB-626	...	N08320	Solution ann.
5	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	...
6	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	...
7	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	...
8	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	...
9	35Ni-19Cr-1 $\frac{1}{4}$ Si	Pipe	SB-535	...	N08330	...
10	35Ni-19Cr-1 $\frac{1}{4}$ Si	Pipe	SB-535	...	N08330	...
11	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate	SB-536	...	N08330	...
12	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate	SB-536	...	N08330	...
13	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. fittings	SB-366	...	N08330	Annealed
14	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. pipe	SB-535	...	N08330	Annealed
15	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. pipe	SB-535	...	N08330	Annealed
16	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate, sheet, strip	SB-536	...	N08330	Annealed
17	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate, sheet, strip	SB-536	...	N08330	Annealed
18	35Ni-19Cr-1 $\frac{1}{4}$ Si	Wld. pipe	SB-710	...	N08330	Annealed
19	35Ni-19Cr-1 $\frac{1}{4}$ Si	Wld. pipe	SB-710	...	N08330	Annealed
20	35Ni-23Cr-7.5Mo-N	Plate, sheet, strip	SB-625	...	N08354	Solution ann.
21	35Ni-23Cr-7.5Mo-N	Plate, sheet, strip	SB-625	...	N08354	Solution ann.
22	35Ni-23Cr-7.5Mo-N	Bar, wire	SB-649	...	N08354	Solution ann.
23	35Ni-23Cr-7.5Mo-N	Bar, wire	SB-649	...	N08354	Solution ann.
24	35Ni-23Cr-7.5Mo-N	Wld. pipe	SB-673	...	N08354	Solution ann.
25	35Ni-23Cr-7.5Mo-N	Wld. pipe	SB-673	...	N08354	Solution ann.
26	35Ni-23Cr-7.5Mo-N	Wld. tube	SB-674	...	N08354	Solution ann.
27	35Ni-23Cr-7.5Mo-N	Wld. tube	SB-674	...	N08354	Solution ann.
28	35Ni-23Cr-7.5Mo-N	Smls. pipe & tube	SB-677	...	N08354	Solution ann.
29	35Ni-23Cr-7.5Mo-N	Smls. pipe & tube	SB-677	...	N08354	Solution ann.
30	46Fe-24Ni-21Cr-6Mo-N	Smls. & wld. fittings	SB-366	...	N08367	Solution ann.
31	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-462	...	N08367	Solution ann.
32	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-462	...	N08367	Solution ann.
33	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-564	...	N08367	Solution ann.
34	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-564	...	N08367	Solution ann.
35	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
36	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
37	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
38	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
39	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
40	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
41	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
42	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
43	46Fe-24Ni-21Cr-6Mo-N	Bar, rod, wire	SB-691	...	N08367	Solution ann.
44	46Fe-24Ni-21Cr-6Mo-N	Bar, rod, wire	SB-691	...	N08367	Solution ann.
45	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	515	195	NP	NP	427	343	NFN-13	...
2	...	45	515	195	NP	NP	427	343	NFN-13	G5
3	...	45	515	195	NP	NP	427	343	NFN-13	G14
4	...	45	515	195	NP	NP	427	343	NFN-13	G5, G14
5	...	46	690	205	816	NP	NP	NP	NFN-13	G2, H2, T14
6	...	46	485	205	816	NP	NP	NP	NFN-13	G2, G5, H2, T12
7	...	46	485	205	NP	NP	899	343	NFN-13	G4, H1, T14
8	...	46	485	205	NP	NP	899	343	NFN-13	G4, G5, H1, T12
9	...	46	485	205	816	NP	NP	NP	NFN-13	G2, H2, T14
10	...	46	485	205	816	NP	NP	NP	NFN-13	G2, G5, H2, T12
11	...	46	485	205	816	NP	NP	NP	NFN-13	G2, H2, T14
12	...	46	485	205	816	NP	NP	NP	NFN-13	G2, G5, H2, T12
13	...	46	485	205	NP	NP	899	343	NFN-13	G4, G5, T12, W12
14	...	46	485	205	NP	NP	816	343	NFN-13	H1, T14, W12
15	...	46	485	205	NP	NP	816	343	NFN-13	G5, H1, T12, W12
16	...	46	485	205	NP	NP	899	343	NFN-13	G4, H1, T14
17	...	46	485	205	NP	NP	899	343	NFN-13	G4, G5, H1, T12
18	...	46	485	205	NP	NP	899	343	NFN-13	G4, G14, H1, T14
19	...	46	485	205	NP	NP	899	343	NFN-13	G4, G5, G14, H1, T12
20	...	45	640	295	NP	NP	427	NP	HA-6	...
21	...	45	640	295	NP	NP	427	NP	HA-6	G5
22	...	45	640	295	NP	NP	427	NP	HA-6	...
23	...	45	640	295	NP	NP	427	NP	HA-6	G5
24	...	45	640	295	NP	NP	427	NP	HA-6	G14
25	...	45	640	295	NP	NP	427	NP	HA-6	G5, G14
26	...	45	640	295	NP	NP	427	NP	HA-6	G14
27	...	45	640	295	NP	NP	427	NP	HA-6	G5, G14
28	...	45	640	295	NP	NP	427	NP	HA-6	...
29	...	45	640	295	NP	NP	427	NP	HA-6	G5
30	>5	45	655	310	NP	427	427	NP	NFN-12	G5, W5, W12
31	...	45	655	310	NP	427	427	343	NFN-12	...
32	...	45	655	310	NP	427	427	343	NFN-12	G5
33	...	45	655	310	NP	427	427	343	NFN-12	...
34	...	45	655	310	NP	427	427	343	NFN-12	G5
35	>5	45	655	310	NP	427	427	343	NFN-12	G14
36	>5	45	655	310	NP	427	427	343	NFN-12	G5, G14
37	>5	45	655	310	NP	427	427	343	NFN-12	G14
38	>5	45	655	310	NP	427	427	343	NFN-12	G5, G14
39	>5	45	655	310	NP	427	427	343	NFN-12	...
40	>5	45	655	310	NP	427	427	343	NFN-12	G5
41	>5	45	655	310	NP	427	427	343	NFN-12	...
42	>5	45	655	310	NP	427	427	343	NFN-12	G5
43	...	45	655	310	NP	427	427	343	NFN-12	...
44	...	45	655	310	NP	427	427	343	NFN-12	G5
45	>5	45	655	310	NP	427	427	343	NFN-12	G14

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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	...
2	129	129	129	129	129	129	129	129	129	129	128	127	125	122	121	119	117	...
3	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	...
4	110	110	110	110	110	110	110	110	110	109	109	108	106	104	103	101	98.9	...
5	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
6	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
7	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
8	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
9	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
10	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
11	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
12	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
13	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
14	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
15	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
16	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
17	138	138	138	138	138	137	135	134	134	133	132	129	127	124	122	120	118	116
18	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
19	117	117	117	117	117	116	115	115	114	113	112	110	108	106	104	102	100	98.6
20	183	178	166	158	152	...	142	...	136	...	132	130	128	126	124	122	121	...
21	183	183	182	177	172	...	165	...	160	...	156	155	154	152	151	150	148	...
22	183	178	166	158	152	...	142	...	136	...	132	130	128	126	124	122	121	...
23	183	183	182	177	172	...	165	...	160	...	156	155	154	152	151	150	148	...
24	156	151	141	134	129	...	121	...	116	...	112	111	109	107	105	104	103	...
25	156	156	155	150	146	...	140	...	136	...	133	132	131	129	128	128	126	...
26	156	151	141	134	129	...	121	...	116	...	112	111	109	107	105	104	103	...
27	156	156	155	150	146	...	140	...	136	...	133	132	131	129	128	128	126	...
28	183	178	166	158	152	...	142	...	136	...	132	130	128	126	124	122	121	...
29	183	183	182	177	172	...	165	...	160	...	156	155	154	152	151	150	148	...
30	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
31	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
32	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
33	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
34	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
35	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
36	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
37	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
38	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
39	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
40	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
41	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
42	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
43	187	185	179	172	164	157	152	147	143	139	136	133	130	128	126	124	122	...
44	187	187	186	182	177	173	170	167	165	163	161	160	159	158	157	156	155	...
45	159	157	152	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
6	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	...	...	...
7	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
8	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
9	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	...	...	...
10	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	...	...	...
11	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	...	...	...
12	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	...	...	...
13	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
14	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	...	...	...
15	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	...	...	...
16	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
17	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
18	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
19	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
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.
2	46Fe-24Ni-21Cr-6Mo-N	Smls. & wld. fittings	SB-366	...	N08367	Solution ann.
3	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
4	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
5	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
6	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
7	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
8	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
9	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
10	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
11	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.
12	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.
13	46Fe-24Ni-21Cr-6Mo-N	Castings	SA-351	CN3MN	J94651	Solution ann.
14	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SB-599	...	N08700	Solution ann.
15	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SB-599	...	N08700	Solution ann.
16	25Ni-47Fe-21Cr-5Mo	Bar, wire	SB-672	...	N08700	Solution ann.
17	32Ni-45Fe-20Cr-Cb	Castings	SA-351	CT15C	...	As cast
18	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08800	Annealed
19	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08800	Annealed
20	33Ni-42Fe-21Cr	Smls. & wld. fittings	SB-366	...	N08800	Annealed
21	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08800	Annealed
22	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08800	Annealed
23	33Ni-42Fe-21Cr	Bar	SB-408	...	N08800	Annealed
24	33Ni-42Fe-21Cr	Bar	SB-408	...	N08800	Annealed
25	33Ni-42Fe-21Cr	Plate	SB-409	...	N08800	Annealed
26	33Ni-42Fe-21Cr	Plate	SB-409	...	N08800	Annealed
27	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08800	Annealed
28	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08800	Annealed
29	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08800	Annealed
30	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08800	Annealed
31	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08800	Annealed
32	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08800	Annealed
33	32Ni-44Fe-21Cr	Smls. tube	SB-163	...	N08801	Ann./stabilized
34	32Ni-44Fe-21Cr	Smls. tube	SB-163	...	N08801	Ann./stabilized
35	32Ni-44Fe-21Cr	Smls. pipe & tube	SB-407	...	N08801	Ann./stabilized
36	32Ni-44Fe-21Cr	Smls. pipe & tube	SB-407	...	N08801	Ann./stabilized
37	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08810	Annealed
38	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08810	Annealed
39	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08810	Annealed
40	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08810	Hot fin./ann.
41	33Ni-42Fe-21Cr	Bar	SB-408	...	N08810	Annealed
42	33Ni-42Fe-21Cr	Bar	SB-408	...	N08810	Annealed
43	33Ni-42Fe-21Cr	Plate	SB-409	...	N08810	Annealed
44	33Ni-42Fe-21Cr	Plate	SB-409	...	N08810	Annealed
45	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08810	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	>5	45	655	310	NP	427	427	343	NFN-12	G5, G14
2	≤5	45	690	310	NP	427	427	NP	NFN-12	G5, W5, W12
3	≤5	45	690	310	NP	427	427	343	NFN-12	G14
4	≤5	45	690	310	NP	427	427	343	NFN-12	G5, G14
5	≤5	45	690	310	NP	427	427	343	NFN-12	G14
6	≤5	45	690	310	NP	427	427	343	NFN-12	G5, G14
7	≤5	45	690	310	NP	427	427	343	NFN-12	...
8	≤5	45	690	310	NP	427	427	343	NFN-12	G5
9	≤5	45	690	310	NP	427	427	343	NFN-12	...
10	≤5	45	690	310	NP	427	427	343	NFN-12	G5
11	≤5	45	690	310	NP	427	427	343	NFN-12	G14
12	≤5	45	690	310	NP	427	427	343	NFN-12	G5, G14
13	...	45	550	260	NP	427	427	343	NFN-12	G15
14	...	45	550	240	NP	NP	343	343	NFN-8	...
15	...	45	550	240	NP	NP	343	343	NFN-8	G5
16	...	45	550	240	NP	NP	343	343	NFN-8	...
17	...	45	435	170	NP	NP	871	343	NFN-9	G4, G15
18	...	45	515	205	NP	427	816	NP	NFN-8	G5, T14
19	...	45	515	205	NP	NP	816	NP	NFN-8	T15
20	...	45	515	205	NP	427	816	NP	NFN-8	G5, T14, W5, W12
21	...	45	515	205	816	427	816	NP	NFN-8	G5, T14
22	...	45	515	205	816	NP	816	NP	NFN-8	T15
23	...	45	515	205	816	427	816	NP	NFN-8	G5, T14
24	...	45	515	205	816	NP	816	NP	NFN-8	T15
25	...	45	515	205	816	427	816	NP	NFN-8	G5, T14
26	...	45	515	205	816	NP	816	NP	NFN-8	T15
27	...	45	515	205	NP	NP	816	NP	NFN-8	G14, T15
28	...	45	515	205	NP	NP	816	NP	NFN-8	G5, G14, T14
29	...	45	515	205	816	NP	816	NP	NFN-8	G5, G14, T14
30	...	45	515	205	816	NP	816	NP	NFN-8	G14, T15
31	...	45	515	205	816	427	816	NP	NFN-8	G5, T14
32	...	45	515	205	816	NP	816	NP	NFN-8	T15
33	...	45	450	170	566	NP	482	NP	NFN-9	H4
34	...	45	450	170	566	NP	482	NP	NFN-9	G5, H4
35	...	45	450	170	566	NP	482	NP	NFN-9	H4
36	...	45	450	170	566	NP	482	NP	NFN-9	G5, H4
37	...	45	450	170	NP	NP	899	NP	NFN-9	G4, T16
38	...	45	450	170	NP	427	899	NP	NFN-9	G4, G5, T15
39	...	45	450	170	816	NP	982	NP	NFN-9	G4, G30, T16
40	...	45	450	170	816	427	982	NP	NFN-9	G4, G5, G30, T15
41	...	45	450	170	816	NP	899	NP	NFN-9	G4, T16
42	...	45	450	170	816	427	899	NP	NFN-9	G4, G5, T15
43	...	45	450	170	816	NP	899	NP	NFN-9	G4, T16
44	...	45	450	170	816	427	899	NP	NFN-9	G4, G5, T15
45	...	45	450	170	NP	NP	899	NP	NFN-9	G4, G14, T16

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	159	159	159	155	150	147	144	142	140	138	137	136	135	134	134	132	131	...
2	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
3	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
4	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
5	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
6	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
7	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
8	197	197	197	192	186	181	178	176	173	171	170	168	167	166	165	164	163	...
9	197	189	179	171	164	157	152	147	143	139	136	133	130	128	126	124	122	...
10	197	197	197	192	186	181	178	176	173	171	170	168	167	166	165	164	163	...
11	168	160	151	145	139	134	130	125	121	118	115	113	110	109	107	106	104	...
12	168	168	167	163	158	155	152	150	148	146	144	143	142	141	141	139	138	...
13	158	154	146	138	129	123	117	113	110	106	104	102	101	99.9	99.2	98.0	96.7	...
14	158	152	143	137	131	126	123	120	118	117	116	112	108	...	...	...	...	...
15	158	158	158	157	156	154	152	150	149	148	148	148	148	...	...	...	...	...
16	158	152	143	137	131	126	123	120	118	117	116	112	108	...	...	...	...	...
17	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
18	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
19	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
20	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
21	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
22	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
23	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
24	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
25	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
26	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
27	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
28	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
29	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
30	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
31	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
32	138	132	127	124	123	121	119	117	116	115	113	112	111	109	108	107	106	104
33	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
34	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
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	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
38	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
39	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
40	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
41	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
42	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
43	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
44	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
45	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

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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	...
18	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
19	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	...	...	...
20	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
21	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
22	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	...	...	...
23	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
24	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	...	...	...
25	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
26	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	...	...	...
27	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	...	...	...
28	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	...	...	...
29	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	...	...	...
30	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	...	...	...
31	138	137	131	108	85.0	64.4	44.8	30.0	15.5	11.3	8.82	6.98	6.43	5.00	...	...	...
32	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	...	...	...
33	72.8	72.0	71.2	69.9	...	...	...	...	...	...	...	...	...	...	...	...	...
34	98.6	97.1	95.9	91.8	...	...	...	...	...	...	...	...	...	...	...	...	...
35	72.8	72.0	71.2	69.9	...	...	...	...	...	...	...	...	...	...	...	...	...
36	98.6	97.1	95.9	91.8	...	...	...	...	...	...	...	...	...	...	...	...	...
37	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
38	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
39	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
40	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
41	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
42	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
43	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
44	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
45	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

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08810	Annealed
2	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08810	Annealed
3	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08810	Annealed
4	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08810	Annealed
5	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08810	Annealed
6	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08811	Annealed
7	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08811	Annealed
8	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08811	Annealed
9	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08811	Annealed
10	33Ni-42Fe-21Cr	Bar	SB-408	...	N08811	Annealed
11	33Ni-42Fe-21Cr	Bar	SB-408	...	N08811	Annealed
12	33Ni-42Fe-21Cr	Plate	SB-409	...	N08811	Annealed
13	33Ni-42Fe-21Cr	Plate	SB-409	...	N08811	Annealed
14	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08811	Annealed
15	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08811	Annealed
16	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08811	Annealed
17	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08811	Annealed
18	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...	N08825	Annealed
19	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...	N08825	Annealed
20	42Ni-21.5Cr-3Mo-2.3Cu	Smls. & wld. fittings	SB-366	...	N08825	Annealed
21	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...	N08825	Cold worked/ann.
22	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...	N08825	Cold worked/ann.
23	42Ni-21.5Cr-3Mo-2.3Cu	Plate	SB-424	...	N08825	Annealed
24	42Ni-21.5Cr-3Mo-2.3Cu	Plate	SB-424	...	N08825	Annealed
25	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...	N08825	Annealed
26	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...	N08825	Annealed
27	42Ni-21.5Cr-3Mo-2.3Cu	Forgings	SB-564	...	N08825	Annealed
28	42Ni-21.5Cr-3Mo-2.3Cu	Forgings	SB-564	...	N08825	Annealed
29	42Ni-21.5Cr-3Mo-2.3Cu	Wld. tube	SB-704	...	N08825	Annealed
30	42Ni-21.5Cr-3Mo-2.3Cu	Wld. tube	SB-704	...	N08825	Annealed
31	42Ni-21.5Cr-3Mo-2.3Cu	Wld. pipe	SB-705	...	N08825	Annealed
32	42Ni-21.5Cr-3Mo-2.3Cu	Wld. pipe	SB-705	...	N08825	Annealed
33	44Fe-25Ni-21Cr-Mo	Forgings	SA-182	...	N08904	Annealed
34	44Fe-25Ni-21Cr-Mo	Smls. tube	SA-213	...	N08904	Annealed
35	44Fe-25Ni-21Cr-Mo	Plate, sheet, strip	SA-240	...	N08904	Annealed
36	44Fe-25Ni-21Cr-Mo	Wld. tube	SA-249	...	N08904	Annealed
37	44Fe-25Ni-21Cr-Mo	Smls. pipe	SA-312	...	N08904	Annealed
38	44Fe-25Ni-21Cr-Mo	Wld. pipe	SA-312	...	N08904	Annealed
39	44Fe-25Ni-21Cr-Mo	Fittings	SA-403	...	N08904	Annealed
40	44Fe-25Ni-21Cr-Mo	Bar	SA-479	...	N08904	Annealed
41	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SB-625	...	N08925	Annealed
42	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SB-625	...	N08925	Annealed
43	25Ni-20Cr-6Mo-Cu-N	Bar, wire	SB-649	...	N08925	Annealed
44	25Ni-20Cr-6Mo-Cu-N	Bar, wire	SB-649	...	N08925	Annealed
45	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SB-673	...	N08925	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	450	170	NP	NP	899	NP	NFN-9	G4, G5, G14, T15
2	...	45	450	170	816	NP	899	NP	NFN-9	G4, G14, T16
3	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, G14, T15
4	...	45	450	170	816	NP	899	NP	NFN-9	G4, T16
5	...	45	450	170	816	427	899	NP	NFN-9	G4, G5, T15
6	...	45	450	170	816	NP	899	NP	NFN-9	G4, T17
7	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, T15
8	...	45	450	170	816	NP	899	NP	NFN-9	G4, T17
9	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, T15
10	...	45	450	170	816	NP	899	NP	NFN-9	G4, T17
11	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, T15
12	...	45	450	170	816	NP	899	NP	NFN-9	G4, T17
13	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, T15
14	...	45	450	170	816	NP	899	NP	NFN-9	G4, G14, T17
15	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, G14, T16
16	...	45	450	170	816	NP	899	NP	NFN-9	G4, T17
17	...	45	450	170	816	NP	899	NP	NFN-9	G4, G5, T15
18	...	45	585	240	NP	427 (Cl. 3 only)	538	343	NFN-7	...
19	...	45	585	240	NP	427 (Cl. 3 only)	538	343	NFN-7	G5
20	...	45	585	240	NP	427 (Cl. 3 only)	538	343	NFN-7	G5, W5, W12
21	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	...
22	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	G5
23	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	...
24	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	G5
25	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	...
26	...	45	585	240	538	427 (Cl. 3 only)	538	343	NFN-7	G5
27	...	45	585	240	NP	NP	538	NP	NFN-7	...
28	...	45	585	240	NP	NP	538	NP	NFN-7	G5
29	...	45	585	240	NP	427	538	343	NFN-7	G14
30	...	45	585	240	NP	NP	538	343	NFN-7	G5, G14
31	...	45	585	240	NP	NP	538	343	NFN-7	G14
32	...	45	585	240	NP	NP	538	343	NFN-7	G5, G14
33	...	45	490	215	NP	371	371	343	NFN-9	W12
34	...	45	490	215	NP	371	371	343	NFN-9	...
35	...	45	490	215	NP	371	371	343	NFN-9	...
36	...	45	490	215	NP	371	371	343	NFN-9	G14
37	...	45	490	215	NP	371	371	343	NFN-9	...
38	...	45	490	215	NP	371	371	343	NFN-9	G14
39	...	45	490	215	NP	371	371	343	NFN-9	W12
40	...	45	490	215	NP	371	371	343	NFN-9	...
41	...	45	600	295	NP	NP	427	343	NFN-12	...
42	...	45	600	295	NP	NP	427	343	NFN-12	G5
43	...	45	600	295	NP	NP	427	343	NFN-12	...
44	...	45	600	295	NP	NP	427	343	NFN-12	G5
45	...	45	600	295	NP	NP	427	343	NFN-12	G14

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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
2	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
3	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
4	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
5	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
6	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
7	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
8	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
9	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
10	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
11	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
12	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
13	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
14	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
15	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
16	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
17	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104	102	100
18	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
19	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
20	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
21	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
22	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
23	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
24	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
25	161	154	146	143	140	137	134	131	129	126	124	122	120	119	119	117	117	117
26	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
27	160	151	146	...	139	...	133	...	128	...	123	...	120	119	118	117	116	116
28	160	160	160	...	160	...	160	...	160	...	160	...	160	160	159	158	157	156
29	137	131	125	122	119	117	114	112	110	108	106	104	102	101	101	100	99.4	98.8
30	137	137	137	137	137	137	137	137	137	137	137	137	137	136	136	135	135	134
31	137	131	125	122	119	117	114	112	110	108	106	104	102	101	101	100	99.4	98.8
32	137	137	137	137	137	137	137	137	137	137	137	137	137	136	136	135	135	134
33	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
34	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
35	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
36	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	...	...	...	...
37	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
38	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	...	...	...	...
39	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
40	140	126	113	108	104	99.9	95.8	92.1	88.8	85.9	83.4	81.3	79.6	78.4	...	...	...	...
41	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
42	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
43	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
44	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
45	145	141	135	129	125	120	117	113	109	106	103	101	99.3	99.3	99.3	99.3	99.3	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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
2	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
3	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
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	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
12	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
13	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
14	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
15	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
16	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
17	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
18	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	116	115	113	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	156	155	153	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	115	114	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	156	154	151	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	98.2	97.2	95.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	133	131	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	98.2	97.2	95.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	133	131	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SB-673	...	N08925	Annealed
2	25Ni-20Cr-6Mo-Cu-N	Wld. tube	SB-674	...	N08925	Annealed
3	25Ni-20Cr-6Mo-Cu-N	Wld. tube	SB-674	...	N08925	Annealed
4	25Ni-20Cr-6Mo-Cu-N	Smls. pipe & tube	SB-677	...	N08925	Annealed
5	25Ni-20Cr-6Mo-Cu-N	Smls. pipe & tube	SB-677	...	N08925	Annealed
6	62Ni-28Mo-5Fe	Plate	SB-333	...	N10001	Annealed
7	62Ni-28Mo-5Fe	Plate	SB-333	...	N10001	Annealed
8	62Ni-28Mo-5Fe	Smls. & wld. fittings	SB-366	...	N10001	Annealed
9	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...	N10001	Solution ann.
10	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...	N10001	Solution ann.
11	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...	N10001	Solution ann.
12	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...	N10001	Solution ann.
13	62Ni-28Mo-5Fe	Wld. tube	SB-626	...	N10001	Solution ann.
14	62Ni-28Mo-5Fe	Wld. tube	SB-626	...	N10001	Solution ann.
15	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
16	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
17	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
18	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
19	62Ni-28Mo-5Fe	Sheet, strip	SB-333	...	N10001	Annealed
20	62Ni-28Mo-5Fe	Sheet, strip	SB-333	...	N10001	Annealed
21	70Ni-16Mo-7Cr-5Fe	Smls. & wld. fittings	SB-366	...	N10003	Annealed
22	70Ni-16Mo-7Cr-5Fe	Plate, sheet, strip	SB-434	...	N10003	Annealed
23	70Ni-16Mo-7Cr-5Fe	Rod	SB-573	...	N10003	Annealed
24	62Ni-25Mo-8Cr-2Fe	Smls. & wld. fittings	SB-366	...	N10242	Annealed
25	62Ni-25Mo-8Cr-2Fe	Plate, sheet, strip	SB-434	...	N10242	Annealed
26	62Ni-25Mo-8Cr-2Fe	Plate, sheet, strip	SB-434	...	N10242	Annealed
27	62Ni-25Mo-8Cr-2Fe	Forgings	SB-564	...	N10242	Annealed
28	62Ni-25Mo-8Cr-2Fe	Forgings	SB-564	...	N10242	Annealed
29	62Ni-25Mo-8Cr-2Fe	Rod	SB-573	...	N10242	Annealed
30	62Ni-25Mo-8Cr-2Fe	Rod	SB-573	...	N10242	Annealed
31	62Ni-25Mo-8Cr-2Fe	Wld. pipe	SB-619	...	N10242	Solution ann.
32	62Ni-25Mo-8Cr-2Fe	Wld. pipe	SB-619	...	N10242	Solution ann.
33	62Ni-25Mo-8Cr-2Fe	Smls. pipe & tube	SB-622	...	N10242	Solution ann.
34	62Ni-25Mo-8Cr-2Fe	Smls. pipe & tube	SB-622	...	N10242	Solution ann.
35	62Ni-25Mo-8Cr-2Fe	Wld. tube	SB-626	...	N10242	Solution ann.
36	62Ni-25Mo-8Cr-2Fe	Wld. tube	SB-626	...	N10242	Solution ann.
37	54Ni-16Mo-15Cr	Smls. & wld. fittings	SB-366	...	N10276	Solution ann.
38	54Ni-16Mo-15Cr	Forgings	SB-462	...	N10276	Solution ann.
39	54Ni-16Mo-15Cr	Forgings	SB-462	...	N10276	Solution ann.
40	54Ni-16Mo-15Cr	Forgings	SB-564	...	N10276	Solution ann.
41	54Ni-16Mo-15Cr	Forgings	SB-564	...	N10276	Solution ann.
42	54Ni-16Mo-15Cr	Rod	SB-574	...	N10276	Solution ann.
43	54Ni-16Mo-15Cr	Rod	SB-574	...	N10276	Solution ann.
44	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...	N10276	Solution ann.
45	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...	N10276	Solution ann.

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	600	295	NP	NP	427	343	NFN-12	G5, G14
2	...	45	600	295	NP	NP	427	343	NFN-12	G14
3	...	45	600	295	NP	NP	427	343	NFN-12	G5, G14
4	...	45	600	295	NP	NP	427	343	NFN-12	...
5	...	45	600	295	NP	NP	427	343	NFN-12	G5
6	...	44	690	310	NP	427 (Cl. 3 only)	427	343	NFN-5	...
7	...	44	690	310	NP	427 (Cl. 3 only)	427	343	NFN-5	G5
8	...	44	690	310	NP	NP	427	343	NFN-5	G5, W12
9	...	44	690	310	NP	NP	427	343	NFN-5	G14
10	...	44	690	310	NP	NP	427	343	NFN-5	G5, G14
11	...	44	690	310	NP	NP	427	343	NFN-5	...
12	...	44	690	310	NP	NP	427	343	NFN-5	G5
13	...	44	690	310	NP	NP	427	343	NFN-5	G14
14	...	44	690	310	NP	NP	427	343	NFN-5	G5, G14
15	...	44	690	315	NP	427 (Cl. 3 only)	427	343	NFN-5	G13
16	...	44	690	315	NP	427 (Cl. 3 only)	427	343	NFN-5	G5, G13
17	...	44	795	315	NP	427 (Cl. 3 only)	427	343	NFN-5	G13
18	...	44	795	315	NP	427 (Cl. 3 only)	427	343	NFN-5	G5, G13
19	...	44	795	345	NP	427 (Cl. 3 only)	427	343	NFN-5	...
20	...	44	795	345	NP	427 (Cl. 3 only)	427	NP	NFN-5	G5
21	...	44	690	275	NP	NP	704	343	NFN-6	T15, W12
22	...	44	690	275	NP	NP	704	343	NFN-6	T15
23	...	44	690	275	NP	NP	704	343	NFN-6	T15
24	...	44	725	310	NP	NP	538	NP	NFN-6	G5, W12
25	...	44	725	310	NP	NP	538	NP	NFN-6	G5
26	...	44	725	310	NP	NP	538	NP	NFN-6	...
27	...	44	725	310	NP	NP	538	NP	NFN-6	G5
28	...	44	725	310	NP	NP	538	NP	NFN-6	...
29	...	44	725	310	NP	NP	538	NP	NFN-6	G5
30	...	44	725	310	NP	NP	538	NP	NFN-6	...
31	...	44	725	310	NP	NP	538	NP	NFN-6	G5, G14
32	...	44	725	310	NP	NP	538	NP	NFN-6	G14
33	...	44	725	310	NP	NP	538	NP	NFN-6	G5
34	...	44	725	310	NP	NP	538	NP	NFN-6	...
35	...	44	725	310	NP	NP	538	NP	NFN-6	G5, G14
36	...	44	725	310	NP	NP	538	NP	NFN-6	G14
37	...	43	690	285	538	427	677	343	NFN-10	G5, T14, W5, W12
38	...	43	690	285	NP	NP	677	NP	NFN-10	T15
39	...	43	690	285	NP	NP	677	NP	NFN-10	G5, T14
40	...	43	690	285	NP	NP	677	343	NFN-10	T15
41	...	43	690	285	NP	NP	677	343	NFN-10	G5, T14
42	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN-10	T15
43	...	43	690	285	538	427	677	343	NFN-10	G5, T14
44	...	43	690	285	538	427	677	343	NFN-10	G5, T14
45	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN-10	T15

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	145	145	145	143	141	138	135	132	130	129	127	125	123	122	120	117	115	...
2	145	141	135	129	125	120	117	113	109	106	103	101	99.3	99.3	99.3	99.3	99.3	...
3	145	145	145	143	141	138	135	132	130	129	127	125	123	122	120	117	115	...
4	172	166	158	152	147	142	137	133	128	124	121	118	117	117	117	117	117	...
5	172	172	171	168	165	162	159	156	153	151	149	147	145	143	141	139	137	...
6	197	193	186	181	177	173	170	167	164	162	160	158	157	155	154	152	151	...
7	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
8	197	197	197	197	197	196	194	193	192	192	191	191	190	189	188	188	187	...
9	168	164	158	154	150	147	145	142	140	138	136	134	133	131	130	130	129	...
10	168	168	168	168	168	166	165	164	164	163	162	162	161	161	160	159	159	...
11	197	193	186	181	177	173	170	167	164	162	160	158	157	155	154	152	151	...
12	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
13	168	164	158	154	150	147	145	142	140	138	136	134	133	131	130	130	129	...
14	168	168	168	168	168	166	165	164	164	163	162	162	161	161	160	159	159	...
15	197	195	191	186	181	177	174	171	168	166	164	162	160	158	157	156	155	...
16	197	197	197	197	197	196	194	193	192	192	191	191	189	189	188	188	187	...
17	212	201	190	185	181	177	174	171	168	166	164	162	160	158	157	156	155	...
18	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	210	209	...
19	227	217	207	201	197	193	189	186	183	180	178	176	174	172	171	170	168	...
20	227	227	227	227	227	225	223	222	221	220	220	219	218	217	216	216	215	...
21	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
22	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
23	184	177	168	162	156	151	146	142	139	136	134	133	131	130	129	127	125	122
24	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
25	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
26	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
27	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
28	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
29	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
30	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
31	176	176	176	176	176	176	176	176	176	176	175	175	174	174	173	173	173	173
32	176	171	164	158	153	149	145	143	141	139	139	139	138	137	136	134	132	129
33	207	207	207	207	207	207	207	207	207	207	206	206	205	205	204	204	203	203
34	207	201	193	186	180	175	171	168	166	164	164	163	162	161	160	158	155	152
35	176	176	176	176	176	176	176	176	176	176	175	175	174	174	173	173	173	173
36	176	171	164	158	153	149	145	143	141	139	139	139	138	137	136	134	132	129
37	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
38	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
39	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
40	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
41	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
42	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
43	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
44	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
45	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	118	113	107	96.7	80.4	59.2	40.7	30.9	25.2	17.9	...	...	...	...	...	...	...
22	118	113	108	97.8	80.7	60.7	40.8	33.5	25.7	17.4	...	...	...	...	...	...	...
23	118	113	108	97.8	80.7	60.7	40.8	33.5	25.7	17.4	...	...	...	...	...	...	...
24	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	172	171	171	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	128	127	127	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	202	201	201	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	150	149	149	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	172	171	171	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	128	127	127	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
38	115	114	114	112	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
39	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
40	115	114	114	112	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
41	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
42	115	114	114	112	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
43	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
44	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
45	115	114	114	112	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.
2	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.
3	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.
4	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.
5	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...	N10276	Solution ann.
6	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...	N10276	Solution ann.
7	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
8	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
9	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
10	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
11	62Ni-22Mo-15Cr	Smls. & wld. fittings	SB-366	...	N10362	Solution ann.
12	62Ni-22Mo-15Cr	Forgings	SB-462	...	N10362	Solution ann.
13	62Ni-22Mo-15Cr	Forgings	SB-462	...	N10362	Solution ann.
14	62Ni-22Mo-15Cr	Forgings	SB-564	...	N10362	Solution ann.
15	62Ni-22Mo-15Cr	Forgings	SB-564	...	N10362	Solution ann.
16	62Ni-22Mo-15Cr	Rod	SB-574	...	N10362	Solution ann.
17	62Ni-22Mo-15Cr	Rod	SB-574	...	N10362	Solution ann.
18	62Ni-22Mo-15Cr	Plate, sheet, strip	SB-575	...	N10362	Solution ann.
19	62Ni-22Mo-15Cr	Plate, sheet, strip	SB-575	...	N10362	Solution ann.
20	62Ni-22Mo-15Cr	Wld. pipe	SB-619	...	N10362	Solution ann.
21	62Ni-22Mo-15Cr	Wld. pipe	SB-619	...	N10362	Solution ann.
22	62Ni-22Mo-15Cr	Smls. pipe & tube	SB-622	...	N10362	Solution ann.
23	62Ni-22Mo-15Cr	Smls. pipe & tube	SB-622	...	N10362	Solution ann.
24	62Ni-22Mo-15Cr	Wld. tube	SB-626	...	N10362	Solution ann.
25	62Ni-22Mo-15Cr	Wld. tube	SB-626	...	N10362	Solution ann.
26	Ni-28Mo-3Fe-1.3Cr-0.25Al	Plate, sheet, strip	SB-333	...	N10629	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	Rod	SB-335	...	N10629	Solution ann.
30	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. & wld. fittings	SB-366	...	N10629	Solution ann.
31	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forged fittings	SB-462	...	N10629	Solution ann.
32	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forged fittings	SB-462	...	N10629	Solution ann.
33	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forgings	SB-564	...	N10629	Solution ann.
34	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forgings	SB-564	...	N10629	Solution ann.
35	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. pipe	SB-619	...	N10629	Solution ann.
36	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. pipe	SB-619	...	N10629	Solution ann.
37	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. pipe & tube	SB-622	...	N10629	Solution ann.
38	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. pipe & tube	SB-622	...	N10629	Solution ann.
39	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. tube	SB-626	...	N10629	Solution ann.
40	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. tube	SB-626	...	N10629	Solution ann.
41	65Ni-28Mo-2Fe	Smls. & wld. fittings	SB-366	...	N10665	Annealed
42	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Annealed
43	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Annealed
44	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Annealed
45	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN-10	W5
2	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN-10	G5, W5
3	...	43	690	285	538	427	677	343	NFN-10	G5, G14, T14, W6
4	...	43	690	285	538	NP	677	343	NFN-10	G14, T15
5	...	43	690	285	538	427	677	343	NFN-10	G5, T14
6	...	43	690	285	538	427 (Cl. 3 only)	677	343	NFN-10	T15
7	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN-10	W5
8	...	43	690	285	NP	427 (Cl. 3 only)	NP	NP	NFN-10	G5, W5
9	...	43	690	285	538	427	677	343	NFN-10	G5, G14, T14, W6
10	...	43	690	285	538	NP	677	343	NFN-10	G14, T15
11	...	43	725	310	NP	NP	427	NP	NFN-10	G5, W12
12	...	43	725	310	NP	NP	427	NP	NFN-10	...
13	...	43	725	310	NP	NP	427	NP	NFN-10	G5
14	...	43	725	310	NP	NP	427	NP	NFN-10	...
15	...	43	725	310	NP	NP	427	NP	NFN-10	G5
16	...	43	725	310	NP	NP	427	NP	NFN-10	...
17	...	43	725	310	NP	NP	427	NP	NFN-10	G5
18	...	43	725	310	NP	NP	427	NP	NFN-10	...
19	...	43	725	310	NP	NP	427	NP	NFN-10	G5
20	...	43	725	310	NP	NP	427	NP	NFN-10	G14
21	...	43	725	310	NP	NP	427	NP	NFN-10	G5, G14
22	...	43	725	310	NP	NP	427	NP	NFN-10	...
23	...	43	725	310	NP	NP	427	NP	NFN-10	G5
24	...	43	725	310	NP	NP	427	NP	NFN-10	G14
25	...	43	725	310	NP	NP	427	NP	NFN-10	G5, G14
26	...	44	760	350	NP	NP	427	NP	NFN-16	G5
27	...	44	760	350	NP	NP	427	NP	NFN-16	...
28	...	44	760	350	NP	NP	427	NP	NFN-16	G5
29	...	44	760	350	NP	NP	427	NP	NFN-16	...
30	...	44	760	350	NP	NP	427	NP	NFN-16	G5, W12
31	...	44	760	350	NP	NP	427	NP	NFN-16	G5
32	...	44	760	350	NP	NP	427	NP	NFN-16	...
33	...	44	760	350	NP	NP	427	NP	NFN-16	G5
34	...	44	760	350	NP	NP	427	NP	NFN-16	...
35	...	44	760	350	NP	NP	427	NP	NFN-16	G5, G14
36	...	44	760	350	NP	NP	427	NP	NFN-16	G14
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	427 (Cl. 3 only)	427	NP	NFN-16	G5, G14, W5
40	...	44	760	350	NP	NP	427	NP	NFN-16	G14
41	...	44	760	350	NP	NP	427	343	NFN-16	G5, W12
42	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN-16	G5, W5
43	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN-16	W5
44	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN-16	G5, W5
45	...	44	760	350	NP	427 (Cl. 3 only)	NP	NP	NFN-16	W5

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	...
2	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	...
3	160	160	160	160	160	160	160	160	158	155	151	147	143	140	138	135	134	133
4	160	152	144	139	135	130	126	121	118	115	111	109	106	104	102	100	98.8	98.1
5	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	156
6	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	115
7	188	180	170	164	158	153	148	143	139	135	131	128	125	122	120	118	117	...
8	188	188	188	188	188	188	188	188	187	183	177	172	169	165	162	159	157	...
9	160	160	160	160	160	160	160	160	158	155	151	147	143	140	138	135	134	133
10	160	152	144	139	135	130	126	121	118	115	111	109	106	104	102	100	98.8	98.1
11	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
12	207	193	182	175	169	163	157	153	149	146	143	141	139	138	136	135	134	...
13	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
14	207	193	182	175	169	163	157	153	149	146	143	141	139	138	136	135	134	...
15	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
16	207	193	182	175	169	163	157	153	149	146	143	141	139	138	136	135	134	...
17	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
18	207	193	182	175	169	163	157	153	149	146	143	141	139	138	136	135	134	...
19	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
20	176	164	155	149	144	139	133	130	127	124	122	120	118	117	116	115	114	...
21	176	176	176	176	176	176	173	172	169	167	164	162	160	158	156	155	153	...
22	207	193	182	175	169	163	157	153	149	146	143	141	139	138	136	135	134	...
23	207	207	207	207	207	207	204	202	199	197	193	190	188	186	184	182	180	...
24	176	164	155	149	144	139	133	130	127	124	122	120	118	117	116	115	114	...
25	176	176	176	176	176	176	173	172	169	167	164	162	160	158	156	155	153	...
26	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
27	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
28	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
29	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
30	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
31	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
32	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
33	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
34	216	216	216	211	204	198	194	191	187	184	181	179	177	176	174	173	172	...
35	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
36	184	184	184	179	174	169	165	162	160	157	154	152	151	149	148	147	146	...
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	216	216	216	215	214	213	212	211	210	...
42	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
43	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
44	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
45	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	131	131	124	100	84.6	69.5	56.7	46.2	35.7	...	...	...	...	...	...	...	...
4	97.5	96.7	96.5	95.2	84.6	69.5	56.7	46.2	35.7	...	...	...	...	...	...	...	...
5	155	154	145	118	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
6	115	114	114	112	99.1	81.6	67.0	54.6	42.2	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	131	131	124	100	84.6	69.5	56.7	46.2	35.7	...	...	...	...	...	...	...	...
10	97.5	96.7	96.5	95.2	84.6	69.5	56.7	46.2	35.7	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Plate, sheet, strip	SB-333	...	N10665	Solution ann.
2	65Ni-28Mo-2Fe	Plate, sheet, strip	SB-333	...	N10665	Solution ann.
3	65Ni-28Mo-2Fe	Rod	SB-335	...	N10665	Solution ann.
4	65Ni-28Mo-2Fe	Rod	SB-335	...	N10665	Solution ann.
5	65Ni-28Mo-2Fe	Forgings	SB-462	...	N10665	Solution ann.
6	65Ni-28Mo-2Fe	Forgings	SB-462	...	N10665	Solution ann.
7	65Ni-28Mo-2Fe	Forgings	SB-564	...	N10665	Solution ann.
8	65Ni-28Mo-2Fe	Forgings	SB-564	...	N10665	Solution ann.
9	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Solution ann.
10	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Solution ann.
11	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...	N10665	Solution ann.
12	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...	N10665	Solution ann.
13	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Solution ann.
14	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Solution ann.
15	65Ni-29.5Mo-2Fe-2Cr	Plate, sheet, strip	SB-333	...	N10675	Solution ann.
16	65Ni-29.5Mo-2Fe-2Cr	Plate, sheet, strip	SB-333	...	N10675	Solution ann.
17	65Ni-29.5Mo-2Fe-2Cr	Rod	SB-335	...	N10675	Solution ann.
18	65Ni-29.5Mo-2Fe-2Cr	Rod	SB-335	...	N10675	Solution ann.
19	65Ni-29.5Mo-2Fe-2Cr	Smls. & wld. fittings	SB-366	...	N10675	Solution ann.
20	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-462	...	N10675	Solution ann.
21	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-462	...	N10675	Solution ann.
22	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-564	...	N10675	Solution ann.
23	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-564	...	N10675	Solution ann.
24	65Ni-29.5Mo-2Fe-2Cr	Wld. pipe	SB-619	...	N10675	Solution ann.
25	65Ni-29.5Mo-2Fe-2Cr	Wld. pipe	SB-619	...	N10675	Solution ann.
26	65Ni-29.5Mo-2Fe-2Cr	Smls. pipe & tube	SB-622	...	N10675	Solution ann.
27	65Ni-29.5Mo-2Fe-2Cr	Smls. pipe & tube	SB-622	...	N10675	Solution ann.
28	65Ni-29.5Mo-2Fe-2Cr	Wld. tube	SB-626	...	N10675	Solution ann.
29	65Ni-29.5Mo-2Fe-2Cr	Wld. tube	SB-626	...	N10675	Solution ann.
30	37Ni-30Co-28Cr-2.7Si	Smls. & wld. fittings	SB-366	...	N12160	Solution ann.
31	37Ni-30Co-28Cr-2.7Si	Plate, sheet, strip	SB-435	...	N12160	Solution ann.
32	37Ni-30Co-28Cr-2.7Si	Plate, sheet, strip	SB-435	...	N12160	Solution ann.
33	37Ni-30Co-28Cr-2.7Si	Forgings	SB-564	...	N12160	Solution ann.
34	37Ni-30Co-28Cr-2.7Si	Forgings	SB-564	...	N12160	Solution ann.
35	37Ni-30Co-28Cr-2.7Si	Rod	SB-572	...	N12160	Solution ann.
36	37Ni-30Co-28Cr-2.7Si	Rod	SB-572	...	N12160	Solution ann.
37	37Ni-30Co-28Cr-2.7Si	Wld. pipe	SB-619	...	N12160	Solution ann.
38	37Ni-30Co-28Cr-2.7Si	Wld. pipe	SB-619	...	N12160	Solution ann.
39	37Ni-30Co-28Cr-2.7Si	Smls. pipe & tube	SB-622	...	N12160	Solution ann.
40	37Ni-30Co-28Cr-2.7Si	Smls. pipe & tube	SB-622	...	N12160	Solution ann.
41	37Ni-30Co-28Cr-2.7Si	Wld. tube	SB-626	...	N12160	Solution ann.
42	37Ni-30Co-28Cr-2.7Si	Wld. tube	SB-626	...	N12160	Solution ann.
43	59Ni-22Cr-14Mo-4Fe-3W	Castings	SA-494	CX2MW	N26022	Solution ann.
44	53Ni-17Mo-16Cr-6Fe-5W	Castings	SA-494	CW-12MW/C	N30002	Annealed
45	62Ni-28Mo-5Fe	Castings	SA-494	N-12MV/B	N30012	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN-16	...
2	...	44	760	350	NP	427 (Cl. 3 only)	427	NP	NFN-16	G5
3	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN-16	G13
4	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN-16	G5, G13
5	...	44	760	350	NP	NP	427	NP	NFN-16	...
6	...	44	760	350	NP	NP	427	NP	NFN-16	G5
7	...	44	760	350	NP	NP	427	NP	NFN-16	...
8	...	44	760	350	NP	NP	427	NP	NFN-16	G5
9	...	44	760	350	NP	NP	427	343	NFN-16	G14
10	...	44	760	350	NP	NP	427	343	NFN-16	G5, G14
11	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN-16	...
12	...	44	760	350	NP	427 (Cl. 3 only)	427	343	NFN-16	G5
13	...	44	760	350	NP	NP	427	343	NFN-16	G5, G14
14	...	44	760	350	NP	NP	427	343	NFN-16	G14
15	...	44	760	350	NP	NP	427	343	NFN-16	G5
16	...	44	760	350	NP	NP	427	343	NFN-16	...
17	...	44	760	350	NP	NP	427	343	NFN-16	G5
18	...	44	760	350	NP	NP	427	343	NFN-16	...
19	...	44	760	350	NP	NP	427	343	NFN-16	G5, W12
20	...	44	760	350	NP	NP	427	NP	NFN-16	G5
21	...	44	760	350	NP	NP	427	NP	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, G14
25	...	44	760	350	NP	NP	427	343	NFN-16	G14
26	...	44	760	350	NP	NP	427	343	NFN-16	G5
27	...	44	760	350	NP	NP	427	343	NFN-16	...
28	...	44	760	350	NP	NP	427	343	NFN-16	G5, G14
29	...	44	760	350	NP	NP	427	343	NFN-16	G14
30	...	46	620	240	NP	NP	816	NP	NFN-13	G5, T14, W12
31	...	46	620	240	NP	NP	816	NP	NFN-13	T14
32	...	46	620	240	NP	NP	816	NP	NFN-13	G5, T14
33	...	46	620	240	NP	NP	816	NP	NFN-13	T14
34	...	46	620	240	NP	NP	816	NP	NFN-13	G5, T14
35	...	46	620	240	NP	NP	816	NP	NFN-13	T14
36	...	46	620	240	NP	NP	816	NP	NFN-13	G5, T14
37	...	46	620	240	NP	NP	816	NP	NFN-13	G14, T14
38	...	46	620	240	NP	NP	816	NP	NFN-13	G5, G14, T14
39	...	46	620	240	NP	NP	816	NP	NFN-13	T14
40	...	46	620	240	NP	NP	816	NP	NFN-13	G5, T14
41	...	46	620	240	NP	NP	816	NP	NFN-13	G14, T14
42	...	46	620	240	NP	NP	816	NP	NFN-13	G5, G14, T14
43	...	43	550	310	NP	NP	260	260	NFN-10	G15
44	...	...	495	275	NP	NP	538	343	NFN-10	G15, W1
45	...	...	525	275	NP	NP	538	343	NFN-10	G15, W1

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
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	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
7	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
8	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
9	184	184	184	181	177	173	170	167	164	162	160	159	157	156	154	151	149	...
10	184	184	184	184	184	184	184	184	184	184	183	182	182	181	180	179	179	...
11	216	216	216	213	208	204	200	196	193	191	189	187	185	183	181	178	176	...
12	216	216	216	216	216	216	216	216	216	216	216	215	214	213	212	211	210	...
13	184	184	184	184	184	184	184	184	184	184	183	182	182	181	180	179	179	...
14	184	184	184	181	177	173	170	167	164	162	160	159	157	156	154	151	149	...
15	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
16	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
17	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
18	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
19	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
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	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
25	184	184	184	181	178	174	170	166	163	160	156	153	150	149	147	146	144	...
26	216	216	216	216	216	216	216	216	215	213	212	210	209	208	207	206	205	...
27	216	216	216	213	209	204	199	195	191	187	183	180	177	175	173	171	169	...
28	184	184	184	184	184	184	184	184	183	181	180	179	178	177	176	175	174	...
29	184	184	184	181	178	174	170	166	163	160	156	153	150	149	147	146	144	...
30	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
31	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
32	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
33	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
34	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
35	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
36	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
37	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
38	137	137	137	137	136	135	131	126	121	117	113	111	108	108	108	108	108	108
39	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
40	161	161	161	161	161	159	154	148	142	137	133	130	128	127	126	126	126	126
41	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
42	137	137	137	137	136	135	131	126	121	117	113	111	108	108	108	108	108	108
43	158	156	152	150	149	148	148	148	148	148	...	...	...	...	...	...	...	...
44	142	138	133	130	128	128	128	127	126	122	118	117	117	117	117	117	117	115
45	150	143	140	140	140	140	140	140	140	138	132	127	126	124	122	119	118	115

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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	...	...	...
31	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	...	...	...
32	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	...	...	...
33	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	...	...	...
34	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	...	...	...
35	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	...	...	...
36	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	...	...	...
37	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	...	...	...
38	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	...	...	...
39	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	...	...	...
40	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	...	...	...
41	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	...	...	...
42	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	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	112	110	108	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	113	110	107	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. & wld. fittings	SB-366	...	R20033	Solution ann.
2	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Forged fittings	SB-462	...	R20033	Solution ann.
3	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Forgings	SB-564	...	R20033	Solution ann.
4	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. pipe	SB-619	...	R20033	Solution ann.
5	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. pipe & tube	SB-622	...	R20033	Solution ann.
6	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Plate, sheet, strip	SB-625	...	R20033	Solution ann.
7	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. tube	SB-626	...	R20033	Solution ann.
8	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Rod	SB-649	...	R20033	Solution ann.
9	21Ni-30Fe-22Cr-18Co-3Mo-3W	Plate, sheet, strip	SB-435	...	R30556	Annealed
10	21Ni-30Fe-22Cr-18Co-3Mo-3W	Plate, sheet, strip	SB-435	...	R30556	Annealed
11	21Ni-30Fe-22Cr-18Co-3Mo-3W	Rod	SB-572	...	R30556	Annealed
12	21Ni-30Fe-22Cr-18Co-3Mo-3W	Rod	SB-572	...	R30556	Annealed
13	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. pipe	SB-619	...	R30556	Annealed
14	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. pipe	SB-619	...	R30556	Annealed
15	21Ni-30Fe-22Cr-18Co-3Mo-3W	Smls. pipe & tube	SB-622	...	R30556	Annealed
16	21Ni-30Fe-22Cr-18Co-3Mo-3W	Smls. pipe & tube	SB-622	...	R30556	Annealed
17	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. tube	SB-626	...	R30556	Annealed
18	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. tube	SB-626	...	R30556	Annealed
19	Co-26Cr-9Ni-5Mo-3Fe-2W	Rod	SB-815	...	R31233	Solution ann.
20	Co-26Cr-9Ni-5Mo-3Fe-2W	Plate, sheet, strip	SB-818	...	R31233	Solution ann.
21	Ti	Plate, sheet, strip	SB-265	1	R50250	Annealed
22	Ti	Smls. tube	SB-338	1	R50250	Annealed
23	Ti	Wld. tube	SB-338	1	R50250	Annealed
24	Ti	Bar, billet	SB-348	1	R50250	Annealed
25	Ti	Smls. & wld. fittings	SB-363	WPT1	R50250	Annealed
26	Ti	Forgings	SB-381	F-1	R50250	Annealed
27	Ti	Smls. pipe	SB-861	1	R50250	Annealed
28	Ti	Wld. pipe	SB-862	1	R50250	Annealed
29	Ti	Castings	SB-367	C-2	R50400	...
30	Ti	Plate, sheet, strip	SB-265	2	R50400	Annealed
31	Ti	Smls. tube	SB-338	2	R50400	Annealed
32	Ti	Wld. tube	SB-338	2	R50400	Annealed
33	Ti	Bar, billet	SB-348	2	R50400	Annealed
34	Ti	Smls. & wld. fittings	SB-363	WPT2	R50400	Annealed
35	Ti	Forgings	SB-381	F-2	R50400	Annealed
36	Ti	Smls. pipe	SB-861	2	R50400	Annealed
37	Ti	Wld. pipe	SB-862	2	R50400	Annealed
38	Ti	Plate, sheet, strip	SB-265	2H	R50400	Annealed
39	Ti	Smls. tube	SB-338	2H	R50400	Annealed
40	Ti	Wld. tube	SB-338	2H	R50400	Annealed
41	Ti	Bar, billet	SB-348	2H	R50400	Annealed
42	Ti	Smls. fittings	SB-363	WPT2H	R50400	Annealed
43	Ti	Wld. fittings	SB-363	WPT2HW	R50400	Annealed
44	Ti	Forgings	SB-381	F-2H	R50400	Annealed
45	Ti	Smls. pipe	SB-861	2H	R50400	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	45	750	380	NP	NP	427	NP	NFN-10	W12
2	...	45	750	380	NP	NP	427	NP	NFN-10	...
3	...	45	750	380	NP	NP	427	NP	NFN-10	...
4	...	45	750	380	NP	NP	427	NP	NFN-10	G14
5	...	45	750	380	NP	NP	427	NP	NFN-10	...
6	...	45	750	380	NP	NP	427	NP	NFN-10	...
7	...	45	750	380	NP	NP	427	NP	NFN-10	G14
8	...	45	750	380	NP	NP	427	NP	NFN-10	...
9	...	45	690	310	NP	NP	899	343	NFN-15	G4, T17
10	...	45	690	310	NP	NP	899	343	NFN-15	G4, G5, T16
11	...	45	690	310	NP	NP	899	343	NFN-15	G4, T17
12	...	45	690	310	NP	NP	899	343	NFN-15	G4, G5, T16
13	...	45	690	310	NP	NP	899	343	NFN-15	G4, G14, T16
14	...	45	690	310	NP	NP	899	343	NFN-15	G4, G5, G14, T15
15	...	45	690	310	NP	NP	899	343	NFN-15	G4, T17
16	...	45	690	310	NP	NP	899	343	NFN-15	G4, G5, T16
17	...	45	690	310	NP	NP	899	343	NFN-15	G4, G14, T16
18	...	45	690	310	NP	NP	899	343	NFN-15	G4, G5, G14, T15
19	...	49	896	379	NP	NP	427	NP	NFN-15	G8
20	...	49	896	379	NP	NP	427	NP	NFN-15	G8
21	...	51	240	138	316	316	316	NP	NFT-3	...
22	...	51	240	138	316	316	316	NP	NFT-3	...
23	...	51	240	138	316	316	316	NP	NFT-3	G14, W6
24	...	51	240	138	316	316	316	NP	NFT-3	...
25	...	51	240	138	NP	316	316	NP	NFT-3	W5, W12
26	...	51	240	138	NP	316	316	NP	NFT-3	...
27	...	51	240	138	316	316	316	NP	NFT-3	...
28	...	51	240	138	316	316	316	NP	NFT-3	G14, W6
29	...	51	345	275	NP	NP	260	260	NFT-2	G15
30	...	51	345	275	316	316	316	316	NFT-2	...
31	...	51	345	275	316	316	316	316	NFT-2	...
32	...	51	345	275	316	316	316	316	NFT-2	G14, W6
33	...	51	345	275	316	316	316	316	NFT-2	...
34	...	51	345	275	NP	316	316	316	NFT-2	W5, W12
35	...	51	345	275	NP	316	316	316	NFT-2	...
36	...	51	345	275	316	316	316	316	NFT-2	...
37	...	51	345	275	316	316	316	316	NFT-2	G14, W6
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	G14, W6
41	...	51	400	275	NP	NP	316	NP	NFT-2	...
42	...	51	400	275	NP	NP	316	NP	NFT-2	...
43	...	51	400	275	NP	NP	316	NP	NFT-2	W12
44	...	51	400	275	NP	NP	316	NP	NFT-2	...
45	...	51	400	275	NP	NP	316	NP	NFT-2	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
2	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
3	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
4	182	182	180	173	164	158	154	150	147	143	140	138	137	135	134	133	131	...
5	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
6	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
7	182	182	180	173	164	158	154	150	147	143	140	138	137	135	134	133	131	...
8	214	214	212	204	193	186	181	177	173	168	164	162	161	159	158	156	154	...
9	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
10	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
11	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
12	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
13	168	159	148	141	135	130	125	122	119	116	114	112	111	109	108	107	106	105
14	168	168	167	166	164	161	159	157	156	155	153	151	149	147	145	144	143	142
15	197	187	174	166	159	153	148	143	140	137	135	132	130	129	127	126	124	123
16	197	197	197	195	193	190	187	185	183	181	180	178	176	173	172	170	168	167
17	168	159	148	141	135	130	125	122	119	116	114	112	111	109	108	107	106	105
18	168	168	167	166	164	161	159	157	156	155	153	151	149	147	145	144	143	142
19	236	235	218	...	196	...	177	...	163	...	154	151	148	146	144	142	139	...
20	236	235	218	...	196	...	177	...	163	...	154	151	148	146	144	142	139	...
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	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
23	58.6	54.6	47.0	42.8	38.4	35.3	32.9	28.6	25.8	23.3	21.4	19.2	...	...	...	...	...	...
24	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
25	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
26	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
27	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
28	58.6	54.6	47.0	42.8	38.4	35.3	32.9	28.6	25.8	23.3	21.4	19.2	...	...	...	...	...	...
29	98.6	90.5	79.4	72.8	66.6	61.7	56.7	52.2	48.3	44.7	...	...	...	...	...	...	...	...
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	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
32	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
33	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
34	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
35	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
36	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
37	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
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	96.9	93.5	82.6	75.9	70.1	65.1	60.7	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
41	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
42	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
43	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
44	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
45	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	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
10	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
11	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
12	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
13	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
14	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
15	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
16	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
17	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
18	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
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Ti	Wld. pipe	SB-862	2H	R50400	Annealed
2	Ti	Castings	SB-367	C-3	R50550	...
3	Ti	Plate, sheet, strip	SB-265	3	R50550	Annealed
4	Ti	Smls. tube	SB-338	3	R50550	Annealed
5	Ti	Wld. tube	SB-338	3	R50550	Annealed
6	Ti	Bar, billet	SB-348	3	R50550	Annealed
7	Ti	Smls. & wld. fittings	SB-363	WPT3	R50550	Annealed
8	Ti	Forgings	SB-381	F-3	R50550	Annealed
9	Ti	Smls. pipe	SB-861	3	R50550	Annealed
10	Ti	Wld. pipe	SB-862	3	R50550	Annealed
11	Ti-Pd	Plate, sheet, strip	SB-265	11	R52250	Annealed
12	Ti-Pd	Plate, sheet, strip	SB-265	17	R52252	Annealed
13	Ti-Ru	Plate, sheet, strip	SB-265	27	R52254	Annealed
14	Ti-Pd	Plate, sheet, strip	SB-265	7	R52400	Annealed
15	Ti-Pd	Smls. tube	SB-338	7	R52400	Annealed
16	Ti-Pd	Wld. tube	SB-338	7	R52400	Annealed
17	Ti-Pd	Bar, billet	SB-348	7	R52400	Annealed
18	Ti-Pd	Smls. fittings	SB-363	WPT7	R52400	Annealed
19	Ti-Pd	Wld. fittings	SB-363	WPT7W	R52400	Annealed
20	Ti-Pd	Castings	SB-367	C-7	R52400	Annealed
21	Ti-Pd	Forgings	SB-381	F-7	R52400	Annealed
22	Ti-Pd	Smls. pipe	SB-861	7	R52400	Annealed
23	Ti-Pd	Wld. pipe	SB-862	7	R52400	Annealed
24	Ti-0.15Pd	Plate, sheet, strip	SB-265	7H	R52400	Annealed
25	Ti-0.15Pd	Smls. tube	SB-338	7H	R52400	Annealed
26	Ti-0.15Pd	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-Pd	Plate, sheet, strip	SB-265	16	R52402	Annealed
34	Ti-Pd	Smls. tube	SB-338	16	R52402	Annealed
35	Ti-Pd	Wld. tube	SB-338	16	R52402	Annealed
36	Ti-Pd	Bar, billet	SB-348	16	R52402	Annealed
37	Ti-Pd	Forgings	SB-381	F-16	R52402	Annealed
38	Ti-0.05Pd	Plate, sheet, strip	SB-265	16H	R52402	Annealed
39	Ti-0.05Pd	Smls. tube	SB-338	16H	R52402	Annealed
40	Ti-0.05Pd	Wld. tube	SB-338	16H	R52402	Annealed
41	Ti-0.05Pd	Bar, billet	SB-348	16H	R52402	Annealed
42	Ti-0.05Pd	Smls. fittings	SB-363	WPT16H	R52402	Annealed
43	Ti-0.05Pd	Wld. fittings	SB-363	WPT16HW	R52402	Annealed
44	Ti-0.05Pd	Forgings	SB-381	F-16H	R52402	Annealed
45	Ti-0.05Pd	Smls. pipe	SB-861	16H	R52402	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	51	400	275	NP	NP	316	NP	NFT-2	W12
2	...	52	450	380	NP	NP	260	NP	NFT-1	G15
3	...	52	450	380	316	316	316	316	NFT-1	...
4	...	52	450	380	316	316	316	316	NFT-1	...
5	...	52	450	380	316	316	316	316	NFT-1	G14, W6
6	...	52	450	380	316	316	316	316	NFT-1	...
7	...	52	450	380	NP	316	316	316	NFT-1	W5, W12
8	...	52	450	380	NP	316	316	316	NFT-1	...
9	...	52	450	380	316	316	316	316	NFT-1	...
10	...	52	450	380	316	316	316	316	NFT-1	G14, W6
11	...	51	240	138	NP	NP	316	NP	NFT-3	...
12	...	51	240	138	NP	NP	316	NP	NFT-3	...
13	...	51	240	138	NP	NP	316	NP	NFT-3	...
14	...	51	345	275	NP	316	316	316	NFT-2	...
15	...	51	345	275	NP	316	316	316	NFT-2	...
16	...	51	345	275	NP	316	316	316	NFT-2	G14, W6
17	...	51	345	275	NP	316	316	316	NFT-2	...
18	...	51	345	275	NP	NP	316	316	NFT-2	...
19	...	51	345	275	NP	NP	316	316	NFT-2	G14
20	...	51	345	275	NP	NP	260	260	NFT-2	G15
21	...	51	345	275	NP	NP	316	316	NFT-2	...
22	...	51	345	275	NP	316	316	316	NFT-2	...
23	...	51	345	275	NP	316	316	316	NFT-2	G14, W6
24	...	51	400	275	NP	NP	316	NP	NFT-2	...
25	...	51	400	275	NP	NP	316	NP	NFT-2	...
26	...	51	400	275	NP	NP	316	NP	NFT-2	G14, W6
27	...	51	400	275	NP	NP	316	NP	NFT-2	...
28	...	51	400	275	NP	NP	316	NP	NFT-2	...
29	...	51	400	275	NP	NP	316	NP	NFT-2	W12
30	...	51	400	275	NP	NP	316	NP	NFT-2	...
31	...	51	400	275	NP	NP	316	NP	NFT-2	...
32	...	51	400	275	NP	NP	316	NP	NFT-2	W12
33	...	51	345	275	NP	NP	316	316	NFT-2	...
34	...	51	345	275	NP	NP	316	316	NFT-2	...
35	...	51	345	275	NP	NP	316	316	NFT-2	G14, W6
36	...	51	345	275	NP	NP	316	316	NFT-2	...
37	...	51	345	275	NP	NP	316	316	NFT-2	...
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	G14, W6
41	...	51	400	275	NP	NP	316	NP	NFT-2	...
42	...	51	400	275	NP	NP	316	NP	NFT-2	...
43	...	51	400	275	NP	NP	316	NP	NFT-2	W12
44	...	51	400	275	NP	NP	316	NP	NFT-2	...
45	...	51	400	275	NP	NP	316	NP	NFT-2	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	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	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	...	...	...	...	...	...	...	...
3	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
4	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
5	109	103	90.1	82.2	74.1	67.3	61.7	56.0	51.2	47.6	44.9	42.5	...	...	...	...	...	...
6	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
7	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
8	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
9	128	121	106	96.5	87.9	79.8	72.3	65.8	60.4	56.2	52.9	49.9	...	...	...	...	...	...
10	109	103	90.1	82.2	74.1	67.3	61.7	56.0	51.2	47.6	44.9	42.5	...	...	...	...	...	...
11	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
12	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
13	68.9	64.2	55.6	50.2	45.3	41.6	38.4	33.9	30.3	27.4	25.2	23.4	...	...	...	...	...	...
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	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
16	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
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	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
19	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
20	98.6	90.5	79.4	72.8	66.6	61.7	56.7	52.2	48.3	44.7	...	...	...	...	...	...	...	...
21	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
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	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
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	96.9	93.5	82.6	75.9	70.1	65.1	60.7	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
27	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
28	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
29	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
30	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
31	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
32	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
33	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
34	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
35	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
36	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
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	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	97.1	93.4	82.6	75.9	70.1	65.1	60.8	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
41	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
42	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
43	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
44	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
45	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Ti-0.05Pd	Wld. pipe	SB-862	16H	R52402	Annealed
2	Ti-Ru	Plate, sheet, strip	SB-265	26	R52404	Annealed
3	Ti-Ru	Smls. tube	SB-338	26	R52404	Annealed
4	Ti-Ru	Wld. tube	SB-338	26	R52404	Annealed
5	Ti-Ru	Bar, billet	SB-348	26	R52404	Annealed
6	Ti-Ru	Smls. fittings	SB-363	WPT26	R52404	Annealed
7	Ti-Ru	Wld. fittings	SB-363	WPT26W	R52404	Annealed
8	Ti-Ru	Forgings	SB-381	F-26	R52404	Annealed
9	Ti-Ru	Smls. pipe	SB-861	26	R52404	Annealed
10	Ti-Ru	Wld. pipe	SB-862	26	R52404	Annealed
11	Ti-0.10Ru	Plate, sheet, strip	SB-265	26H	R52404	Annealed
12	Ti-0.10Ru	Smls. tube	SB-338	26H	R52404	Annealed
13	Ti-0.10Ru	Wld. tube	SB-338	26H	R52404	Annealed
14	Ti-0.10Ru	Bar, billet	SB-348	26H	R52404	Annealed
15	Ti-0.10Ru	Smls. fittings	SB-363	WPT26H	R52404	Annealed
16	Ti-0.10Ru	Wld. fittings	SB-363	WPT26HW	R52404	Annealed
17	Ti-0.10Ru	Forgings	SB-381	F-26H	R52404	Annealed
18	Ti-0.10Ru	Smls. pipe	SB-861	26H	R52404	Annealed
19	Ti-0.10Ru	Wld. pipe	SB-862	26H	R52404	Annealed
20	Ti-0.3Mo-0.8Ni	Plate, sheet, strip	SB-265	12	R53400	Annealed
21	Ti-0.3Mo-0.8Ni	Smls. tube	SB-338	12	R53400	Annealed
22	Ti-0.3Mo-0.8Ni	Wld. tube	SB-338	12	R53400	Annealed
23	Ti-0.3Mo-0.8Ni	Bar, billet	SB-348	12	R53400	Annealed
24	Ti-0.3Mo-0.8Ni	Smls. fittings	SB-363	WPT12	R53400	Annealed
25	Ti-0.3Mo-0.8Ni	Wld. fittings	SB-363	WPT12W	R53400	Annealed
26	Ti-0.3Mo-0.8Ni	Forgings	SB-381	F-12	R53400	Annealed
27	Ti-0.3Mo-0.8Ni	Smls. pipe	SB-861	12	R53400	Annealed
28	Ti-0.3Mo-0.8Ni	Wld. pipe	SB-862	12	R53400	Annealed
29	Ti-4Al-2.5V-1.5Fe	Plate, sheet, strip	SB-265	38	R54250	Annealed
30	Ti-4Al-2.5V-1.5Fe	Smls. tube	SB-338	38	R54250	Annealed
31	Ti-4Al-2.5V-1.5Fe	Wld. tube	SB-338	38	R54250	Annealed
32	Ti-4Al-2.5V-1.5Fe	Bar, billet	SB-348	38	R54250	Annealed
33	Ti-4Al-2.5V-1.5Fe	Smls. fittings	SB-363	WPT38	R54250	Annealed
34	Ti-4Al-2.5V-1.5Fe	Wld. fittings	SB-363	WPT38W	R54250	Annealed
35	Ti-4Al-2.5V-1.5Fe	Forgings	SB-381	F-38	R54250	Annealed
36	Ti-4Al-2.5V-1.5Fe	Smls. pipe	SB-861	38	R54250	Annealed
37	Ti-4Al-2.5V-1.5Fe	Wld. pipe	SB-862	38	R54250	Annealed
38	Ti-3Al-2.5V	Plate, sheet, strip	SB-265	9	R56320	Annealed
39	Ti-3Al-2.5V	Smls. tube	SB-338	9	R56320	Annealed
40	Ti-3Al-2.5V	Wld. tube	SB-338	9	R56320	Annealed
41	Ti-3Al-2.5V	Bar, billet	SB-348	9	R56320	Annealed
42	Ti-3Al-2.5V	Smls. fittings	SB-363	WPT9	R56320	Annealed
43	Ti-3Al-2.5V	Wld. fittings	SB-363	WPT9W	R56320	Annealed
44	Ti-3Al-2.5V	Forgings	SB-381	F-9	R56320	Annealed
45	Ti-3Al-2.5V	Smls. pipe	SB-861	9	R56320	Annealed

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	51	400	275	NP	NP	316	NP	NFT-2	W12
2	...	51	345	275	NP	NP	316	316	NFT-2	...
3	...	51	345	275	NP	NP	316	316	NFT-2	...
4	...	51	345	275	NP	NP	316	316	NFT-2	G14, W6
5	...	51	345	275	NP	NP	316	316	NFT-2	...
6	...	51	345	275	NP	NP	316	316	NFT-2	...
7	...	51	345	275	NP	NP	316	316	NFT-2	G14
8	...	51	345	275	NP	NP	316	316	NFT-2	...
9	...	51	345	275	NP	NP	316	316	NFT-2	...
10	...	51	345	275	NP	NP	316	316	NFT-2	G14, W6
11	...	51	400	275	NP	NP	316	NP	NFT-2	...
12	...	51	400	275	NP	NP	316	NP	NFT-2	...
13	...	51	400	275	NP	NP	316	NP	NFT-2	G14, W6
14	...	51	400	275	NP	NP	316	NP	NFT-2	...
15	...	51	400	275	NP	NP	316	NP	NFT-2	...
16	...	51	400	275	NP	NP	316	NP	NFT-2	W12
17	...	51	400	275	NP	NP	316	NP	NFT-2	...
18	...	51	400	275	NP	NP	316	NP	NFT-2	...
19	...	51	400	275	NP	NP	316	NP	NFT-2	W12
20	...	52	485	345	NP	NP	316	316	NFT-5	...
21	...	52	485	345	NP	NP	316	316	NFT-5	...
22	...	52	485	345	NP	NP	316	316	NFT-5	G14, W6
23	...	52	485	345	NP	NP	316	316	NFT-5	...
24	...	52	485	345	NP	NP	316	316	NFT-5	...
25	...	52	485	345	NP	NP	316	316	NFT-5	G14
26	...	52	485	345	NP	NP	316	316	NFT-5	...
27	...	52	485	345	NP	NP	316	316	NFT-5	...
28	...	52	485	345	NP	NP	316	316	NFT-5	G14, W6
29	...	54	895	794	NP	NP	349	NP	NFT-6	...
30	...	54	895	794	NP	NP	349	NP	NFT-6	...
31	...	54	895	794	NP	NP	349	NP	NFT-6	G14, W6
32	...	54	895	794	NP	NP	349	NP	NFT-6	...
33	...	54	895	794	NP	NP	349	NP	NFT-6	...
34	...	54	895	794	NP	NP	349	NP	NFT-6	G14, W6
35	...	54	895	794	NP	NP	349	NP	NFT-6	...
36	...	54	895	794	NP	NP	349	NP	NFT-6	...
37	...	54	895	794	NP	NP	349	NP	NFT-6	G14, W6
38	...	53	620	485	NP	316	316	316	NFT-4	...
39	...	53	620	485	NP	316	316	316	NFT-4	...
40	...	53	620	485	NP	316	316	316	NFT-4	G14, W6
41	...	53	620	485	NP	316	NP	NP	NFT-4	...
42	...	53	620	485	NP	316	NP	NP	NFT-4	...
43	...	53	620	485	NP	316	NP	NP	NFT-4	G14, W6
44	...	53	620	485	NP	316	NP	NP	NFT-4	...
45	...	53	620	485	NP	316	316	316	NFT-4	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	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	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
3	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
4	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
5	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
6	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
7	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
8	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
9	98.6	94.6	83.5	76.9	70.8	65.8	61.4	57.6	53.9	50.1	46.7	43.7	...	...	...	...	...	...
10	83.4	80.8	71.2	65.4	60.5	56.1	52.3	49.1	46.1	43.0	39.9	36.7	...	...	...	...	...	...
11	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
12	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
13	97.1	93.4	82.6	75.9	70.1	65.1	60.8	56.8	53.1	49.6	46.3	43.3	...	...	...	...	...	...
14	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
15	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
16	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
17	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
18	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
19	114	110	97.2	89.3	82.5	76.6	71.5	66.8	62.5	58.4	54.4	51.0	...	...	...	...	...	...
20	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
21	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
22	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
23	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
24	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
25	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
26	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
27	138	138	126	119	111	105	99.5	94.9	91.4	88.8	86.4	83.9	...	...	...	...	...	...
28	117	117	108	101	94.9	89.3	84.2	80.2	77.4	75.4	73.6	71.7	...	...	...	...	...	...
29	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
30	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
31	218	218	214	206	197	190	183	177	172	167	164	162	159	...	...	...	...	...
32	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
33	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
34	218	218	214	206	197	190	183	177	172	167	164	162	159	...	...	...	...	...
35	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
36	256	256	252	242	232	223	215	208	202	197	193	190	187	...	...	...	...	...
37	218	218	214	206	197	190	183	177	172	167	164	162	159	...	...	...	...	...
38	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
39	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
40	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
41	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
42	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
43	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
44	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
45	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	Ti-3Al-2.5V	Wld. pipe	SB-862	9	R56320	Annealed
2	Ti-3Al-2.5V-0.1Ru	Plate, sheet, strip	SB-265	28	R56323	Annealed
3	Ti-3Al-2.5V-0.1Ru	Smls. tube	SB-338	28	R56323	Annealed
4	Ti-3Al-2.5V-0.1Ru	Wld. tube	SB-338	28	R56323	Annealed
5	Ti-3Al-2.5V-0.1Ru	Bar, billet	SB-348	28	R56323	Annealed
6	Ti-3Al-2.5V-0.1Ru	Smls. fittings	SB-363	WPT28	R56323	Annealed
7	Ti-3Al-2.5V-0.1Ru	Wld. fittings	SB-363	WPT28W	R56323	Annealed
8	Ti-3Al-2.5V-0.1Ru	Forgings	SB-381	F-28	R56323	Annealed
9	Ti-3Al-2.5V-0.1Ru	Smls. pipe	SB-861	28	R56323	Annealed
10	Ti-3Al-2.5V-0.1Ru	Wld. pipe	SB-862	28	R56323	Annealed
11	99.2Zr	Forgings	SB-493	...	R60702	Annealed
12	99.2Zr	Smls. tube	SB-523	...	R60702	Annealed
13	99.2Zr	Wld. tube	SB-523	...	R60702	Annealed
14	99.2Zr	Bar, wire	SB-550	...	R60702	Annealed
15	99.2Zr	Plate, sheet, strip	SB-551	...	R60702	Annealed
16	99.2Zr	Smls. fittings	SB-653	PZ-2	R60702	Annealed
17	99.2Zr	Wld. fittings	SB-653	PZ-2W	R60702	Annealed
18	99.2Zr	Smls. & wld. pipe	SB-658	...	R60702	Annealed
19	99.2Zr	Castings	SB-752	702C	R61702	...
20	95.5Zr + 2.5Nb	Forgings	SB-493	...	R60705	Annealed
21	95.5Zr + 2.5Nb	Bar, wire	SB-550	...	R60705	Annealed
22	95.5Zr + 2.5Nb	Plate, sheet, strip	SB-551	...	R60705	Annealed
23	95.5Zr + 2.5Nb	Smls. & wld. pipe	SB-658	...	R60705	Annealed
24	95.5Zr + 2.5Nb	Castings	SB-752	705C	R61705	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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)				External Pressure Chart No.	Notes
					I	III	VIII-1	XII		
1	...	53	620	485	NP	316	316	316	NFT-4	G14, W6
2	...	53	620	485	NP	NP	316	NP	NFT-4	...
3	...	53	620	485	NP	NP	316	NP	NFT-4	...
4	...	53	620	485	NP	NP	316	NP	NFT-4	G14, W6
5	...	53	620	485	NP	NP	316	NP	NFT-4	...
6	...	53	620	485	NP	NP	316	NP	NFT-4	...
7	...	53	620	485	NP	NP	316	NP	NFT-4	G14, W6
8	...	53	620	485	NP	NP	316	NP	NFT-4	...
9	...	53	620	485	NP	NP	316	NP	NFT-4	...
10	...	53	620	485	NP	NP	316	NP	NFT-4	G14, W6
11	...	61	380	205	NP	204	371	NP	NFZ-1	...
12	...	61	380	205	NP	204	371	NP	NFZ-1	...
13	...	61	380	205	NP	204	371	NP	NFZ-1	G14, W6
14	...	61	380	205	NP	204	371	NP	NFZ-1	...
15	...	61	380	205	NP	NP	371	NP	NFZ-1	...
16	...	61	380	205	NP	NP	371	NP	NFZ-1	...
17	...	61	380	205	NP	NP	371	NP	NFZ-1	G14, W6
18	...	61	380	205	NP	NP	371	NP	NFZ-1	W12
19	...	61	380	276	NP	NP	316	NP	NFZ-1	G15
20	...	62	485	380	NP	NP	371	NP	NFZ-2	...
21	...	62	550	380	NP	NP	371	NP	NFZ-2	...
22	...	62	550	380	NP	NP	371	NP	NFZ-2	...
23	...	62	550	380	NP	NP	371	NP	NFZ-2	W12
24	...	62	483	345	NP	NP	316	NP	NFZ-1	G15

Table 1B (Cont'd)
Section I; Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
2	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
3	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
4	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
5	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
6	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
7	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
8	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
9	177	177	168	162	155	148	141	133	127	122	120	118	...	...	...	...	...	...
10	151	151	143	138	132	126	119	113	108	104	102	101	...	...	...	...	...	...
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	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	...	...	...	...
13	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	...	...	...	...
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	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	...	...	...	...
17	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	...	...	...	...
18	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	...	...	...	...
19	108	107	97.0	89.5	82.0	74.7	67.6	61.1	55.1	49.9	45.7	42.4	...	...	...	...	...	...
20	138	127	112	103	96.0	90.0	86.0	83.0	81.0	80.0	79.0	78.0	76.0	74.0	...	...	...	...
21	158	145	128	118	110	103	99.0	95.0	93.0	91.0	89.0	84.0	81.0	78.0	...	...	...	...
22	158	145	128	118	110	103	99.0	95.0	93.0	91.0	89.0	84.0	81.0	78.0	...	...	...	...
23	158	145	128	118	110	103	99.0	95.0	93.0	91.0	89.0	84.0	81.0	78.0	...	...	...	...
24	138	137	126	118	110	102	95.1	88.6	82.6	77.3	72.8	69.2	...	...	...	...	...	...

Table 1B (Cont'd)
Section I; Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 1B**GENERAL NOTES**

- (a) The following abbreviations are used: ann., annealed; cond., condenser; CW, cold worked; exch., exchanger; extr., extruded; fin., finished; fr., from; HW, Hot worked; 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) 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.
- (d) 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.
- (e) An alternative typeface is used for stress values obtained from time-dependent properties (see Notes T1 through T20).
- (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.

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 66²/₃% 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.
- G9 Use Figure NFC-6 up to and including 150°C. Use the 315°C curve of Figure 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 C37700 and 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 section 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.

NOTES TO TABLE 1B (CONT'D)**NOTES – GENERAL REQUIREMENTS (CONT'D)**

- 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.
- 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.
- G33 External pressure chart NFN-2 may be used for temperatures between 205°C and 315°C.
- G34 Alloy N06025 in the solution annealed condition is subject to severe loss of rupture ductility in the approximate temperature range of 650°C to 760°C.
- G35 For external pressure design, the maximum design temperature is limited to 650°C.
- G36 For Section I use, the *y* values (see Section I, PG-27.4.6) shall be as follows: for 566°C and below, 0.4; for 593°C, 0.5; and for 621°C and above, 0.7.
- (25) G37 The maximum allowable stress values for greater than 900°C are 4.0 MPa (925°C), 3.3 MPa (950°C), 2.7 MPa (975°C), and 2.2 MPa (1000°C). The maximum use temperature is 982°C; the value listed at 1000°C is provided for interpolation purposes only.
- (25) G38 The maximum allowable stress values for greater than 900°C are 3.4 MPa (925°C), 2.8 MPa (950°C), 2.3 MPa (975°C), and 1.9 MPa (1000°C). The maximum use temperature is 982°C; the value listed at 1000°C is provided for interpolation purposes only.
- G39 The maximum allowable stress value at 204°C is 29.6 MPa.
- G40 The maximum allowable stress value at 204°C is 17.9 MPa.
- G41 Allowable stress values listed are set equal to those of an annealed temper, as data were not provided to justify higher values.
- G42 Time-dependent values are based on creep testing of as-welded product.
- G43 The allowable stress value at 65°C shall be used at 66°C.
- G44 The maximum allowable stress values for greater than 900°C are 8.2 MPa (927°C), 6.5 MPa (954°C), and 4.3 MPa (982°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.
- T19 Allowable stresses for temperatures of 450°C and above are values obtained from time-dependent properties.
- T20 Allowable stresses for temperatures of 200°C and above are values obtained from time-dependent properties.
- T21 Allowable stresses for temperatures of 225°C and above are values obtained from time-dependent properties.
- T22 Allowable stresses for temperatures of 250°C and above are values obtained from time-dependent properties.

NOTES TO TABLE 1B (CONT'D)

NOTES – TIME-DEPENDENT PROPERTIES [See General Note (e)] (CONT'D)

T23 Allowable stresses for temperatures of 230°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 For Section VIII and XII applications, no welding is permitted.
- W9 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.
- W10 For welded and brazed constructions, stress values for the welded and annealed (W061) temper material shall be used.
- 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.

INTENTIONALLY LEFT BLANK

Table 2A
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Wld. pipe	SA-672	A45	K01700	...	...	1	1
4	Carbon steel	Wld. pipe	SA-53	E/A	K02504	...	...	1	1
5	Carbon steel	Smls. pipe	SA-53	S/A	K02504	...	...	1	1
6	Carbon steel	Smls. pipe	SA-106	A	K02501	...	...	1	1
7	Carbon steel	Bar, shapes	SA-675	50	...	...	...	1	1
8	Carbon steel	Plate	SA-285	B	K02200	...	≤50	1	1
9	Carbon steel	Wld. pipe	SA-672	A50	K02200	...	...	1	1
10	Carbon steel	Bar, shapes	SA-675	55	...	...	...	1	1
11	Carbon steel	Plate	SA-285	C	K02801	...	≤50	1	1
12	Carbon steel	Wld. pipe	SA-333	1	K03008	...	...	1	1
13	Carbon steel	Smls. pipe	SA-333	1	K03008	...	...	1	1
14	Carbon steel	Wld. tube	SA-334	1	K03008	...	...	1	1
15	Carbon steel	Smls. tube	SA-334	1	K03008	...	...	1	1
16	Carbon steel	Plate	SA-516	55	K01800	...	...	1	1
17	Carbon steel	Smls. pipe	SA-524	II	K02104	...	...	1	1
18	Carbon steel	Wld. pipe	SA-671	CA55	K02801	...	...	1	1
19	Carbon steel	Wld. pipe	SA-671	CE55	K02202	...	...	1	1
20	Carbon steel	Wld. pipe	SA-672	A55	K02801	...	...	1	1
21	Carbon steel	Wld. pipe	SA-672	B55	K02001	...	...	1	1
22	Carbon steel	Wld. pipe	SA-672	C55	K01800	...	...	1	1
23	Carbon steel	Wld. pipe	SA-672	E55	K02202	...	...	1	1
24	Carbon steel	Plate, bar, shapes	SA-36	...	K02600	...	...	1	1
25	Carbon steel	Plate	SA-662	A	K01701	...	...	1	1
26	Carbon steel	Forgings	SA-181	...	K03502	60	...	1	1
27	Carbon steel	Castings	SA-216	WCA	J02502	...	...	1	1
28	Carbon steel	Forgings	SA-266	1	K03506	...	...	1	1
29	Carbon steel	Forgings	SA-350	LF1	K03009	1	...	1	1
30	Carbon steel	Castings	SA-352	LCA	J02504	...	...	1	1
31	Carbon steel	Cast pipe	SA-660	WCA	J02504	...	...	1	1
32	Carbon steel	Bar, shapes	SA-675	60	...	...	...	1	1
33	Carbon steel	Forgings	SA-765	I	K03046	...	...	1	1
34	Carbon steel	Plate	SA-515	60	K02401	...	...	1	1
35	Carbon steel	Plate	SA-516	60	K02100	...	...	1	1
36	Carbon steel	Wld. pipe	SA-671	CB60	K02401	...	...	1	1
37	Carbon steel	Wld. pipe	SA-671	CC60	K02100	...	...	1	1
38	Carbon steel	Wld. pipe	SA-671	CE60	K02402	...	...	1	1
39	Carbon steel	Wld. pipe	SA-672	B60	K02401	...	...	1	1
40	Carbon steel	Wld. pipe	SA-672	C60	K02100	...	...	1	1
41	Carbon steel	Wld. pipe	SA-672	E60	K02402	...	...	1	1
42	Carbon steel	Plate	SA-283	D	K02702	...	...	1	1
43	Carbon steel	Wld. pipe	SA-53	E/B	K03005	...	...	1	1
44	Carbon steel	Smls. pipe	SA-53	S/B	K03005	...	...	1	1
45	Carbon steel	Smls. pipe	SA-106	B	K03006	...	...	1	1

Table 2A
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	310	155	NP	371	CS-6	...
2	310	165	371	371	CS-1	...
3	310	165	371	NP	CS-1	G1, G4
4	330	205	371 (SPT)	NP	CS-2	E2
5	330	205	371 (SPT)	NP	CS-2	E2
6	330	205	371	371	CS-2	E2
7	345	170	371 (SPT)	371	CS-1	...
8	345	185	371	371	CS-1	E2
9	345	185	371	NP	CS-1	E2, G1, G4
10	380	190	371 (SPT)	371	CS-1	...
11	380	205	371	371	CS-2	...
12	380	205	371	NP	CS-2	...
13	380	205	371	371	CS-2	...
14	380	205	371	NP	CS-2	...
15	380	205	371	371	CS-2	...
16	380	205	371	371	CS-2	...
17	380	205	NP	371	CS-2	...
18	380	205	371	NP	CS-2	G1, G4
19	380	205	371	NP	CS-2	G1, G4
20	380	205	371	NP	CS-2	G1, G4
21	380	205	371	NP	CS-2	G1, G4
22	380	205	371	NP	CS-2	G1, G4
23	380	205	371	NP	CS-2	G1, G4
24	400	250	371 (SPT)	371	CS-2	E2
25	400	275	NP	371	CS-2	E1
26	415	205	371	371	CS-2	...
27	415	205	371	371	CS-2	...
28	415	205	371	371	CS-2	...
29	415	205	371	371	CS-2	...
30	415	205	371	NP	CS-2	...
31	415	205	371	NP	CS-2	...
32	415	205	371 (SPT)	371	CS-2	...
33	415	205	NP	371	CS-2	...
34	415	220	371	371	CS-2	...
35	415	220	371	371	CS-2	...
36	415	220	371	NP	CS-2	G1, G4
37	415	220	371	NP	CS-2	G1, G4
38	415	220	371	NP	CS-2	G1, G4
39	415	220	371	NP	CS-2	G1, G4
40	415	220	371	NP	CS-2	G1, G4
41	415	220	371	NP	CS-2	G1, G4
42	415	230	NP	371	CS-2	E2
43	415	240	371 (SPT)	NP	CS-2	E2
44	415	240	371 (SPT)	NP	CS-2	E2
45	415	240	371	371	CS-2	E2

Table 2A
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	103	97.3	94.1	92.8	91.6	88.6	84.9	80.7	78.4	75.9	73.4	...	...	...	...	...
2	103	103	101	99.4	97.8	94.8	90.5	86.2	83.9	81.4	78.9	...	...	...	...	...
3	103	103	101	99.4	97.8	94.8	90.5	86.2	83.9	81.4	78.9	...	...	...	...	...
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	110	110	110	110	110	110	110	108	104	100	99.1	...	...	...	...	...
7	115	110	105	103	101	98.2	94.6	89.8	87.4	84.7	81.6	...	...	...	...	...
8	115	115	113	112	110	106	102	97.1	93.9	91.1	89.4	...	...	...	...	...
9	115	115	113	112	110	106	102	97.1	93.9	91.1	89.4	...	...	...	...	...
10	126	121	115	113	112	109	104	98.9	96.1	92.9	89.8	...	...	...	...	...
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	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
21	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
22	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
23	126	126	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
24	133	133	133	133	133	133	133	129	125	122	119	...	...	...	...	...
25	133	133	133	133	133	133	133	133	133	133	132	...	...	...	...	...
26	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
27	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
28	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
29	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
30	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
31	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
32	138	131	125	123	122	118	113	107	104	101	98.1	...	...	...	...	...
33	138	130	126	124	122	118	114	107	104	101	98.1	...	...	...	...	...
34	138	138	134	132	130	126	121	115	112	108	105	...	...	...	...	...
35	138	138	134	132	130	126	121	115	112	108	105	...	...	...	...	...
36	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
37	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
38	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
39	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
40	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
41	138	136	134	132	130	126	121	115	112	108	105	...	...	...	...	...
42	138	138	138	136	134	130	125	118	115	111	105	...	...	...	...	...
43	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
44	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
45	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Fittings	SA-234	WPB	K03006	...	...	1	1
2	Carbon steel	Wld. fittings	SA-234	WPB	K03006	W	...	1	1
3	Carbon steel	Wld. tube	SA-333	6	K03006	...	...	1	1
4	Carbon steel	Smls. pipe	SA-333	6	K03006	...	...	1	1
5	Carbon steel	Smls. & wld. tube	SA-334	6	K03006	...	...	1	1
6	Carbon steel	Forgings	SA-372	A	K03002	...	...	1	1
7	Carbon steel	Fittings	SA-420	WPL6	...	...	...	1	1
8	Carbon steel	Wld. fittings	SA-420	WPL6	...	WP-W	...	1	1
9	Carbon steel	Smls. pipe	SA-524	I	K02104	...	...	1	1
10	Carbon steel	Bar	SA-696	B	K03200	...	...	1	1
11	Carbon steel	Forgings	SA-727	...	K02506	...	...	1	1
12	Carbon steel	Wld. tube	SA-178	C	K03503	...	...	1	1
13	Carbon steel	Wld. tube	SA-178	C	K03503	...	...	1	1
14	Carbon steel	Smls. tube	SA-210	A-1	K02707	...	...	1	1
15	Carbon steel	Bar, shapes	SA-675	65	...	...	...	1	1
16	Carbon steel	Castings	SA-352	LCB	J03003	...	...	1	1
17	Carbon steel	Plate	SA-515	65	K02800	...	...	1	1
18	Carbon steel	Plate	SA-516	65	K02403	...	...	1	1
19	Carbon steel	Wld. pipe	SA-671	CB65	K02800	...	...	1	1
20	Carbon steel	Wld. pipe	SA-671	CC65	K02403	...	...	1	1
21	Carbon steel	Wld. pipe	SA-672	B65	K02800	...	...	1	1
22	Carbon steel	Wld. pipe	SA-672	C65	K02403	...	...	1	1
23	Carbon steel	Plate	SA-662	B	K02203	...	...	1	1
24	Carbon steel	Plate	SA-537	...	K12437	1	$65 < t \leq 100$	1	2
(25) 25	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	$35 < t \leq 160$	1	1
(25) 26	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	$t \leq 35$	1	1
27	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$150 < t \leq 250$	1	2
28	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$100 < t \leq 150$	1	2
29	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...	$65 < t \leq 100$	1	2
30	Carbon steel	Bar, shapes	SA-675	70	...	...	...	1	1
31	Carbon steel	Forgings	SA-105	...	K03504	...	...	1	2
32	Carbon steel	Forgings	SA-181	...	K03502	70	...	1	2
33	Carbon steel	Castings	SA-216	WCB	J03002	...	...	1	2
34	Carbon steel	Forgings	SA-266	2	K03506	...	...	1	2
35	Carbon steel	Forgings	SA-266	4	K03017	...	...	1	2
36	Carbon steel	Forgings	SA-350	LF2	K03011	...	...	1	2
37	Carbon steel	Forgings	SA-508	1	K13502	...	...	1	2
38	Carbon steel	Forgings	SA-508	1A	K13502	...	...	1	2
39	Carbon steel	Forgings	SA-541	1	K03506	...	...	1	2
40	Carbon steel	Forgings	SA-541	1A	K03020	...	...	1	2
41	Carbon steel	Cast pipe	SA-660	WCB	J03003	...	...	1	2
42	Carbon steel	Forgings	SA-765	II	K03047	...	...	1	2
43	Carbon steel	Plate	SA-515	70	K03101	...	...	1	2
44	Carbon steel	Plate	SA-516	70	K02700	...	...	1	2
45	Carbon steel	Wld. pipe	SA-671	CB70	K03101	...	...	1	2

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	415	240	371	371	CS-2	E2
2	415	240	371	NP	CS-2	E2
3	415	240	371	NP	CS-2	E2
4	415	240	371	371	CS-2	E2
5	415	240	371	NP	CS-2	E2
6	415	240	NP	343	CS-2	G19, H5
7	415	240	371	371	CS-2	E2
8	415	240	371	NP	CS-2	E2
9	415	240	NP	371	CS-2	E2
10	415	240	371	NP	CS-2	E2
11	415	250	371 (SPT)	371	CS-2	E2
12	415	255	371	NP	CS-2	E2
13	415	255	NP	371	CS-2	E2, G18
14	415	255	371	371	CS-2	E2
15	450	225	NP	371	CS-2	...
16	450	240	371	371	CS-2	...
17	450	240	371	371	CS-2	...
18	450	240	371	371	CS-2	...
19	450	240	371	NP	CS-2	G1, G4
20	450	240	371	NP	CS-2	G1, G4
21	450	240	371	NP	CS-2	G1, G4
22	450	240	371	NP	CS-2	G1, G4
23	450	275	NP	371	CS-2	E2
24	450	310	371	371	CS-2	E2
25	460	255	NP	371	CS-2	E2
26	460	280	NP	371	CS-2	E2
27	470	280	NP	371	CS-2	E2
28	480	295	NP	371	CS-2	E2
29	450	310	371	NP	CS-2	E2, G1, G2
30	485	240	NP	371	CS-2	...
31	485	250	371	371	CS-2	...
32	485	250	371	371	CS-2	...
33	485	250	371	371	CS-2	...
34	485	250	371	371	CS-2	...
35	485	250	NP	371	CS-2	...
36	485	250	371	371	CS-2	...
37	485	250	371	371	CS-2	...
38	485	250	371	371	CS-2	...
39	485	250	371	371	CS-2	...
40	485	250	371	371	CS-2	...
41	485	250	371	NP	CS-2	...
42	485	250	NP	371	CS-2	...
43	485	260	371	371	CS-2	...
44	485	260	371	371	CS-2	...
45	485	260	371	NP	CS-2	G1, G3

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
2	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
3	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
4	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
5	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
6	138	138	138	138	138	137	132	126	122	119	...	...	...	...	...	...
7	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
8	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
9	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
10	138	138	138	138	138	137	132	126	122	118	115	...	...	...	...	...
11	138	138	138	138	138	138	136	129	125	122	119	...	...	...	...	...
12	138	138	138	138	138	138	138	133	129	125	122	...	...	...	...	...
13	117	117	117	117	117	117	117	113	109	106	104	...	...	...	...	...
14	138	138	138	138	138	138	138	133	129	125	122	...	...	...	...	...
15	150	141	136	134	132	128	123	117	113	110	106	...	...	...	...	...
16	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...
17	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...
18	150	150	147	144	142	138	132	126	122	118	115	...	...	...	...	...
19	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...
20	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...
21	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...
22	150	149	147	145	142	138	132	126	122	118	115	...	...	...	...	...
23	150	150	150	150	150	150	150	144	139	136	132	...	...	...	...	...
24	150	150	150	150	150	150	150	150	148	140	134	...	...	...	...	...
25	153	153	153	151	149	145	139	132	128	124	120	101	83.8	66.8	50.3	33.2 (25)
26	153	153	153	153	153	153	153	145	141	136	132	101	83.8	66.8	50.3	33.2 (25)
27	157	157	157	157	157	157	154	146	141	137	123	101	83.8	66.8	50.3	33.2
28	160	160	160	160	160	160	160	153	149	144	123	101	83.8	66.8	50.3	33.2
29	150	150	150	150	150	150	150	150	148	140	134	...	...	...	...	...
30	161	151	147	144	142	138	132	126	122	118	115	...	...	...	...	...
31	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
32	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
33	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
34	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
35	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
36	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
37	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
38	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
39	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
40	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
41	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
42	161	156	151	148	146	142	136	129	125	122	118	...	...	...	...	...
43	161	161	160	157	154	149	143	136	132	129	124	...	...	...	...	...
44	161	161	160	157	154	149	143	136	132	129	124	...	...	...	...	...
45	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Wld. pipe	SA-671	CC70	K02700	...	...	1	2
2	Carbon steel	Wld. pipe	SA-672	B70	K03101	...	...	1	2
3	Carbon steel	Wld. pipe	SA-672	C70	K02700	...	...	1	2
4	Carbon steel	Smls. pipe	SA-106	C	K03501	...	...	1	2
5	Carbon steel	Smls. tube	SA-210	C	K03501	...	...	1	2
6	Carbon steel	Castings	SA-216	WCC	K02503	...	...	1	2
7	Carbon steel	Fittings	SA-234	WPC	K03501	...	...	1	2
8	Carbon steel	Wld. fittings	SA-234	WPC	K03501	W	...	1	2
9	Carbon steel	Castings	SA-352	LCC	J02505	...	...	1	2
10	Carbon steel	Castings	SA-487	16	...	A	...	1	2
11	Carbon steel	Plate	SA-537	...	K12437	3	$100 < t \leq 150$	1	3
12	Carbon steel	Cast pipe	SA-660	WCC	J02505	...	...	1	2
13	Carbon steel	Bar	SA-696	C	K03200	...	...	1	2
14	Carbon steel	Plate	SA-662	C	K02007	...	...	1	2
15	Carbon steel	Plate	SA-537	...	K12437	2	$100 < t \leq 150$	1	3
16	Carbon steel	Plate	SA-738	C	...	...	$100 < t \leq 150$	1	3
17	Carbon steel	Plate	SA-537	...	K12437	1	≤ 65	1	2
18	Carbon steel	Wld. pipe	SA-671	CD70	K12437	...	≤ 65	1	2
19	Carbon steel	Wld. pipe	SA-672	D70	K12437	...	≤ 65	1	2
20	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...	≤ 65	1	2
(25)	Carbon steel	Plate	SA-841	A	...	1	$t \leq 100$	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	$70 < t \leq 160$	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	$35 < t \leq 70$	1	2
(25)	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$60 < t \leq 100$	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	$t \leq 35$	1	2
26	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$40 < t \leq 60$	1	2
27	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$16 < t \leq 40$	1	2
28	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	≤ 16	1	2
29	Carbon steel	Forgings	SA-266	3	K05001	...	...	1	2
30	Carbon steel	Plate	SA-299	A	K02803	...	> 25	1	2
31	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...	> 25	1	2
32	Carbon steel	Plate	SA-299	A	K02803	...	≤ 25	1	2
33	Carbon steel	Wld. pipe	SA-671	CK75	K02803	...	≤ 25	1	2
34	Carbon steel	Wld. pipe	SA-672	N75	K02803	...	≤ 25	1	2
35	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...	≤ 25	1	2
36	Carbon steel	Forgings	SA-372	B	K04001	...	...	1	2
37	Carbon steel	Plate	SA-738	A	K12447	N	≤ 65	1	2
38	Carbon steel	Plate	SA-738	A	K12447	QT	...	1	2
39	Carbon steel	Plate	SA-537	...	K12437	3	$65 < t \leq 100$	1	3
40	Carbon steel	Plate	SA-537	...	K12437	2	$65 < t \leq 100$	1	3
41	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...	$65 < t \leq 100$	1	3
42	Carbon steel	Plate	SA-738	C	...	...	$65 < t \leq 100$	1	3
43	Carbon steel	Plate	SA-299	B	K02803	...	$t > 25$	1	3
44	Carbon steel	Plate	SA-299	B	K02803	...	$t \leq 25$	1	3
45	Carbon steel	Forgings	SA-765	IV	K02009	...	...	1	3

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	485	260	371	NP	CS-2	G1, G4
2	485	260	371	NP	CS-2	G1, G3
3	485	260	371	NP	CS-2	G1, G4
4	485	275	371	371	CS-2	E2
5	485	275	NP	371	CS-2	E2
6	485	275	371	371	CS-2	E2
7	485	275	371	371	CS-2	E2
8	485	275	371	NP	CS-2	E2
9	485	275	371	NP	CS-2	E2
10	485	275	371	NP	CS-2	E2
11	485	275	NP	371	CS-2	E2
12	485	275	371	NP	CS-2	E2
13	485	275	371	NP	CS-2	E2
14	485	295	NP	371	CS-3	E2
15	485	315	371	371	CS-3	E2
16	485	315	NP	343	CS-3	...
17	485	345	371	371	CS-3	E2
18	485	345	371	NP	CS-3	E2, G1, G4
19	485	345	371	NP	CS-3	E2, G1, G4
20	485	345	371	NP	CS-3	E2, G1, G4
21	485	345	NP	371	CS-3	E2
22	490	280	NP	371	CS-2	E2
23	510	285	NP	371	CS-2	E2
24	490	315	NP	371	CS-2	E2
25	510	305	NP	371	CS-2	E2
26	510	335	NP	371	CS-2	E2
27	510	345	NP	371	CS-2	E2
28	510	355	NP	371	CS-2	E2
29	515	260	371	371	CS-2	W6
30	515	275	371	371	CS-2	...
31	515	275	371	NP	CS-2	G1, G4
32	515	290	371	371	CS-2	E2
33	515	290	371	NP	CS-2	E2, G1
34	515	290	371	NP	CS-2	E2, G1
35	515	290	371	NP	CS-2	E2, G1
36	515	310	NP	38	CS-3	G19, H5, W5, W6
37	515	310	NP	371	CS-2	...
38	515	310	NP	371	CS-2	...
39	515	345	NP	371	CS-5	E2
40	515	380	371	371	CS-5	E2
41	515	380	371	NP	CS-5	E2
42	515	380	NP	343	CS-5	...
43	550	310	NP	371	CS-3	E2
44	550	325	NP	371	CS-3	E2
45	550	345	NP	371	CS-3	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...
2	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...
3	161	160	160	157	154	149	143	136	132	129	124	...	...	...	...	...
4	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
5	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
6	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
7	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
8	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
9	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
10	161	160	159	155	151	146	142	137	134	131	128	...	...	...	...	...
11	161	161	161	160	160	154	148	143	141	139	136	...	...	...	...	...
12	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
13	161	161	161	161	161	158	151	143	139	136	132	...	...	...	...	...
14	161	161	161	161	161	161	161	155	150	145	142	...	...	...	...	...
15	161	161	161	161	161	161	161	160	159	153	141	...	...	...	...	...
16	161	161	161	161	161	161	161	160	159	153	...	...	...	...	...	...
17	161	161	160	159	157	156	157	156	153	150	147	...	...	...	...	...
18	161	161	160	159	157	156	157	156	153	150	147	...	...	...	...	...
19	161	161	160	159	157	156	157	156	153	150	147	...	...	...	...	...
20	161	161	160	159	157	156	157	156	153	150	147	...	...	...	...	...
21	161	161	161	161	161	161	161	161	161	156	149	...	...	...	...	...
22	163	163	163	163	163	159	153	145	141	136	132	101	83.8	66.8	50.3	33.2
23	170	170	170	169	167	161	155	147	143	139	135	101	83.8	66.8	50.3	33.2
24	163	163	163	163	163	163	163	163	159	154	123	101	83.8	66.8	50.3	33.2
25	170	170	170	170	170	170	166	157	153	149	136	101	83.3	66.8	50.3	33.2
26	170	170	170	170	170	170	170	170	169	164	123	101.0	83.8	66.8	50.3	33.2
27	170	170	170	170	170	170	170	170	170	169	123	101.0	83.8	66.8	50.3	33.2
28	170	170	170	170	170	170	170	170	170	170	123	101.0	83.8	66.8	50.3	33.2
29	172	162	157	155	152	148	142	135	131	127	123	...	...	...	...	...
30	172	172	167	164	163	158	151	143	139	135	131	...	...	...	...	...
31	172	170	168	165	163	158	151	143	139	135	131	...	...	...	...	...
32	172	172	172	172	171	165	159	151	147	142	139	...	...	...	...	...
33	172	172	172	172	171	165	159	151	147	142	139	...	...	...	...	...
34	172	172	172	172	171	165	159	151	147	142	139	...	...	...	...	...
35	172	172	172	172	171	165	159	151	147	142	139	...	...	...	...	...
36	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	172	172	172	171	167	157	148	141	138	135	133	...	...	...	...	...
38	172	172	172	172	172	172	167	161	158	156	153	...	...	...	...	...
39	172	172	172	172	172	172	172	172	167	152	147	...	...	...	...	...
40	172	172	172	172	172	172	172	172	170	168	167	...	...	...	...	...
41	172	172	172	172	172	172	172	172	170	168	167	...	...	...	...	...
42	172	172	172	172	172	172	172	172	170	168	...	...	...	...	...	...
43	183	183	183	183	183	177	170	161	157	152	133	...	...	...	...	...
44	183	183	183	183	183	177	170	161	157	152	133	...	...	...	...	...
45	184	184	184	184	184	182	182	178	175	172	170	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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-537	...	K12437	3	≤65	1	3
2	Carbon steel	Plate	SA-537	...	K12437	2	≤65	1	3
3	Carbon steel	Wld. pipe	SA-671	CD80	K12437	...	≤65	1	3
4	Carbon steel	Wld. pipe	SA-672	D80	K12437	...	≤65	1	3
5	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...	≤65	1	3
6	Carbon steel	Plate	SA-738	C	...	...	≤65	1	3
7	Carbon steel	Plate	SA-841	B	...	2	$t \leq 100$	1	3
8	Carbon steel	Plate	SA-612	...	K02900	N	$12.5 < t \leq 25$	10C	1
9	Carbon steel	Plate	SA-612	...	K02900	N	≤12.5	10C	1
10	Carbon steel	Plate	SA-738	B	K12007	...	...	1	3
11	...	...	...	...	...	...	...	...	...
12	Carbon steel	Forgings	SA-372	C	K04801	...	...	...	...
13	Carbon steel	Plate	SA-724	A	K11831	...	...	1	4
14	Carbon steel	Plate	SA-724	C	K12037	...	...	1	4
15	Carbon steel	Plate	SA-724	B	K12031	...	...	1	4
16	Ductile cast iron	Castings	SA-874	...	...	...	$300 < t < 530$	...	...
17	Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT	...	...	$300 < t < 530$	...	...
18	C-Mn-Si-Cb	Plate	SA-737	B	K12001	...	...	1	2
19	C-Mn-Si-V	Plate	SA-737	C	K12202	...	...	1	3
20	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1b	K11422	...	...	3	1
21	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1	K11522	...	...	3	1
22	C- $\frac{1}{2}$ Mo	Fittings	SA-234	WP1	K12821	...	...	3	1
23	C- $\frac{1}{2}$ Mo	Wld. fittings	SA-234	WP1	K12821	W	...	3	1
24	C- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P1	K11522	...	...	3	1
25	C- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP1	K11522	...	...	3	1
26	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1a	K12023	...	...	3	1
27	C- $\frac{1}{2}$ Mo	Castings	SA-217	WC1	J12524	...	...	3	1
28	C- $\frac{1}{2}$ Mo	Castings	SA-352	LC1	J12522	...	...	3	1
29	C- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP1	J12521	...	...	3	1
30	C- $\frac{1}{2}$ Mo	Plate	SA-204	A	K11820	...	...	3	1
31	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L65	K11820	...	...	3	1
32	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-65	K11820	...	...	3	1
33	C- $\frac{1}{2}$ Mo	Forgings	SA-182	F1	K12822	...	...	3	2
34	C- $\frac{1}{2}$ Mo	Plate	SA-204	B	K12020	...	...	3	2
35	C- $\frac{1}{2}$ Mo	Forgings	SA-336	F1	K12520	...	...	3	2
36	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L70	K12020	...	...	3	2
37	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-70	K12020	...	...	3	2
38	C- $\frac{1}{2}$ Mo	Plate	SA-204	C	K12320	...	...	3	2
39	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L75	K12320	...	...	3	2
40	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-75	K12320	...	...	3	2
41	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	70	...	...	...
42	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	70	...	...	...
43	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo-V	Plate	SA-517	B	K11630	...	≤32	11B	4
44	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Forgings	SA-592	A	K11856	...	$65 < t \leq 100$	11B	1
45	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Plate	SA-517	A	K11856	...	≤32	11B	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	550	380	NP	371	CS-5	E1
2	550	415	371	371	CS-5	E1
3	550	415	371	NP	CS-5	E1, G1, G4
4	550	415	371	NP	CS-5	E1, G1, G4
5	550	415	371	NP	CS-5	E1, G1, G4
6	550	415	NP	343	CS-5	E1
7	550	415	NP	343	CS-3	...
8	560	345	NP	343	CS-3	...
9	570	345	NP	343	CS-3	...
10	585	415	343	316	CS-5	...
11	...	...	...	...	...	...
12	620	380	NP	38	CS-3	G19, H5, W5, W6
13	620	485	NP	371	CS-5	E1
14	620	485	NP	371	CS-5	E1
15	655	515	NP	371	CS-5	E1
16	300	200	343	NP	CD-2	G17, W1
17	300	200	343	NP	CD-2	G17, W1
18	485	345	371	371	CS-3	E2
19	550	415	371	371	CS-3	E1
20	365	195	NP	371	CS-1	...
21	380	205	NP	371	CS-2	...
22	380	205	371	371	CS-2	...
23	380	205	371	NP	CS-2	...
24	380	205	371	371	CS-2	...
25	380	205	371	371	CS-2	...
26	415	220	NP	371	CS-2	...
27	450	240	371	371	CS-2	...
28	450	240	371	371	CS-2	...
29	450	240	371	NP	CS-2	...
30	450	255	371	371	CS-2	...
31	450	255	371	NP	CS-2	G1, G2
32	450	255	371	NP	CS-2	G1, G2
33	485	275	371	371	CS-2	...
34	485	275	371	371	CS-2	...
35	485	275	371	371	CS-2	...
36	485	275	371	NP	CS-2	G1, G2
37	485	275	371	NP	CS-2	G1, G2
38	515	295	371	371	CS-2	...
39	515	295	371	NP	CS-2	G1, G2
40	515	295	371	NP	CS-2	G1, G2
41	825	485	NP	38	CS-3	G19, H4, W5, W6
42	825	485	NP	38	CS-3	G19, H4, W5, W6
43	795	690	371 (SPT)	371	HT-1	...
44	725	620	371 (SPT)	NP	CS-5	...
45	795	690	371 (SPT)	371	HT-1	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	184	184	184	184	184	184	184	183	182	177	166	...	...	...	...	...
2	184	184	184	184	184	184	184	183	182	177	166	...	...	...	...	...
3	184	184	184	184	184	184	184	183	182	177	166	...	...	...	...	...
4	184	184	184	184	184	184	184	183	182	177	166	...	...	...	...	...
5	184	184	184	184	184	184	184	183	182	177	166	...	...	...	...	...
6	184	184	184	184	184	184	184	183	182	177	...	...	...	...	...	...
7	183	183	183	183	183	183	183	183	183	178	166	161	215	...	...	...
8	186	186	186	185	183	173	164	158	155	151	...	...	...	...	...	...
9	191	191	191	190	187	174	163	158	154	151	...	...	...	...	...	...
10	195	195	195	195	195	195	195	195	193	190	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	207	207	207	207	207	207	207	206	197	180	178	...	...	...	...	...
14	207	207	207	207	207	207	207	206	197	180	178	...	...	...	...	...
15	219	219	219	219	219	219	219	218	204	180	178	...	...	...	...	...
16	75.0	75.0	74.3	...	71.2	68.9	67.6	66.7	65.8	64.2	...	...	...	...	...	...
17	75.0	75.0	74.3	...	71.2	68.9	67.6	66.7	65.8	64.2	...	...	...	...	...	...
18	161	161	161	161	161	161	161	157	155	153	152	...	...	...	...	...
19	184	184	184	184	184	184	184	184	183	180	178	...	...	...	...	...
20	122	122	120	118	116	113	110	107	105	103	101	...	...	...	...	...
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	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...
24	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...
25	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...
26	138	138	138	135	132	129	125	121	119	117	116	...	...	...	...	...
27	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...
28	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...
29	150	150	149	147	145	140	137	133	131	128	127	...	...	...	...	...
30	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...
31	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...
32	150	150	150	150	150	148	144	141	138	136	133	...	...	...	...	...
33	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
34	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
35	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
36	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
37	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
38	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...
39	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...
40	172	172	172	172	172	172	168	163	160	158	155	...	...	...	...	...
41	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
44	241	241	241	241	241	241	241	240	239	233	228	...	...	...	...	...
45	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	$\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{Si}$	Forgings	SA-592	A	K11856	...	≤ 65	11B	1
2	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P2	K11547	...	...	3	1
3	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP2	K11547	...	...	3	1
4	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2	K12143	1	...	3	1
5	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$	K12143	...	...	3	1
6	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T2	K11547	...	...	3	1
7	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP2	J11547	...	...	3	1
8	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F2	K12122	...	...	3	2
9	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2	K12143	2/NT	...	3	2
10	$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	Smls. tube	SA-423	1	K11535	...	...	4	2
11	$\frac{3}{4}\text{Cr}-\frac{3}{4}\text{Ni}-\text{Cu}-\text{Al}$	Smls. pipe	SA-333	4	K11267	...	...	4	2
12	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	70	...	...	...
13	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	70	...	...	...
14	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	70	...	...	...
15	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	G41370	110	...	...	...
16	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	12	K11757	1	...	4	1
17	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	1CR	K11757	22	...	4	1
18	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP12	J11562	...	...	4	1
19	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F12	K11562	1	...	4	1
20	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T12	K11562	...	...	4	1
21	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Fittings	SA-234	WP12	K12062	1	...	4	1
22	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P12	K11562	...	...	4	1
23	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP12	K11562	...	...	4	1
24	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$250 < t \leq 500$	4	1
25	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$150 < t \leq 250$	4	1
26	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$100 < t \leq 150$	4	1
27	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$100 < t \leq 250$	4	1
28	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$60 < t \leq 100$	4	1
29	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$70 < t \leq 100$	4	1
(25) 30	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$35 < t \leq 70$	4	1
(25) 31	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$t \leq 35$	4	1
32	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	12	K11757	2	...	4	1
33	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$16 < t \leq 60$	4	1
34	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$t \leq 16$	4	1
35	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	1CR	K11757	42/NT	...	4	1
36	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F12	K11564	2	...	4	1
37	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-336	F12	K11564	...	...	4	1
38	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Castings	SA-217	WC6	J12072	...	...	4	1
39	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP11	J12072	...	...	4	1
40	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Bar	SA-739	B11	K11797	...	...	4	1
41	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	Forgings	SA-182	F11	K11597	1	...	4	1
42	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	Smls. tube	SA-213	T11	K11597	...	...	4	1
43	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	Fittings	SA-234	WP11	...	1	...	4	1
44	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	Wld. fittings	SA-234	WP11	...	1/W	...	4	1
45	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	Smls. pipe	SA-335	P11	K11597	...	...	4	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	795	690	NP	371	HT-1	...
2	380	205	371	371	CS-2	...
3	380	205	371	371	CS-2	...
4	380	230	371	371	CS-2	...
5	380	230	371	NP	CS-2	G1, G2
6	415	205	371	371	CS-2	...
7	415	205	371	NP	CS-2	...
8	485	275	NP	371	CS-2	...
9	485	310	NP	38	CS-3	...
10	415	255	NP	371	CS-2	...
11	415	240	NP	38	CS-2	...
12	825	485	NP	343	CS-5	G19, H4, W5, W6
13	825	485	NP	343	CS-5	G19, H4, W5, W6
14	825	485	NP	343	CS-5	G19, H4, W5, W6
15	930	760	NP	343	HT-1	H4, W5, W6
16	380	230	371	482	CS-2	...
17	380	230	371	NP	CS-2	G15
18	415	205	371	NP	CS-2	...
19	415	220	NP	482	CS-2	...
20	415	220	371	482	CS-2	...
21	415	220	371	482	CS-2	...
22	415	220	371	482	CS-2	...
23	415	220	371	482	CS-2	...
24	420	240	NP	482	CS-2	E4
25	420	245	NP	482	CS-2	E4
26	430	255	NP	482	CS-2	E4
27	440	265	NP	482	CS-2	E4
28	440	270	NP	482	CS-2	E4
29	440	275	NP	482	CS-2	E4
30	440	285	NP	482	CS-2	E4
31	440	295	NP	482	CS-2	E4
32	450	275	371	482	CS-2	E4
33	450	290	NP	482	CS-2	E4
34	450	300	NP	482	CS-2	E4
35	450	275	371	NP	CS-2	G16
36	485	275	371	482	CS-2	E4
37	485	275	371	482	CS-2	E4
38	485	275	371	482	CS-2	E4
39	485	275	371	NP	CS-2	...
40	485	310	371	482	CS-3	E4
41	415	205	NP	482	CS-2	...
42	415	205	371	482	CS-2	...
43	415	205	371	482	CS-2	...
44	415	205	371	NP	CS-2	...
45	415	205	371	482	CS-2	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
2	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...
3	126	126	126	125	124	120	117	114	112	110	108	...	...	...	...	...
4	126	126	126	126	126	126	126	125	123	121	119	...	...	...	...	...
5	126	126	126	126	126	126	126	125	123	121	119	...	...	...	...	...
6	138	134	129	126	124	120	117	114	112	110	108	...	...	...	...	...
7	138	134	129	126	124	120	117	114	112	110	108	...	...	...	...	...
8	161	161	161	161	161	160	156	152	149	147	144	...	...	...	...	...
9	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
11	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	276	276	276	276	276	276	273	265	259	253	...	...	...	...	...	...
13	276	276	276	276	276	276	273	265	259	253	...	...	...	...	...	...
14	276	276	276	276	276	276	273	265	259	253	...	...	...	...	...	...
15	310	304	297	296	295	293	291	289	286	272	...	...	...	...	...	...
16	126	125	124	122	121	121	119	117	115	113	112	110	108	107	104	102
17	126	125	124	122	121	121	119	117	115	113	112	...	...	...	...	...
18	138	131	124	120	117	112	109	106	104	103	102	...	...	...	...	...
19	138	136	132	128	125	120	116	113	112	110	109	107	106	103	101	98.2
20	138	136	132	128	125	120	116	113	112	110	109	107	106	103	101	98.2
21	138	136	132	128	125	120	116	113	112	110	109	107	106	103	101	98.2
22	138	136	132	128	125	120	116	113	112	110	109	107	106	103	101	98.2
23	138	136	132	128	125	120	116	113	112	110	109	107	106	103	101	98.2
24	140	139	138	136	134	131	127	123	122	121	119	117	115	113	110	97.2
25	140	139	137	136	136	133	129	125	124	123	121	119	117	115	112	94.4
26	143	142	140	139	139	138	134	131	129	127	125	124	121	119	117	94.4
27	147	145	143	143	142	141	140	136	135	133	131	129	127	124	121	97.2
28	147	147	147	147	147	147	142	138	137	135	133	131	129	126	123	94.4
29	147	145	144	143	141	140	140	140	140	138	136	134	132	129	126	97.2
30	147	145	144	143	141	140	140	140	140	140	140	139	137	133	131	97.2 (25)
31	147	145	144	143	141	140	140	140	140	140	140	140	140	138	135	97.2 (25)
32	150	150	146	144	143	143	143	141	139	137	136	134	132	129	125	121
33	150	148	147	146	145	144	144	144	144	144	143	141	139	135	133	94.4
34	150	148	147	146	145	144	144	144	144	144	144	144	143	140	137	94.4
35	150	148	146	144	143	143	143	141	139	137	136	...	...	...	...	...
36	161	159	158	156	154	150	145	141	139	137	136	134	132	129	125	121
37	161	161	157	156	154	150	145	141	139	137	136	134	132	129	125	121
38	161	161	161	161	161	156	151	146	143	141	138	136	133	130	106	71.4
39	161	161	161	161	161	156	151	146	143	141	138	...	...	...	...	...
40	161	161	161	161	161	161	161	161	160	159	155	153	149	143	108	65.0
41	138	132	127	124	121	116	112	109	108	106	104	102	99.5	97.0	94.5	92.0
42	138	132	127	124	121	116	112	109	108	106	104	102	99.5	97.0	94.5	92.0
43	138	132	127	124	121	116	112	109	108	106	104	102	99.5	97.0	94.5	92.0
44	138	132	127	124	121	116	112	109	108	106	104	...	...	...	...	...
45	138	132	127	124	121	116	112	109	108	106	104	102	99.5	97.0	94.5	92.0

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forged pipe	SA-369	FP11	K11597	...	...	4	1
2	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	1	...	4	1
3	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	1 $\frac{1}{4}$ CR	K11789	...	...	4	1
4	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11572	2	...	4	1
5	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	2	...	4	1
6	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	100 < t ≤ 250	4	1
7	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	60 < t ≤ 100	4	1
8	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	≤60	4	1
9	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	3	...	4	1
10	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	2	...	4	1
11	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	1 $\frac{1}{4}$ CR	K11789	NT	...	4	1
12	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	65 < t ≤ 100	11B	2
13	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	≤65	11B	2
14	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	65 < t ≤ 150	11B	2
15	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	≤65	11B	2
16	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	1	...	5A	1
17	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	1	...	5A	1
18	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA-213	T22	K21590	...	...	5A	1
19	2 $\frac{1}{4}$ Cr-1Mo	Fittings	SA-234	WP22	K21590	1	...	5A	1
20	2 $\frac{1}{4}$ Cr-1Mo	Wld. fittings	SA-234	WP22	K21590	1/W	...	5A	1
21	2 $\frac{1}{4}$ Cr-1Mo	Smls. pipe	SA-335	P22	K21590	...	...	5A	1
22	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	1	...	5A	1
23	2 $\frac{1}{4}$ Cr-1Mo	Forged pipe	SA-369	FP22	K21590	...	...	5A	1
24	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	1	...	5A	1
25	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	150 < t ≤ 250	5A	1
26	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	200 < t ≤ 500	5A	1
27	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	100 < t ≤ 150	5A	1
28	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	60 < t ≤ 100	5A	1
29	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	40 < t ≤ 60	5A	1
30	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	16 < t ≤ 40	5A	1
31	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	t ≤ 16	5A	1
32	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR	K21590	...	...	5A	1
33	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9	J21890	...	...	5A	1
34	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9	J21890	...	...	5A	1
35	2 $\frac{1}{4}$ Cr-1Mo	Cast pipe	SA-426	CP22	J21890	...	...	5A	1
36	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	3	...	5A	1
37	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	3	...	5A	1
38	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	2	...	5A	1
39	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR	K21590	NT	...	5A	1
40	2 $\frac{1}{4}$ Cr-1Mo	Bar	SA-739	B22	K21390	...	...	5A	1
(25) 41	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	t ≤ 200	5A	1
42	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-487	8	J22091	A	...	5C	1
43	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-508	22	K21590	3	...	5C	1
44	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	3	...	5C	1
45	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-542	B	K21590	4	...	5C	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	415	205	371	482	CS-2	...
2	415	240	371	482	CS-2	E4
3	415	240	371	NP	CS-2	G1, G2
4	485	275	371	482	CS-2	E4
5	485	275	NP	482	CS-2	E4
6	490	380	...	482	CS-3	E4
7	500	390	...	482	CS-3	E4
8	510	400	...	482	CS-3	E4
9	515	310	NP	371	CS-3	...
10	515	310	371	482	CS-3	E3
11	515	310	371	NP	CS-3	G1, G2
12	725	620	371 (SPT)	371	CS-5	S1
13	795	690	NP	371	HT-1	...
14	725	620	371 (Cl. MC & SPT)	371	CS-5	...
15	795	690	371 (Cl. MC & SPT)	371	HT-1	...
16	415	205	NP	482	CS-2	E3, W2
17	415	205	371	NP	CS-2	...
18	415	205	371	482	CS-2	E3, W2
19	415	205	371	482	CS-2	E3, W2
20	415	205	371	NP	CS-2	...
21	415	205	371	482	CS-2	E3, W2
22	415	205	371	482	CS-2	E3, W2
23	415	205	371	482	CS-2	E3, W2
24	415	205	371	482	CS-2	E3, H1, W2
25	450	250	NP	482	CS-3	E3, W2
26	450	265	NP	482	CS-3	E3, W2
27	460	260	NP	482	CS-3	E3, W2
28	470	280	NP	482	CS-3	E3, W2
29	480	290	NP	482	CS-3	E3, W2
30	480	300	NP	482	CS-3	E3, W2
31	480	310	NP	482	CS-3	E3, W2
32	415	205	371	NP	CS-2	G1, G2
33	485	275	371	482	CS-2	E4, W2
34	485	275	371 (SPT)	NP	CS-2	...
35	485	275	371	NP	CS-2	...
36	515	310	371	482	CS-3	E3, W2
37	515	310	371	482	CS-3	E3, W2
38	515	310	371	482	CS-3	E3, W2
39	515	310	371	NP	CS-3	G1, G2
40	515	310	371	482	CS-3	E3, W2
41	520	310	NP	482	CS-3	E3, W5
42	585	380	371	371	CS-3	...
43	585	380	371	454	CS-2	...
44	585	380	NP	454	CS-2	G21
45	585	380	NP	454	CS-2	G21

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	138	132	127	124	121	116	112	109	108	106	104	102	99.5	97.0	94.5	92.0
2	138	138	138	138	138	135	131	127	126	123	121	118	116	114	106	97.1
3	138	138	138	138	138	135	131	127	126	123	121	...	...	...	...	...
4	161	161	161	161	161	156	151	146	143	141	138	136	133	130	109	80.6
5	161	161	161	161	161	156	151	146	143	141	138	136	133	130	109	80.6
6	163	163	163	163	162	162	162	162	162	162	162	162	160	155	104	73.7
7	167	167	167	166	165	165	165	165	165	165	165	165	163	158	104	73.7
8	170	170	170	169	168	168	168	168	168	168	168	168	166	161	104	73.7
9	172	172	172	172	172	172	169	164	161	158	155	...	...	...	...	...
10	172	172	172	172	172	172	169	164	161	158	155	153	149	142	119	91.4
11	172	172	172	172	172	172	169	164	161	158	155	...	...	...	...	...
12	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...
13	264	264	264	264	264	264	264	264	264	264	263	...	...	...	...	...
14	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...
15	264	264	264	264	264	264	264	264	264	264	263	...	...	...	...	...
16	138	133	128	126	125	124	123	123	123	123	123	123	122	119	99.6	80.9
17	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
18	138	133	128	126	125	124	123	123	123	123	123	123	122	119	101	77.7
19	138	132	128	127	125	124	123	123	123	123	123	123	122	119	101	77.7
20	138	132	128	127	125	124	123	123	123	123	123	...	...	...	...	...
21	138	132	128	127	125	124	123	123	123	123	123	123	122	119	101	77.7
22	138	132	128	127	125	124	123	123	123	123	123	123	122	119	101	77.7
23	138	132	128	127	125	124	123	123	123	123	123	123	122	119	101	77.7
24	138	133	128	126	125	124	123	123	123	123	123	123	122	119	101	77.7
25	150	150	150	149	145	141	139	136	135	133	132	130	127	125	123	88.4
26	150	150	150	149	147	145	144	144	143	142	141	139	136	132	128	88.4
27	153	153	153	152	151	147	144	141	140	139	137	135	133	129	126	122.0
28	157	157	156	155	154	151	150	149	149	148	146	144	141	138	128	88.4
29	160	160	160	159	157	154	154	153	152	151	149	147	144	141	128	88.4
30	160	160	160	159	158	155	155	154	153	152	150	148	144	139	128	88.4
31	160	160	160	159	158	155	155	154	153	152	150	148	144	139	128	88.4
32	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
33	161	161	161	160	159	156	155	155	154	153	151	148	145	139	118	93.2
34	161	161	161	160	159	156	155	155	154	153	151	...	...	...	...	...
35	161	161	161	160	159	156	155	155	154	153	151	...	...	...	...	...
36	172	172	172	170	167	166	166	165	164	162	161	158	155	152	128	94.6
37	172	172	172	170	167	166	166	165	164	162	161	158	155	152	128	94.6
38	172	172	172	170	167	166	166	165	164	162	161	158	155	152	128	94.6
39	172	172	172	170	167	166	166	165	164	162	161	...	...	...	...	...
40	172	172	172	170	167	166	166	165	164	162	161	158	155	152	128	94.6
41	173	173	173	172	170	167	167	166	165	164	163	160	157	153	116	89.4
42	195	195	195	193	191	189	189	188	187	186	184	...	...	...	...	...
43	195	195	195	193	191	189	189	188	187	186	184	180	176	156	133	...
44	195	195	195	193	191	189	189	188	187	186	184	180	176	156	133	...
45	195	195	195	193	191	189	189	188	187	186	184	180	176	156	133	...

(25)

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	4	≥6	5C	4
2	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-182	F22V	K31835	...	...	5C	1
3	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-336	F22V	K31835	...	...	5C	1
4	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-541	22V	K31835	...	...	5C	1
5	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-542	D	K31835	4a	...	5C	1
6	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-832	22V	K31835	...	...	5C	1
7	3Cr-1Mo	Smls. tube	SA-213	T21	K31545	...	...	5A	1
8	3Cr-1Mo	Smls. pipe	SA-335	P21	K31545	...	...	5A	1
9	3Cr-1Mo	Forgings	SA-336	F21	K31545	1	...	5A	1
10	3Cr-1Mo	Forged pipe	SA-369	FP21	K31545	...	...	5A	1
11	3Cr-1Mo	Plate	SA-387	21	K31545	1	...	5A	1
12	3Cr-1Mo	Cast pipe	SA-426	CP21	J31545	...	...	5A	1
13	3Cr-1Mo	Forgings	SA-182	F21	K31545	...	...	5A	1
14	3Cr-1Mo	Forgings	SA-336	F21	K31545	3	...	5A	1
15	3Cr-1Mo	Plate	SA-387	21	K31545	2	...	5A	1
16	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-182	F3V	K31830	...	...	5C	1
17	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-336	F3V	K31830	...	...	5C	1
18	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-508	3V	K31830	...	...	5C	1
19	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-541	3V	K31830	...	...	5C	1
20	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-542	C	K31830	4a	...	5C	1
21	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-832	21V	K31830	...	...	5C	1
22	5Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T5	K41545	...	...	5B	1
23	5Cr- $\frac{1}{2}$ Mo	Fittings	SA-234	WP5	K41545	...	...	5B	1
24	5Cr- $\frac{1}{2}$ Mo	Wld. fittings	SA-234	WP5	K41545	W	...	5B	1
25	5Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P5	K41545	...	...	5B	1
26	5Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP5	K41545	...	...	5B	1
27	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	1	...	5B	1
28	5Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	5CR	K41545	...	...	5B	1
29	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5	K41545	...	...	5B	1
30	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5	K41545	...	...	5B	1
31	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	2	...	5B	1
32	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5A	K42544	...	...	5B	1
33	5Cr- $\frac{1}{2}$ Mo	Castings	SA-217	C5	J42045	NT	...	5B	1
34	5Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP5	J42045	...	...	5B	1
35	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5a	K42544	...	...	5B	1
36	5Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T5b	K51545	...	...	5B	1
37	5Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P5b	K51545	...	...	5B	1
38	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. tube	SA-213	T5c	K41245	...	...	5B	1
39	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. pipe	SA-335	P5c	K41245	...	...	5B	1
40	9Cr-1Mo	Smls. tube	SA-213	T9	K90941	...	...	5B	1
41	9Cr-1Mo	Fittings	SA-234	WP9	K90941	...	...	5B	1
42	9Cr-1Mo	Smls. pipe	SA-335	P9	K90941	...	...	5B	1
43	9Cr-1Mo	Forged pipe	SA-369	FP9	K90941	...	...	5B	1
44	9Cr-1Mo	Forgings	SA-182	F9	K90941	...	...	5B	1
45	9Cr-1Mo	Forgings	SA-336	F9	K90941	...	...	5B	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	725	585	371	NP	CS-3	S3, W1
2	585	415	NP	482	CS-2	G21
3	585	415	NP	482	CS-2	G21
4	585	415	NP	482	CS-2	G21
5	585	415	NP	482	CS-2	G21
6	585	415	NP	482	CS-2	G21
7	415	205	371	454	CS-2	E3
8	415	205	371	454	CS-2	E3
9	415	205	371	454	CS-2	E3
10	415	205	371	454	CS-2	E3
11	415	205	371	454	CS-2	E3
12	415	205	371	NP	CS-2	...
13	515	310	371	454	CS-3	E3
14	515	310	371	454	CS-3	E3
15	515	310	371	454	CS-3	E3
16	585	415	NP	454	CS-3	G21
17	585	415	NP	454	CS-3	G21
18	585	415	NP	454	CS-3	G21
19	585	415	NP	454	CS-3	G21
20	585	415	NP	454	CS-3	G21
21	585	415	NP	454	CS-3	G21
22	415	205	371	371	CS-2	...
23	415	205	371	371	CS-2	...
24	415	205	371	NP	CS-2	...
25	415	205	371	371	CS-2	...
26	415	205	371	371	CS-2	...
27	415	205	371	371	CS-2	...
28	415	205	371	NP	CS-2	G1, G2
29	415	250	NP	371	CS-2	...
30	485	275	371	371	CS-2	...
31	515	310	371	371	CS-3	...
32	550	345	NP	371	CS-3	...
33	620	415	371	371	CS-3	...
34	620	415	371	NP	CS-3	...
35	620	450	NP	371	CS-5	...
36	415	205	NP	371	CS-2	...
37	415	205	NP	371	CS-2	...
38	415	205	NP	371	CS-2	...
39	415	205	NP	371	CS-2	...
40	415	205	371	371	CS-2	...
41	415	205	NP	371	CS-2	...
42	415	205	371	371	CS-2	...
43	415	205	371	371	CS-2	...
44	585	380	NP	371	CS-3	...
45	585	380	NP	371	CS-3	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	241	241	241	241	241	241	240	238	236	234	231	...	...	...	...	...
2	195	195	195	195	195	195	195	192	189	186	182	178	174	170	164	159
3	195	195	195	195	195	195	195	192	189	186	182	178	174	170	164	159
4	195	195	195	195	195	195	195	192	189	186	182	178	174	170	164	159
5	195	195	195	195	195	195	195	192	189	186	182	178	174	170	164	159
6	195	195	195	195	195	195	195	192	189	186	182	178	174	170	164	159
7	138	133	128	126	125	124	123	123	123	123	123	123	122	112	101	...
8	138	133	128	126	125	124	123	123	123	123	123	123	122	112	101	...
9	138	132	128	127	125	124	123	123	123	123	123	123	122	112	101	...
10	138	133	128	126	125	124	123	123	123	123	123	123	122	112	101	...
11	138	133	128	126	125	124	123	123	123	123	123	123	122	112	101	...
12	138	133	128	126	125	124	123	123	123	123	123	...	...	...	...	...
13	172	172	172	170	167	166	166	165	164	162	161	158	156	136	113	...
14	172	172	172	170	167	166	166	165	164	162	161	158	156	136	113	...
15	172	172	172	170	167	166	166	165	164	162	161	158	156	136	113	...
16	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
17	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
18	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
19	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
20	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
21	195	195	195	192	187	182	179	176	175	173	172	170	168	165	162	...
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	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
29	138	138	138	136	134	132	132	131	130	128	125	...	...	...	...	...
30	161	161	160	158	156	154	154	153	151	149	146	...	...	...	...	...
31	172	172	171	169	167	165	165	164	162	159	156	...	...	...	...	...
32	184	184	183	180	178	177	177	175	173	170	167	...	...	...	...	...
33	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
34	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
35	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
36	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
37	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
38	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
39	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
40	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
41	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
42	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
43	138	131	124	121	120	119	118	117	115	114	112	...	...	...	...	...
44	195	195	195	192	189	188	187	186	184	180	177	...	...	...	...	...
45	195	195	195	192	189	188	187	186	184	180	177	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Castings	SA-217	C12	J82090	NT	...	5B	1
2	9Cr-1Mo	Cast pipe	SA-426	CP9	J82090	...	...	5B	1
3	9Cr-1Mo-V	Smls. tube	SA-213	T91 Type 1	K90901	...	...	15E	1
4	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Type 1	K90901	...	...	15E	1
5	9Cr-1Mo-V	Plate	SA-387	91 Type 1	K90901	2	...	15E	1
6	9Cr-1Mo-V	Forgings	SA-182	F91 Type 1	K90901	...	...	15E	1
7	9Cr-1Mo-V	Forgings	SA-336	F91	K90901	...	...	15E	1
8	12Cr	Bar	SA-479	403	S40300	A	...	6	1
9	12Cr	Bar	SA-479	403	S40300	1	...	6	1
10	12Cr-Al	Bar	SA/JIS G4303	SUS405	...	...	...	7	1
11	12Cr-Al	Plate	SA-240	405	S40500	...	...	7	1
12	12Cr-Al	Bar	SA-479	405	S40500	...	...	7	1
13	12Cr-Al	Smls. tube	SA-268	TP405	S40500	...	...	7	1
14	12 ¹ / ₂ Cr-2Ni	Bar	SA-479	414	S41400	...	...	6	4
15	13Cr	Plate	SA-240	410S	S41008	...	...	7	1
16	13Cr	Smls. tube	SA-268	TP410	S41000	...	...	6	1
17	13Cr	Plate	SA-240	410	S41000	...	...	6	1
18	13Cr	Forgings	SA-182	F6a	S41000	1	...	6	1
19	13Cr	Forgings	SA-182	F6a	S41000	1	...	6	3
20	13Cr	Bar	SA-479	410	S41000	A	...	6	1
21	13Cr	Bar	SA-479	410	S41000	1	...	6	1
22	13Cr	Forgings	SA-182	F6a	S41000	2	...	6	3
23	13Cr	Forgings	SA-336	F6	S41000	...	...	6	3
24	13Cr	Castings	SA-217	CA15	J91150	...	...	6	3
25	13Cr	Cast pipe	SA-426	CPCA15	J91150	...	...	6	3
26	13Cr	Bar	SA/EN 10088-3	X12Cr13	...	QT650	$t \leq 160$	...	...
27	13Cr-4Ni	Castings	SA-487	CA6NM	J91540	A	...	6	4
28	13Cr-4Ni	Forgings	SA-182	F6NM	S41500	...	...	6	4
29	13Cr-4Ni	Bar	SA-479	...	S41500	...	...	6	4
30	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	...	...	...	...
31	15Cr	Smls. tube	SA-268	TP429	S42900	...	...	6	2
32	15Cr	Plate	SA-240	429	S42900	...	...	6	2
33	17Cr	Smls. tube	SA-268	TP430	S43000	...	...	7	2
34	17Cr	Plate	SA-240	430	S43000	...	...	7	2
35	17Cr-4Ni-4Cu	Forgings, bar	SA-564	630	S17400	H1150	...	...	...
(25) 36	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1150	...	...	...
(25) 37	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1150	...	...	...
38	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1100	...	...	...
39	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1100	...	...	...
40	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1100	...	...	...
41	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1075	...	...	...
42	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1075	...	...	...
43	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1075	...	...	...
44	26Cr-3Ni-3Mo	Plate	SA-240	26-3-3	S44660	...	≤ 5	10K	1
45	26Cr-3Ni-3Mo	Smls. tube	SA-268	26-3-3	S44660	...	≤ 5	10K	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	620	415	371 (SPT)	371	CS-3	...
2	620	415	371	NP	CS-3	...
3	585	415	371	NP	CS-3	...
4	585	415	371	NP	CS-3	...
5	585	415	371	NP	CS-3	...
6	620	415	371	NP	CS-3	...
7	585	415	NP	482	CS-3	...
8	485	275	371	NP	...	...
9	485	275	371	NP	...	...
10	410	174	371	NP	CS-1	G13
11	415	170	371	427	CS-1	G13
12	415	170	371	NP	CS-1	G13
13	415	205	NP	427	CS-2	G13
14	795	620	371	NP	CS-3	...
15	415	205	371	427	CS-2	...
16	415	205	NP	427	CS-2	...
17	450	205	NP	427	CS-2	...
18	485	275	371	NP	CS-2	...
19	485	275	NP	427	CS-3	E3
20	485	275	371	NP	CS-2	...
21	485	275	371	NP	CS-2	...
22	585	380	371	427	CS-3	...
23	585	380	NP	427	CS-3	...
24	620	450	371	38	CS-5	...
25	620	450	371	NP	CS-5	...
26	650	450	371 (SPT)	NP	...	H2, W1
27	760	550	371	NP	CS-5	...
28	795	620	371	NP	CS-3	...
29	795	620	371	NP	CS-3	...
30	1035	930	316	NP	HA-7	W1
31	415	240	NP	427	CS-2	G13
32	450	205	NP	427	CS-2	G13
33	415	240	NP	427	CS-2	G13
34	450	205	NP	427	CS-2	G13
35	930	725	343	NP	HT-1	G8, W1
36	930	725	343	316	HT-1	G8, W8
37	930	725	343	316	HT-1	G8, W8
38	965	795	343	316	HT-1	G8, W1
39	965	795	343	316	HT-1	G8, W1
40	965	795	343	316	HT-1	G8, W1
41	1000	860	343	NP	HT-1	G8, W1
42	1000	860	343	NP	HT-1	G8, W1
43	1000	860	343	NP	HT-1	G8, W1
44	585	450	NP	371	HA-5	G13, H6
45	585	450	NP	371	HA-5	G13, H6

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
2	207	206	206	203	201	199	198	196	194	191	188	...	...	...	...	...
3	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
4	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
5	195	195	195	195	195	194	194	192	190	187	183	...	...	...	...	...
6	207	207	207	207	207	206	205	204	201	198	194	...	...	...	...	...
7	195	195	195	195	195	194	194	192	190	187	183	178	172	165	156	147
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	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...	...
11	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	90.2	87.1	83.5	...	...
12	115	110	105	103	102	100	98.9	97.2	96.1	94.7	92.7	...	...	...	...	...
13	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
14	264	264	264	262	260	254	249	244	241	237	232	...	...	...	...	...
15	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
16	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
17	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
18	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
19	161	161	161	159	158	155	153	150	148	145	142	137	133	125	92.5	68.4
20	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
21	161	161	160	159	158	155	153	150	148	145	141	...	...	...	...	...
22	195	195	195	194	192	188	186	182	180	176	172	167	161	155	...	...
23	195	195	195	194	192	188	186	182	180	176	172	167	161	155	...	...
24	207	207	207	205	203	199	197	193	190	186	182	...	...	...	...	...
25	207	207	207	205	203	199	197	193	190	186	182	...	...	...	...	...
26	217	217	217	215	212	209	206	202	199	196	191	...	...	...	...	...
27	253	253	253	250	248	242	238	233	231	227	224	...	...	...	...	...
28	264	264	264	264	264	262	254	244	240	235	229	...	...	...	...	...
29	264	264	264	264	264	262	254	244	240	235	229	...	...	...	...	...
30	345	345	345	345	345	341	331	319	313	...	...	...	...	...	...	...
31	138	138	138	137	135	133	131	129	127	124	122	118	113	109	...	...
32	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
33	138	138	138	137	135	133	131	129	127	124	122	118	113	109	...	...
34	138	132	126	124	123	120	119	117	115	114	111	108	104	101	...	...
35	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
36	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
37	310	310	310	310	310	302	296	292	290	288	...	...	...	...	...	...
38	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
39	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
40	322	322	322	322	322	314	308	303	301	299	...	...	...	...	...	...
41	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
42	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
43	333	333	333	333	333	325	319	314	312	309	...	...	...	...	...	...
44	195	195	195	195	195	193	191	191	190	189	188	...	...	...	...	...
45	195	195	195	195	195	193	191	191	190	189	188	...	...	...	...	...

(25)
(25)

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	26Cr-3Ni-3Mo	Wld. tube	SA-268	26-3-3	S44660	...	≤5	10K	1
2	26Cr-3Ni-3Mo	Wld. tube	SA-803	26-3-3	S44660	...	≤5	10K	1
3	27Cr-1Mo	Plate	SA-240	XM-27	S44627	...	...	10I	1
4	27Cr-1Mo	Smls. & wld. tube	SA-268	TPXM-27	S44627	...	...	10I	1
5	27Cr-1Mo	Bar	SA-479	XM-27	S44627	...	...	10I	1
6	29Cr-4Mo-Ti	Smls. tube	SA-268	...	S44735	...	...	10J	1
7	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	NT	...	...	...
8	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	QT	...	...	...
9	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2	J13005	A	...	3	3
10	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	A	K12021	...	...	3	2
11	Mn- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	H75	K12021	...	...	3	2
12	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	B	K12022	...	...	3	3
13	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	1	...	3	3
14	Mn- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	H80	K12022	...	...	3	3
15	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	2	...	3	3
16	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	3	...	11A	4
17	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	1	...	3	3
18	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	2	...	3	3
19	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	3	...	11A	4
20	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-302	C	K12039	...	...	3	3
21	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	1	...	3	3
22	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J80	K12539	...	...	3	3
23	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	2	...	3	3
24	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J90	K12539	...	...	3	3
25	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	3	...	11A	4
26	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J100	K12539	...	...	11A	4
27	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-302	D	K12054	...	...	3	3
28	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	1	...	3	3
29	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	1	...	3	3
30	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	2	...	3	3
31	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	2	...	3	3
(25) 32	...	...	...	...	...	...	...	...	...
33	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	3	...	11A	4
34	Mn- $\frac{1}{2}$ Ni-V	Plate	SA/NF A 36-215	P440NJ4	...	...	$8 \leq t \leq 20$	10A	1
35	Mn- $\frac{1}{2}$ Ni-V	Plate	SA-225	C	K12524	...	...	10A	1
36	Mn-V	Castings	SA-487	1	J13002	A/NT	...	10A	1
37	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	A/NT	...	3	3
38	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	1	...	3	3
39	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	2	...	3	3
40	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	$65 < t \leq 100$	11B	3
41	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Plate	SA-517	F	K11576	...	≤65	11B	3
42	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	≤65	11B	3
43	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Smls. tube	SA-423	2	K11540	...	...	4	2
44	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	1	...	3	3
45	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	1	...	3	3

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	585	450	NP	371	HA-5	G13, G18, H6
2	585	450	NP	316	HA-5	G13, G18, H6
3	450	275	343	NP	HA-2	G13
4	450	275	343	NP	HA-2	G13
5	450	275	343	NP	HA-2	G13
6	515	415	NP	316	HA-6	G13
7	725	450	NP	343	CS-5	G19, W5, W6
8	725	450	NP	343	CS-5	G19, W5, W6
9	585	365	371 (SPT)	NP	CS-3	...
10	515	310	371	371	CS-3	...
11	515	310	371	NP	CS-3	G1, G2
12	550	345	371	371	CS-3	...
13	550	345	371	371	CS-5	...
14	550	345	371	NP	CS-3	G1, G2
15	620	485	371	371	CS-5	...
16	690	570	371	NP	CS-5	...
17	550	345	371	NP	CS-5	...
18	620	485	371	371	CS-5	...
19	690	570	371	371	CS-5	...
20	550	345	371	371	CS-3	...
21	550	345	371	371	CS-5	...
22	550	345	371	NP	CS-5	G1, G2
23	620	485	371	371	CS-5	...
24	620	485	371	NP	CS-5	G1, G2
25	690	570	371	371	CS-5	...
26	690	570	371	NP	CS-5	G1, G2
27	550	345	371	371	CS-3	...
28	550	345	371	371	CS-5	...
29	550	345	NP	371	CS-5	...
30	620	485	371	371	CS-5	...
31	620	485	NP	371	CS-5	...
32	...	...	...	...	...	...
33	690	570	371	NP	CS-5	...
34	630	440	NP	65	CS-5	...
35	725	485	NP	371	CS-5	...
36	585	380	371 (SPT)	371	CS-3	...
37	620	415	371	371	CS-3	...
38	550	345	371	371	CS-5	...
39	620	450	371	371	CS-5	...
40	725	620	371 (SPT)	371	CS-5	S1
41	795	690	371 (SPT)	371	HT-1	...
42	795	690	NP	371	HT-1	...
43	415	255	NP	371	CS-2	...
44	550	345	371	371	CS-5	...
45	550	345	371	371	CS-5	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	166	166	166	166	165	164	163	162	161	160	160	...	...	...	...	...
2	166	166	166	166	165	164	163	162	161	...	...	...	...	...	...	...
3	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
4	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
5	150	150	149	147	144	135	131	129	129	128	...	...	...	...	...	...
6	172	171	169	168	167	166	163	161	160	...	...	...	...	...	...	...
7	241	236	229	228	226	226	226	226	226	226	...	...	...	...	...	...
8	241	236	229	228	226	226	226	226	226	226	...	...	...	...	...	...
9	195	195	195	195	195	194	194	190	187	185	182	...	...	...	...	...
10	172	172	172	172	172	172	172	172	172	171	168	...	...	...	...	...
11	172	172	172	172	172	172	172	172	172	171	168	...	...	...	...	...
12	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
13	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
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	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
17	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
18	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
19	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
20	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
21	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
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	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
25	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
26	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
27	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
28	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
29	183	183	183	183	183	183	183	183	183	183	183	...	...	...	...	...
30	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
31	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	230	230	230	230	230	230	230	230	230	230	230	...	...	...	...	...
34	210	210	210	...	...	...	...	...	...	...	...	...	...	...	...	...
35	241	241	241	241	241	241	241	241	239	233	229	...	...	...	...	...
36	196	190	184	181	180	180	180	178	175	172	168	...	...	...	...	...
37	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
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	241	241	241	241	241	241	241	241	241	240	236	...	...	...	...	...
41	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
42	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
43	138	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...
44	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...
45	184	184	184	184	184	184	184	184	184	184	184	...	...	...	...	...

(25)

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\frac{1}{3}\text{Cr}-\text{V}$	Forgings	SA-508	2	K12766	2	...	3	3
2	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\frac{1}{3}\text{Cr}-\text{V}$	Forgings	SA-541	2	K12765	2	...	3	3
3	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\text{Cr}-\text{V}$	Forgings	SA-508	3	K12042	1	...	3	3
4	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\text{Cr}-\text{V}$	Forgings	SA-508	3	K12042	2	...	3	3
5	$\frac{3}{4}\text{Ni}-1\text{Mo}-\frac{3}{4}\text{Cr}$	Castings	SA-217	WC5	J22000	...	...	4	1
6	$1\text{Ni}-\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Castings	SA-217	WC4	J12082	...	...	4	1
7	$1\frac{1}{4}\text{Ni}-1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-517	P	K21650	...	$65 < t \leq 100$	11B	8
8	$1\frac{1}{4}\text{Ni}-1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-517	P	K21650	...	≤ 65	11B	8
9	2Ni-1Cu	Forgings	SA-182	FR	K22035	...	...	9A	1
10	2Ni-1Cu	Smls. pipe	SA-333	9	K22035	...	...	9A	1
11	2Ni-1Cu	Smls. pipe	SA-334	9	K22035	...	...	9A	1
12	2Ni-1Cu	Forgings	SA-350	LF9	K22036	...	...	9A	1
13	2Ni-1Cu	Fittings	SA-420	WPL9	K22035	...	...	9A	1
(25) 14	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-372	N	K23550	100	...	...	...
15	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-723	1	K23550	1	...	...	...
(25) 16	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-372	N	K23550	120	...	...	...
17	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-723	1	K23550	2	...	...	...
18	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-723	1	K23550	3	...	...	...
19	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-723	1	K23550	4	...	...	...
20	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	Forgings	SA-723	1	K23550	5	...	...	...
21	$2\frac{1}{2}\text{Ni}$	Plate	SA-203	A	K21703	...	...	9A	1
22	$2\frac{1}{2}\text{Ni}$	Plate	SA-203	B	K22103	...	...	9A	1
23	$2\frac{1}{2}\text{Ni}$	Castings	SA-352	LC2	J22500	...	...	9A	1
24	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	C	...	3	...	3	3
25	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	C	...	1	...	11A	5
26	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	C	...	2	...	11B	10
(25) 27	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-372	P	K34035	100	...	...	...
28	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	1	...	...	...
(25) 29	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-372	P	K34035	120	...	...	...
30	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	2	...	...	...
31	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	3	...	...	...
32	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	4	...	...	...
33	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	5	...	...	...
34	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	3	...	3	3
35	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	1	...	11A	5
36	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	2	...	11B	10
37	$3\frac{1}{2}\text{Ni}$	Smls. pipe	SA-333	3	K31918	...	...	9B	1
38	$3\frac{1}{2}\text{Ni}$	Smls. tube	SA-334	3	K31918	...	...	9B	1
39	$3\frac{1}{2}\text{Ni}$	Fittings	SA-420	WPL3	...	...	...	9B	1
40	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	D	K31718	...	...	9B	1
41	$3\frac{1}{2}\text{Ni}$	Forgings	SA-350	LF3	K32025	...	...	9B	1
42	$3\frac{1}{2}\text{Ni}$	Forgings	SA-765	III	K32026	...	...	9B	1
43	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	E	K32018	...	...	9B	1
44	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	E	K32018	...	...	9B	1
45	$3\frac{1}{2}\text{Ni}$	Castings	SA-352	LC3	J31550	...	...	9B	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	620	450	371	371	CS-5	...
2	620	450	371	371	CS-5	...
3	550	345	371	371	CS-5	...
4	620	450	371	371	CS-5	...
5	485	275	371	371	CS-2	...
6	485	275	371 (SPT)	371	CS-2	...
7	725	620	371 (SPT)	371	CS-5	...
8	795	690	371 (SPT)	371	HT-1	...
9	435	315	NP	38	CS-3	...
10	435	315	NP	38	CS-3	...
11	435	315	NP	38	CS-3	...
12	435	315	NP	38	CS-3	...
13	435	315	NP	38	CS-3	...
14	795	690	NP	343	HT-1	W1
15	795	690	371 (SPT)	371	HT-1	G14, G20, W1
16	930	825	NP	343	HT-1	W1
17	930	825	371 (SPT)	371	HT-1	G6, G20, W1
18	1070	965	371 (SPT)	NP	HT-1	W1
19	1205	1105	371 (SPT)	NP	HT-1	W1
20	1310	1240	371 (SPT)	NP	HT-1	W1
21	450	255	NP	149	CS-2	...
22	485	275	NP	149	CS-2	...
23	485	275	38	38	CS-2	...
24	620	485	NP	343	CS-5	...
25	725	585	NP	343	CS-5	...
26	795	690	NP	343	HT-1	...
27	795	690	NP	343	HT-1	W1
28	795	690	371 (SPT)	371	HT-1	G14, G20, W1
29	930	825	NP	343	HT-1	W1
30	930	825	371 (SPT)	371	HT-1	G6, G20, W1
31	1070	965	371 (SPT)	NP	HT-1	W1
32	1205	1105	371 (SPT)	NP	HT-1	W1
33	1310	1240	371 (SPT)	NP	HT-1	W1
34	620	485	NP	343	CS-5	...
35	725	585	343	343	CS-5	G5, H3, S4, W3
36	795	690	NP	343	HT-1	...
37	450	240	NP	38	CS-2	...
38	450	240	NP	38	CS-2	...
39	450	240	NP	149	CS-2	...
40	450	255	NP	149	CS-2	...
41	485	260	371	149	CS-2	...
42	485	260	NP	38	CS-2	...
43	485	275	149 (SPT)	149	CS-2	...
44	485	275	260	NP	CS-2	...
45	485	275	38	38	CS-2	...

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
2	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
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	161	161	161	161	161	161	159	156	154	152	149	...	...	...	...	...
6	161	161	161	161	161	161	159	156	154	152	149	...	...	...	...	...
7	241	241	241	241	241	241	241	241	241	240	236	...	...	...	...	...
8	264	264	264	264	264	264	264	264	264	263	258	...	...	...	...	...
9	145	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	145	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	145	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	145	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	145	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	264	264	264	264	264	264	264	264	263	259	...	...	...	...	...	(25)
15	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...
16	310	310	310	310	310	310	310	310	309	304	...	...	...	...	...	(25)
17	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...
18	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...
19	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...
20	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...
21	150	150	150	150	150	...	...	...	...	...	...	...	...	...	...	...
22	161	161	161	161	161	...	...	...	...	...	...	...	...	...	...	...
23	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...	...
25	241	241	241	241	241	239	237	236	233	230	...	...	...	...	...	...
26	264	264	264	264	264	262	260	257	255	252	...	...	...	...	...	...
27	264	264	264	264	264	264	264	264	263	259	...	...	...	...	...	(25)
28	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...
29	310	310	310	310	310	310	310	310	309	304	...	...	...	...	...	(25)
30	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...
31	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...
32	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...
33	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...
34	207	207	207	207	207	205	204	202	200	197	...	...	...	...	...	...
35	241	241	241	241	241	239	237	236	233	230	...	...	...	...	...	...
36	264	264	264	264	264	262	260	257	255	252	...	...	...	...	...	...
37	150	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	150	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	150	149	147	145	142	...	...	...	...	...	...	...	...	...	...	...
40	150	150	150	150	150	...	...	...	...	...	...	...	...	...	...	...
41	161	160	157	155	152	148	142	133	128	122	116	...	...	...	...	...
42	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	161	161	161	161	161	...	...	...	...	...	...	...	...	...	...	...
44	161	161	161	161	161	158	151	...	...	...	...	...	...	...	...	...
45	161	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	3 $\frac{1}{2}$ Ni	Plate	SA-203	F	...	...	>50	9B	1
2	3 $\frac{1}{2}$ Ni	Plate	SA-203	F	...	...	≤50	9B	1
3	3 $\frac{1}{2}$ Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-508	4N	K22375	3	...	3	3
4	3 $\frac{1}{2}$ Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-508	4N	K22375	1	...	11A	5
5	3 $\frac{1}{2}$ Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-508	4N	K22375	2	...	11B	10
6	4Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	3	K44045	1	...	...	...
7	4Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	3	K44045	2	...	...	...
8	4Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	3	K44045	3	...	...	...
9	4Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	3	K44045	4	...	...	...
10	4Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	3	K44045	5	...	...	...
11	5Ni- $\frac{1}{4}$ Mo	Plate	SA-645	...	K41583	...	...	11A	2
12	7Ni	Plate	SA-553	III	K61365	...	≤50	11A	1
13	7Ni	Plate	SA-553	III	K61365	...	≤50	11A	1
14	8Ni	Plate	SA-553	II	K71340	...	...	11A	1
15	8Ni	Plate	SA-553	II	K71340	...	...	11A	1
16	9Ni	Smls. pipe	SA-333	8	K81340	...	...	11A	1
17	9Ni	Smls. pipe	SA-333	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	Plate	SA-353	...	K81340	...	...	11A	1
21	9Ni	Plate	SA-353	...	K81340	...	...	11A	1
22	9Ni	Fittings	SA-420	WPL8	K81340	...	...	11A	1
23	9Ni	Fittings	SA-420	WPL8	K81340	...	...	11A	1
24	9Ni	Forgings	SA-522	I	K81340	...	...	11A	1
25	9Ni	Forgings	SA-522	I	K81340	...	...	11A	1
26	9Ni	Plate	SA-553	I	K81340	...	...	11A	1
27	9Ni	Plate	SA-553	I	K81340	...	...	11A	1
28	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660	S66286	...	...	...	...
(25) 29	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10	N08810	...	...	45	...
(25) 30	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H	N08810	...	...	45	...
(25) 31	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...	...	45	...
(25) 32	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H	N08810	...	...	45	...
(25) 33	42Fe-33Ni-21Cr	Bar	SA-276	800H	N08810	...	...	45	...
(25) 34	42Fe-33Ni-21Cr	Smls. pipe	SA-312	800H	N08810	...	...	45	...
(25) 35	42Fe-33Ni-21Cr	Wld. pipe	SA-312	800H	N08810	...	...	45	...
(25) 36	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H	N08810	...	...	45	...
(25) 37	42Fe-33Ni-21Cr	Bar	SA-479	800H	N08810	...	...	45	...
(25) 38	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H	N08810	...	...	45	...
(25) 39	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10	N08810	...	...	45	...
40	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	...	8	3
41	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	...	8	3
42	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	>130	8	1
43	16Cr-12Ni-2Mo	Forgings	SA-965	F316L	S31603	...	...	8	1
44	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316L	...	...	...	8	1
45	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	≤130	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	345	NP	38	CS-3	...
2	550	380	NP	38	CS-3	...
3	620	485	343	371	CS-5	...
4	725	585	343	371	CS-5	H3, S4, W3
5	795	690	NP	343	HT-1	...
6	795	690	371 (SPT)	371	HT-1	G14, G20, W1
7	930	825	371 (SPT)	371	HT-1	G6, G20, W1
8	1070	965	371 (SPT)	NP	HT-1	W1
9	1205	1105	371 (SPT)	NP	HT-1	W1
10	1310	1240	371 (SPT)	NP	HT-1	W1
11	655	450	NP	121	CS-3	W4
12	690	515	NP	66	CS-3	G22, W7
13	690	515	NP	66	CS-3	G22, W4
14	690	585	NP	121	CS-3	W7
15	690	585	NP	121	CS-3	W4
16	690	515	NP	121	CS-3	W7
17	690	515	NP	121	CS-3	W4
18	690	515	NP	121	CS-3	W7
19	690	515	NP	121	CS-3	W4
20	690	515	NP	121	CS-3	W7
21	690	515	NP	121	CS-3	W4
22	690	515	NP	121	CS-3	W7
23	690	515	NP	121	CS-3	W4
24	690	515	NP	121	CS-3	G19, S6, W7
25	690	515	NP	121	CS-3	G19, S6, W4
26	690	585	NP	121	CS-3	W7
27	690	585	NP	121	CS-3	W4
28	895	585	371	NP	HA-5	W1
29	450	170	427	427	NFN-9	G7, G23, G24
30	450	170	427	427	NFN-9	G7, G24
31	450	170	427	427	NFN-9	G7, G24
32	450	170	NP	427	NFN-9	G7, G18
33	450	170	427	427	NFN-9	G7, G23, G24
34	450	170	427	427	NFN-9	G7, G24
35	450	170	NP	427	NFN-9	G7, G18, G24
36	450	170	NP	427	NFN-9	G7, G18, G24
37	450	170	427	427	NFN-9	G7, G23, G24
38	450	170	NP	427	NFN-9	G7, G18
39	450	170	427	427	NFN-9	G7, G23, G24
40	655	310	NP	38	HA-6	...
41	655	310	NP	427	HA-6	G7
42	450	170	427	427	HA-4	G7
43	450	170	427	427	HA-4	G7
44	480	175	427	NP	HA-4	G7
45	485	170	427	427	HA-4	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	184	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	207	207	207	207	207	205	204	202	200	197	194	...	...	...	...	...
4	241	241	241	241	241	239	237	236	233	230	226	...	...	...	...	...
5	264	264	264	264	264	262	260	257	255	252	...	...	...	...	...	...
6	264	264	264	264	264	264	264	264	263	259	253	...	...	...	...	...
7	310	310	310	310	310	310	310	310	309	304	297	...	...	...	...	...
8	356	356	356	356	356	356	356	356	355	349	341	...	...	...	...	...
9	402	402	402	402	402	402	402	402	401	394	386	...	...	...	...	...
10	436	436	436	436	436	436	436	436	435	428	418	...	...	...	...	...
11	208	208	193	191	...	...	...	...	...	...	...	...	...	...	...	...
12	230	230	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	219	219	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
15	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
16	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
17	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
18	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
19	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
20	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
21	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
22	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
23	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
24	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
25	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
26	230	230	213	207	...	...	...	...	...	...	...	...	...	...	...	...
27	219	219	202	197	...	...	...	...	...	...	...	...	...	...	...	...
28	299	299	299	299	299	299	294	289	287	284	282	...	...	...	...	...
29	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
30	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
31	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
32	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3	...	...	(25)
33	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
34	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
35	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3	...	...	(25)
36	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3	...	...	(25)
37	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
38	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3	...	...	(25)
39	115	115	115	115	115	115	115	115	113	110	108	105	104	...	...	(25)
40	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	207	203	187	179	170	162	159	158	158	157	156	154	152	149	146	143
42	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
43	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
44	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
45	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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. tube	SA-213	TP316L	S31603	...	...	8	1
2	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	...	...	8	1
3	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...	8	1
4	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...	8	1
5	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	...	8	1
6	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316L	S31603	...	...	8	1
7	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	...	8	1
8	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	1	...	8	1
9	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	3	...	8	1
10	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	4	...	8	1
11	16Cr-12Ni-2Mo	Fittings	SA-403	316L	S31603	...	...	8	1
12	16Cr-12Ni-2Mo	Fittings	SA-403	316L	S31603	CR	...	8	1
13	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316L	S31603	WP-W	...	8	1
14	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316L	S31603	WP-W	...	8	1
15	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316L	S31603	WP-WX	...	8	1
16	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	...	...	8	1
17	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L	S31603	...	...	8	1
18	16Cr-12Ni-2Mo	Wld. pipe	SA-688	TP316L	S31603	...	...	8	1
19	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316L	S31603	...	...	8	1
20	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316L	S31603	...	...	8	1
21	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	>130	8	1
22	16Cr-12Ni-2Mo	Forgings	SA-965	F316	S31600	...	...	8	1
23	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	>130	8	1
24	16Cr-12Ni-2Mo	Forgings	SA-965	F316H	S31609	...	...	8	1
25	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	≤130	8	1
26	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...	...	8	1
27	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...	...	8	1
28	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...	8	1
29	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...	8	1
30	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	...	8	1
31	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316	S31600	...	...	8	1
32	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	...	8	1
33	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	1	...	8	1
34	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	3	...	8	1
35	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	4	...	8	1
36	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316	S31600	...	...	8	1
37	16Cr-12Ni-2Mo	Fittings	SA-403	316	S31600	...	...	8	1
38	16Cr-12Ni-2Mo	Fittings	SA-403	316	S31600	WP-S	...	8	1
39	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316	S31600	WP-W	...	8	1
40	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	...	...	8	1
41	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	...	8	1
42	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	...	8	1
43	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316	S31600	...	...	8	1
44	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316	S31600	...	...	8	1
45	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	≤130	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	485	170	427	427	HA-4	G7
2	485	170	427	427	HA-4	G7
3	485	170	427	NP	HA-4	G7
4	485	170	NP	427	HA-4	G7, G18
5	485	170	427	NP	HA-4	G7
6	485	170	427	427	HA-4	G7
7	485	170	NP	427	HA-4	G7, G18
8	485	170	427	NP	HA-4	G7
9	485	170	427	NP	HA-4	G7
10	485	170	427	NP	HA-4	G7
11	485	170	427	NP	HA-4	G7
12	485	170	NP	427	HA-4	G7, G18
13	485	170	427	NP	HA-4	G7
14	485	170	NP	427	HA-4	G7, G18
15	485	170	NP	427	HA-4	G7, G18
16	485	170	427	NP	HA-4	G7
17	485	170	427	NP	HA-4	G7
18	485	170	NP	427	HA-4	G7, G18
19	485	170	427	NP	HA-4	G7
20	485	170	427	NP	HA-4	G7
21	485	205	427	427	HA-2	G7
22	485	205	427	427	HA-2	G7, G9, G10
23	485	205	427	427	HA-2	G7
24	485	205	427	427	HA-2	G7
25	515	205	427	427	HA-2	G7, G9
26	515	205	427	427	HA-2	G7, G9
27	515	205	427	427	HA-2	G7, G9, G10
28	515	205	427	NP	HA-2	G7
29	515	205	NP	427	HA-2	G7, G9, G18
30	515	205	427	NP	HA-2	G7
31	515	205	427	427	HA-2	G7, G9, G10
32	515	205	NP	427	HA-2	G7, G9, G18
33	515	205	427	NP	HA-2	G7
34	515	205	427	NP	HA-2	G7
35	515	205	427	NP	HA-2	G7
36	515	205	427	427	HA-2	G7, G9, G10
37	515	205	427	NP	HA-2	G7
38	515	205	NP	427	HA-2	G7
39	515	205	427	NP	HA-2	G7
40	515	205	427	NP	HA-2	G7
41	515	205	427	NP	HA-2	G7
42	515	205	NP	427	HA-2	G7, G9, G18
43	515	205	427	NP	HA-2	G7
44	515	205	427	NP	HA-2	G7
45	515	205	427	NP	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
2	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
3	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
4	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	...	...
5	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
6	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
7	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	...	...
8	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
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	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	...	...
13	115	115	115	115	115	109	103	98.0	95.7	94.1	92.8	90.9	89.0	87.8	...	...
14	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	...	...
15	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	...	...
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	...	...
18	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	...	...
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	...	...
21	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
22	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
23	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
24	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
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	...	...
28	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
29	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
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	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
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	...	...
41	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
42	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
43	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
44	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
45	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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. tube	SA-213	TP316H	S31609	...	...	8	1
2	16Cr-12Ni-2Mo	Plate	SA-240	316H	S31609	...	...	8	1
3	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...	8	1
4	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	...	8	1
5	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316H	S31609	...	...	8	1
6	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316H	S31609	...	...	8	1
7	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316H	S31609	...	...	8	1
8	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	1	...	8	1
9	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	3	...	8	1
10	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	4	...	8	1
11	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H	S31609	...	...	8	1
12	16Cr-12Ni-2Mo	Fittings	SA-403	316H	S31609	...	...	8	1
13	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316H	S31609	WP-W	...	8	1
14	16Cr-12Ni-2Mo	Bar	SA-479	316H	S31609	...	...	8	1
15	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316H	S31609	...	...	8	1
16	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316H	S31609	...	...	8	1
17	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316	...	...	...	8	1
18	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2	...	...	≤75	8	1
19	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...	≤75	8	1
20	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...	>130	8	1
21	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316LN	S31653	...	...	8	1
22	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...	≤130	8	1
23	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316LN	S31653	...	...	8	1
24	16Cr-12Ni-2Mo-N	Plate	SA-240	316LN	S31653	...	...	8	1
25	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316LN	S31653	...	...	8	1
26	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316LN	S31653	...	...	8	1
27	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	1	...	8	1
28	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	3	...	8	1
29	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	4	...	8	1
30	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316LN	S31653	...	...	8	1
31	16Cr-12Ni-2Mo-N	Fittings	SA-403	316LN	S31653	...	...	8	1
32	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316LN	S31653	WP-W	...	8	1
33	16Cr-12Ni-2Mo-N	Bar	SA-479	316LN	S31653	...	...	8	1
34	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316LN	S31653	...	...	8	1
35	16Cr-12Ni-2Mo-N	Wld. pipe	SA-813	TP316LN	S31653	...	...	8	1
36	16Cr-12Ni-2Mo-N	Wld. pipe	SA-814	TP316LN	S31653	...	...	8	1
37	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316N	S31651	...	≤130	8	1
38	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N	S31651	...	≤125	8	1
39	16Cr-12Ni-2Mo-N	Plate	SA-240	316N	S31651	...	≤125	8	1
40	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	...	8	1
41	16Cr-12Ni-2Mo-N	Wld. pipe	SA-312	TP316N	S31651	...	≤125	8	1
42	16Cr-12Ni-2Mo-N	Smls. pipe	SA-312	TP316N	S31651	...	≤125	8	1
43	16Cr-12Ni-2Mo-N	Wld. pipe	SA-312	TP316N	S31651	...	...	8	1
44	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	1	≤125	8	1
45	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	3	≤125	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	427	427	HA-2	G7
2	515	205	427	NP	HA-2	G7
3	515	205	427	NP	HA-2	G7
4	515	205	NP	427	HA-2	G7, G18
5	515	205	427	NP	HA-2	G7
6	515	205	427	427	HA-2	G7
7	515	205	NP	427	HA-2	G7, G18
8	515	205	427	NP	HA-2	G7
9	515	205	427	NP	HA-2	G7
10	515	205	427	NP	HA-2	G7
11	515	205	427	427	HA-2	G7
12	515	205	427	NP	HA-2	G7
13	515	205	427	NP	HA-2	G7
14	515	205	427	NP	HA-2	G7
15	515	205	427	NP	HA-2	G7
16	515	205	427	NP	HA-2	G7
17	520	205	427	NP	HA-2	G7
18	520	220	NP	427	HA-4	G7
19	520	220	NP	427	HA-2	G7
20	485	205	427	NP	HA-2	G7
21	485	205	427	NP	HA-2	G7
22	515	205	427	NP	HA-2	G7
23	515	205	427	NP	HA-2	G7
24	515	205	427	NP	HA-2	G7
25	515	205	427	NP	HA-2	G7
26	515	205	427	NP	HA-2	G7
27	515	205	427	NP	HA-2	G7
28	515	205	427	NP	HA-2	G7
29	515	205	427	NP	HA-2	G7
30	515	205	427	NP	HA-2	G7
31	515	205	427	NP	HA-2	G7
32	515	205	427	NP	HA-2	G7
33	515	205	427	NP	HA-2	G7
34	515	205	427	NP	HA-2	G7
35	515	205	427	NP	HA-2	G7
36	515	205	427	NP	HA-2	G7
37	550	240	427	NP	HA-2	G7
38	550	240	427	427	HA-2	G7
39	550	240	427	427	HA-2	G7
40	550	240	NP	427	HA-2	G7, G18
41	550	240	427	NP	HA-2	G7
42	550	240	427	427	HA-2	G7
43	550	240	NP	427	HA-2	G7, G18
44	550	240	427	NP	HA-2	G7
45	550	240	427	NP	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
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	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
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	...	...
14	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
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	147	147	147	147	147	140	131	125	122	121	119	116	114	113	110	108
19	147	147	147	147	147	142	133	127	124	122	120	118	117	115	114	113
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	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	...	...
30	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...
31	138	138	138	138	138	131	122	116	113	110	107	105	102	99.7	...	...
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	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
38	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
39	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
40	137	137	137	137	137	137	132	125	122	119	117	115	113	110	...	...
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	...	...
43	137	137	137	137	137	137	132	125	122	119	117	115	113	110	...	...
44	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
45	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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-N	Wld. pipe	SA-358	316N	S31651	4	≤125	8	1
2	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N	S31651	...	...	8	1
3	16Cr-12Ni-2Mo-N	Fittings	SA-403	316N	S31651	...	...	8	1
4	16Cr-12Ni-2Mo-N	Fittings	SA-403	316N	S31651	CR	...	8	1
5	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316N	S31651	WP-W	...	8	1
6	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316N	S31651	WP-W	...	8	1
7	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316N	S31651	WP-WX	...	8	1
8	16Cr-12Ni-2Mo-N	Bar	SA-479	316N	S31651	...	...	8	1
9	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316N	S31651	...	...	8	1
10	16Cr-12Ni-2Mo-N	Wld. pipe	SA-813	TP316N	S31651	...	...	8	1
11	16Cr-12Ni-2Mo-N	Wld. pipe	SA-814	TP316N	S31651	...	...	8	1
12	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N	S31651	...	≤125	8	1
13	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-11-2	...	...	≤75	8	1
14	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-13-3	...	...	≤75	8	1
15	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	...	8	3
16	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	...	8	3
17	18Cr-5Ni-3Mo	Smls. tube	SA-789	...	S31500	...	...	10H	1
18	18Cr-5Ni-3Mo	Wld. tube	SA-789	...	S31500	...	...	10H	1
19	18Cr-5Ni-3Mo	Smls. pipe	SA-790	...	S31500	...	...	10H	1
20	18Cr-5Ni-3Mo	Wld. pipe	SA-790	...	S31500	...	...	10H	1
21	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	>130	8	1
22	18Cr-8Ni	Forgings	SA-965	F304L	S30403	...	...	8	1
23	18Cr-8Ni	Bar	SA/JIS G4303	SUS304L	...	...	...	8	1
24	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	≤130	8	1
25	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	...	...	8	1
26	18Cr-8Ni	Plate	SA-240	304L	S30403	...	...	8	1
27	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...	8	1
28	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...	8	1
29	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...	8	1
30	18Cr-8Ni	Smls. pipe	SA-312	TP304L	S30403	...	...	8	1
31	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...	8	1
32	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	1	...	8	1
33	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	3	...	8	1
34	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	4	...	8	1
35	18Cr-8Ni	Fittings	SA-403	304L	S30403	...	...	8	1
36	18Cr-8Ni	Fittings	SA-403	304L	S30403	WP-S	...	8	1
37	18Cr-8Ni	Wld. fittings	SA-403	304L	S30403	WP-W	...	8	1
38	18Cr-8Ni	Bar	SA-479	304L	S30403	...	...	8	1
39	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...	8	1
40	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...	8	1
41	18Cr-8Ni	Wld. pipe	SA-813	TP304L	S30403	...	...	8	1
42	18Cr-8Ni	Wld. pipe	SA-814	TP304L	S30403	...	...	8	1
43	18Cr-8Ni	Castings	SA-351	CF3	J92500	...	...	8	1
44	18Cr-8Ni	Cast pipe	SA-451	CPF3	J92500	...	...	8	1
45	18Cr-8Ni	Castings	SA-351	CF10	J92590	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	550	240	427	NP	HA-2	G7
2	550	240	427	427	HA-2	G7
3	550	240	427	NP	HA-2	G7
4	550	240	NP	427	HA-2	G7, G18
5	550	240	427	NP	HA-2	G7
6	550	240	NP	427	HA-2	G7, G18
7	550	240	NP	427	HA-2	G7, G18
8	550	240	427	NP	HA-2	G7
9	550	240	427	NP	HA-2	G7
10	550	240	427	NP	HA-2	G7
11	550	240	427	NP	HA-2	G7
12	550	240	427	427	HA-2	G7
13	580	280	...	427	HA-2	G7
14	580	280	...	427	HA-2	G7
15	690	380	NP	427	HA-6	G7
16	690	415	NP	427	HA-6	G7
17	635	440	NP	316	HA-5	G13
18	635	440	NP	316	HA-5	G13, G18
19	635	440	NP	316	HA-5	G13
20	635	440	NP	316	HA-5	G13, G18
21	450	170	427	427	HA-3	G7
22	450	170	NP	427	HA-3	G7
23	480	175	427	NP	HA-3	G7
24	485	170	427	427	HA-3	G7
25	485	170	427	427	HA-3	G7
26	485	170	427	427	HA-3	G7
27	485	170	427	NP	HA-3	G7
28	485	170	NP	427	HA-3	G7, G18
29	485	170	427	NP	HA-3	G7
30	485	170	427	427	HA-3	G7
31	485	170	NP	427	HA-3	G7, G18
32	485	170	427	NP	HA-3	G7
33	485	170	427	NP	HA-3	G7
34	485	170	427	NP	HA-3	G7
35	485	170	427	NP	HA-3	G7
36	485	170	NP	427	HA-3	G7
37	485	170	427	NP	HA-3	G7
38	485	170	427	NP	HA-3	G7
39	485	170	427	NP	HA-3	G7
40	485	170	NP	427	HA-3	G7, G18
41	485	170	427	NP	HA-3	G7
42	485	170	427	NP	HA-3	G7
43	485	205	427	427	HA-3	G7, G13
44	485	205	427	NP	HA-3	G7, G13
45	485	205	NP	427	HA-3	G7, G10, G13

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	...	...
2	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
3	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
4	137	137	137	137	137	137	132	125	122	119	117	115	113	110	...	...
5	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
6	137	137	137	137	137	137	132	125	122	119	117	115	113	110	...	...
7	137	137	137	137	137	137	132	125	122	119	117	115	113	110	...	...
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	161	161	161	161	161	161	155	147	144	140	137	135	133	130	...	...
13	187	187	187	187	182	174	166	157	152	149	145	142	139	136	...	...
14	187	187	187	187	182	174	166	157	152	149	145	142	139	136	...	...
15	230	228	223	216	209	201	190	181	177	174	172	169	166	163	...	...
16	230	228	223	216	209	201	197	193	191	187	184	180	175	170	...	...
17	212	208	203	199	196	195	195	195	195	...	...	...	...	...	...	...
18	180	177	173	169	167	165	165	165	165	...	...	...	...	...	...	...
19	212	208	203	199	196	195	195	195	195	...	...	...	...	...	...	...
20	180	177	173	169	167	165	165	165	165	...	...	...	...	...	...	...
21	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
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	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.9	76.6	75.4	...	...
29	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
30	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
31	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.9	76.6	75.4	...	...
32	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
33	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
34	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
35	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
36	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
37	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
38	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
39	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
40	97.9	97.9	97.9	97.9	97.9	93.0	87.2	82.9	81.6	80.2	78.4	77.9	76.6	75.4	...	...
41	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
42	115	115	115	115	115	110	103	97.7	95.8	94.1	92.9	91.6	89.7	88.4	...	...
43	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
44	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
45	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Castings	SA-351	CF8	J92600	...	...	8	1
2	18Cr-8Ni	Cast pipe	SA-451	CPF8	J92600	...	...	8	1
3	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	>130	8	1
4	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	≥200	8	1
5	18Cr-8Ni	Forgings	SA-965	F304	S30400	...	...	8	1
6	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	>130	8	1
7	18Cr-8Ni	Forgings	SA-965	F304H	S30409	...	...	8	1
8	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9	...	...	≤75	8	1
9	18Cr-8Ni	Plate	SA-240	302	S30200	...	...	8	1
10	18Cr-8Ni	Plate	SA-240	304H	S30409	...	...	8	1
11	18Cr-8Ni	Bar	SA-479	302	S30200	...	...	8	1
12	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	≤130	8	1
13	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...	...	8	1
14	18Cr-8Ni	Plate	SA-240	304	S30400	...	...	8	1
15	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...	8	1
16	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...	8	1
17	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...	8	1
18	18Cr-8Ni	Smls. pipe	SA-312	TP304	S30400	...	...	8	1
19	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...	8	1
20	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	1	...	8	1
21	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	3	...	8	1
22	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	4	...	8	1
23	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	<200	8	1
24	18Cr-8Ni	Fittings	SA-403	304	S30400	...	...	8	1
25	18Cr-8Ni	Fittings	SA-403	304	S30400	CR	...	8	1
26	18Cr-8Ni	Fittings	SA-403	304	S30400	WP-S	...	8	1
27	18Cr-8Ni	Wld. fittings	SA-403	304	S30400	WP-W	...	8	1
28	18Cr-8Ni	Wld. fittings	SA-403	304	S30400	WP-W	...	8	1
29	18Cr-8Ni	Wld. fittings	SA-403	304	S30400	WP-WX	...	8	1
30	18Cr-8Ni	Bar	SA-479	304	S30400	...	...	8	1
31	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...	8	1
32	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...	8	1
33	18Cr-8Ni	Wld. tube	SA-813	TP304	S30400	...	...	8	1
34	18Cr-8Ni	Wld. tube	SA-814	TP304	S30400	...	...	8	1
35	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	≤130	8	1
36	18Cr-8Ni	Smls. tube	SA-213	TP304H	S30409	...	...	8	1
37	18Cr-8Ni	Plate	SA-240	304H	S30409	...	...	8	1
38	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...	8	1
39	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...	8	1
40	18Cr-8Ni	Wld. pipe	SA-312	TP304H	S30409	...	...	8	1
41	18Cr-8Ni	Smls. pipe	SA-312	TP304H	S30409	...	...	8	1
42	18Cr-8Ni	Wld. pipe	SA-312	TP304H	S30409	...	...	8	1
43	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	1	...	8	1
44	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	3	...	8	1
45	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	4	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	485	205	427	427	HA-1	G7, G9, G10, G13
2	485	205	427	NP	HA-1	G7, G13
3	485	205	427	427	HA-1	G7, G9, G10
4	485	205	427	427	HA-1	G7, G9, G10, S2
5	485	205	427	427	HA-1	G7, G9, G10
6	485	205	427	427	HA-1	G7
7	485	205	427	427	HA-1	G7
8	500	200	NP	427	HA-3	G7
9	515	205	NP	427	HA-1	G7, G9
10	515	205	NP	427	HA-1	G7
11	515	205	427	NP	HA-1	G7
12	515	205	427	427	HA-1	G7, G9, G10
13	515	205	427	427	HA-1	G7, G9
14	515	205	427	427	HA-1	G7, G9, G10
15	515	205	427	NP	HA-1	G7
16	515	205	NP	427	HA-1	G7, G9, G18
17	515	205	427	NP	HA-1	G7
18	515	205	427	427	HA-1	G7, G9, G10
19	515	205	NP	427	HA-1	G7, G9, G18
20	515	205	427	NP	HA-1	G7
21	515	205	427	NP	HA-1	G7
22	515	205	427	NP	HA-1	G7
23	515	205	427	427	HA-1	G7, G9, G10, S5
24	515	205	427	NP	HA-1	G7
25	515	205	NP	427	HA-1	G7, G18
26	515	205	NP	427	HA-1	G7
27	515	205	427	NP	HA-1	G7
28	515	205	NP	427	HA-1	G7, G18
29	515	205	NP	427	HA-1	G7, G18
30	515	205	427	NP	HA-1	G7
31	515	205	427	NP	HA-1	G7
32	515	205	NP	427	HA-1	G7, G9, G18
33	515	205	427	NP	HA-1	G7
34	515	205	427	NP	HA-1	G7
35	515	205	427	427	HA-1	G7
36	515	205	427	427	HA-1	G7
37	515	205	427	NP	HA-1	G7
38	515	205	427	NP	HA-1	G7
39	515	205	NP	427	HA-1	G7, G18
40	515	205	427	NP	HA-1	G7
41	515	205	427	427	HA-1	G7
42	515	205	NP	427	HA-1	G7, G18
43	515	205	427	NP	HA-1	G7
44	515	205	427	NP	HA-1	G7
45	515	205	427	NP	HA-1	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	133	133	133	133	133	127	119	113	111	109	107	106	104	104	102	99.9
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	...	...
19	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
29	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	...	...
42	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
43	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
44	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
45	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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. pipe	SA-376	TP304H	S30409	...	...	8	1
2	18Cr-8Ni	Fittings	SA-403	304H	S30409	...	...	8	1
3	18Cr-8Ni	Fittings	SA-403	304H	S30409	CR	...	8	1
4	18Cr-8Ni	Fittings	SA-403	304H	S30409	WP-S	...	8	1
5	18Cr-8Ni	Wld. fittings	SA-403	304H	S30409	WP-W	...	8	1
6	18Cr-8Ni	Wld. fittings	SA-403	304H	S30409	WP-W	...	8	1
7	18Cr-8Ni	Wld. fittings	SA-403	304H	S30409	WP-WX	...	8	1
8	18Cr-8Ni	Bar	SA-479	304H	S30409	...	...	8	1
9	18Cr-8Ni	Wld. tube	SA-813	TP304H	S30409	...	...	8	1
10	18Cr-8Ni	Wld. tube	SA-814	TP304H	S30409	...	...	8	1
11	18Cr-8Ni	Plate	SA/EN 10028-7	X5CrNi18-10	...	...	≤75	8	1
12	18Cr-8Ni	Bar	SA/JIS G4303	SUS302	...	...	...	8	1
13	18Cr-8Ni	Bar	SA/JIS G4303	SUS304	...	...	...	8	1
14	18Cr-8Ni	Castings	SA-351	CF3A	J92500	...	...	8	1
15	18Cr-8Ni	Cast pipe	SA-451	CPF3A	J92500	...	...	8	1
16	18Cr-8Ni	Castings	SA-351	CF8A	J92600	...	...	8	1
17	18Cr-8Ni	Cast pipe	SA-451	CPF8A	J92600	...	...	8	1
18	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...	>130	8	1
19	18Cr-8Ni-N	Forgings	SA-965	F304LN	S30453	...	...	8	1
20	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...	≤130	8	1
21	18Cr-8Ni-N	Smls. tube	SA-213	TP304LN	S30453	...	...	8	1
22	18Cr-8Ni-N	Plate	SA-240	304LN	S30453	...	...	8	1
23	18Cr-8Ni-N	Wld. tube	SA-249	TP304LN	S30453	...	...	8	1
24	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304LN	S30453	...	...	8	1
25	18Cr-8Ni-N	Wld. pipe	SA-358	304LN	S30453	1	...	8	1
26	18Cr-8Ni-N	Wld. pipe	SA-358	304LN	S30453	3	...	8	1
27	18Cr-8Ni-N	Wld. pipe	SA-358	304LN	S30453	4	...	8	1
28	18Cr-8Ni-N	Smls. pipe	SA-376	TP304LN	S30453	...	...	8	1
29	18Cr-8Ni-N	Fittings	SA-403	304LN	S30453	...	...	8	1
30	18Cr-8Ni-N	Wld. fittings	SA-403	304LN	S30453	WP-W	...	8	1
31	18Cr-8Ni-N	Bar	SA-479	304LN	S30453	...	...	8	1
32	18Cr-8Ni-N	Wld. tube	SA-688	TP304LN	S30453	...	...	8	1
33	18Cr-8Ni-N	Wld. tube	SA-813	TP304LN	S30453	...	...	8	1
34	18Cr-8Ni-N	Wld. tube	SA-814	TP304LN	S30453	...	...	8	1
35	18Cr-8Ni-N	Forgings	SA-182	F304N	S30451	...	...	8	1
36	18Cr-8Ni-N	Smls. tube	SA-213	TP304N	S30451	...	...	8	1
37	18Cr-8Ni-N	Plate	SA-240	304N	S30451	...	...	8	1
38	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...	8	1
39	18Cr-8Ni-N	Wld. pipe	SA-312	TP304N	S30451	...	...	8	1
40	18Cr-8Ni-N	Smls. pipe	SA-312	TP304N	S30451	...	...	8	1
41	18Cr-8Ni-N	Wld. pipe	SA-312	TP304N	S30451	...	...	8	1
42	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	1	...	8	1
43	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	3	...	8	1
44	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	4	...	8	1
45	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N	S30451	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	427	427	HA-1	G7
2	515	205	427	NP	HA-1	G7
3	515	205	NP	427	HA-1	G7, G18
4	515	205	NP	427	HA-1	G7
5	515	205	427	NP	HA-1	G7
6	515	205	NP	427	HA-1	G7, G18
7	515	205	NP	427	HA-1	G7, G18
8	515	205	427	NP	HA-1	G7
9	515	205	427	NP	HA-1	G7
10	515	205	427	NP	HA-1	G7
11	520	210	NP	427	HA-1	G7, G18
12	520	205	427	NP	HA-1	G7
13	520	205	427	NP	HA-1	G7
14	530	240	371	NP	HA-3	G7, G13
15	530	240	371	NP	HA-3	G7, G13
16	530	240	371	NP	HA-1	G7, G13
17	530	240	371	NP	HA-1	G7, G13
18	485	205	427	NP	HA-1	G7
19	485	205	427	NP	HA-1	G7
20	515	205	427	NP	HA-1	G7
21	515	205	427	NP	HA-1	G7
22	515	205	427	NP	HA-1	G7
23	515	205	427	NP	HA-1	G7
24	515	205	427	NP	HA-1	G7
25	515	205	427	NP	HA-1	G7
26	515	205	427	NP	HA-1	G7
27	515	205	427	NP	HA-1	G7
28	515	205	427	NP	HA-1	G7
29	515	205	427	NP	HA-1	G7
30	515	205	427	NP	HA-1	G7
31	515	205	427	NP	HA-1	G7
32	515	205	427	NP	HA-1	G7
33	515	205	427	NP	HA-1	G7
34	515	205	427	NP	HA-1	G7
35	550	240	427	NP	HA-1	G7
36	550	240	427	427	HA-1	G7
37	550	240	427	427	HA-1	G7
38	550	240	NP	427	HA-1	G7, G18
39	550	240	427	NP	HA-1	G7
40	550	240	427	427	HA-1	G7
41	550	240	NP	427	HA-1	G7, G18
42	550	240	427	NP	HA-1	G7
43	550	240	427	NP	HA-1	G7
44	550	240	427	NP	HA-1	G7
45	550	240	427	427	HA-1	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
7	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
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	140	140	140	140	140	131.4	123.3	117.9	115.2	112.5	110.7	108.9	106.2	104.4	...	...
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	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...
15	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...
16	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...
17	161	161	161	159	156	150	142	135	132	130	127	...	...	...	...	...
18	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
19	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
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	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	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
36	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
37	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
38	137	137	136	135	132	120	112	106	104	102	100	99.2	97.3	95.5	...	...
39	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
40	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
41	137	137	136	135	132	120	112	106	104	102	100	99.2	97.3	95.5	...	...
42	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
43	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
44	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
45	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Fittings	SA-403	304N	S30451	...	...	8	1
2	18Cr-8Ni-N	Fittings	SA-403	304N	S30451	CR	...	8	1
3	18Cr-8Ni-N	Wld. fittings	SA-403	304N	S30451	WP-W	...	8	1
4	18Cr-8Ni-N	Wld. fittings	SA-403	304N	S30451	WP-W	...	8	1
5	18Cr-8Ni-N	Wld. fittings	SA-403	304N	S30451	WP-WX	...	8	1
6	18Cr-8Ni-N	Bar	SA-479	304N	S30451	...	...	8	1
7	18Cr-8Ni-N	Wld. tube	SA-688	TP304N	S30451	...	...	8	1
8	18Cr-8Ni-N	Wld. pipe	SA-813	TP304N	S30451	...	...	8	1
9	18Cr-8Ni-N	Wld. pipe	SA-814	TP304N	S30451	...	...	8	1
10	18Cr-8Ni-N	Forgings	SA-965	F304N	S30451	...	...	8	1
11	18Cr-8Ni-N	Plate	SA/EN 10028-7	X2CrNiN18-10	...	...	≤75	8	1
12	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9	...	...	≤75	8	1
13	18Cr-8Ni-4Si-N	Bar	SA-479	...	S21800	...	...	8	3
14	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	...	8	1
15	18Cr-10Ni-Cb	Cast pipe	SA-451	CPF8C	J92710	...	...	8	1
16	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	>130	8	1
17	18Cr-10Ni-Cb	Forgings	SA-965	F347	S34700	...	...	8	1
18	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	>130	8	1
19	18Cr-10Ni-Cb	Forgings	SA-965	F347H	S34709	...	...	8	1
20	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	>130	8	1
21	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	>130	8	1
22	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	≤130	8	1
23	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347	S34700	...	...	8	1
24	18Cr-10Ni-Cb	Plate	SA-240	347	S34700	...	...	8	1
25	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...	8	1
26	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...	8	1
27	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347	S34700	...	...	8	1
28	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347	S34700	...	...	8	1
29	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347	S34700	...	...	8	1
30	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	1	...	8	1
31	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	3	...	8	1
32	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	4	...	8	1
33	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347	S34700	...	...	8	1
34	18Cr-10Ni-Cb	Fittings	SA-403	347	S34700	...	...	8	1
35	18Cr-10Ni-Cb	Fittings	SA-403	347	S34700	CR	...	8	1
36	18Cr-10Ni-Cb	Fittings	SA-403	347	S34700	WP-S	...	8	1
37	18Cr-10Ni-Cb	Wld. fittings	SA-403	347	S34700	WP-W	...	8	1
38	18Cr-10Ni-Cb	Wld. fittings	SA-403	347	S34700	WP-W	...	8	1
39	18Cr-10Ni-Cb	Wld. fittings	SA-403	347	S34700	WP-WX	...	8	1
40	18Cr-10Ni-Cb	Bar	SA-479	347	S34700	...	...	8	1
41	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347	S34700	...	...	8	1
42	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP347	S34700	...	...	8	1
43	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	≤130	8	1
44	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H	S34709	...	...	8	1
45	18Cr-10Ni-Cb	Plate	SA-240	347H	S34709	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	550	240	427	NP	HA-1	G7
2	550	240	NP	427	HA-1	G7, G18
3	550	240	427	NP	HA-1	G7
4	550	240	NP	427	HA-1	G7, G18
5	550	240	NP	427	HA-1	G7, G18
6	550	240	427	NP	HA-1	G7
7	550	240	427	NP	HA-1	G7
8	550	240	427	NP	HA-1	G7
9	550	240	427	NP	HA-1	G7
10	550	240	427	427	HA-1	G7
11	550	270	NP	427	HA-1	G7
12	550	270	NP	427	HA-1	G7
13	655	345	427	NP	HA-6	...
14	485	205	427	427	HA-2	G7, G9, G13
15	485	205	427	NP	HA-2	G7, G13
16	485	205	427	427	HA-2	G7, G9
17	485	205	427	427	HA-2	G7, G9
18	485	205	427	427	HA-2	G7
19	485	205	427	427	HA-2	G7, G9
20	485	205	NP	427	HA-2	G7, G9
21	485	205	NP	427	HA-2	G7
22	515	205	427	427	HA-2	G7, G9
23	515	205	427	427	HA-2	G7, G9
24	515	205	427	427	HA-2	G7, G9
25	515	205	427	NP	HA-2	G7
26	515	205	NP	427	HA-2	G7, G9, G18
27	515	205	427	NP	HA-2	G7
28	515	205	427	427	HA-2	G7, G9
29	515	205	NP	427	HA-2	G7, G9, G18
30	515	205	427	NP	HA-2	G7
31	515	205	427	NP	HA-2	G7
32	515	205	427	NP	HA-2	G7
33	515	205	427	427	HA-2	G7, G9
34	515	205	427	NP	HA-2	G7
35	515	205	NP	427	HA-2	G7, G18
36	515	205	NP	427	HA-2	G7
37	515	205	427	NP	HA-2	G7
38	515	205	NP	427	HA-2	G7, G18
39	515	205	NP	427	HA-2	G7, G18
40	515	205	427	NP	HA-2	G7
41	515	205	427	NP	HA-2	G7
42	515	205	427	NP	HA-2	G7
43	515	205	427	427	HA-2	G7
44	515	205	427	427	HA-2	G7
45	515	205	427	427	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
2	137	137	136	135	132	120	112	106	104	102	100	99.2	97.3	95.5	...	...
3	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
4	137	137	136	135	132	120	112	106	104	102	100	99.2	97.3	95.5	...	...
5	137	137	136	135	132	120	112	106	104	102	100	99.2	97.3	95.5	...	...
6	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
7	161	161	160	159	155	141	132	125	122	120	118	116	115	113	...	...
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	180	178	172	167	163	157	154	151	148	145	142	140	137	134	...	...
12	180	180	180	178	174	158	148	140	137	135	132	131	129	126	...	...
13	219	198	175	162	152	138	128	123	121	119	118	116	116	115	...	...
14	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
15	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
16	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
17	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
18	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
19	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
20	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
21	138	138	138	138	138	134	129	127	127	126	126	126	126	126	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
36	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...
37	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...
38	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
39	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	...	...
44	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...
45	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Wld. tube	SA-249	TP347H	S34709	...	...	8	1
2	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...	...	8	1
3	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347H	S34709	...	...	8	1
4	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347H	S34709	...	...	8	1
5	18Cr-10Ni-Cb	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	Fittings	SA-403	347H	S34709	CR	...	8	1
9	18Cr-10Ni-Cb	Fittings	SA-403	347H	S34709	WP-S	...	8	1
10	18Cr-10Ni-Cb	Wld. fittings	SA-403	347H	S34709	WP-W	...	8	1
11	18Cr-10Ni-Cb	Wld. fittings	SA-403	347H	S34709	WP-W	...	8	1
12	18Cr-10Ni-Cb	Wld. fittings	SA-403	347H	S34709	WP-WX	...	8	1
13	18Cr-10Ni-Cb	Bar	SA-479	347H	S34709	...	...	8	1
14	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347H	S34709	...	...	8	1
15	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP347H	S34709	...	...	8	1
16	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	≤130	8	1
17	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348	S34800	...	...	8	1
18	18Cr-10Ni-Cb	Plate	SA-240	348	S34800	...	...	8	1
19	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...	8	1
20	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...	8	1
21	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348	S34800	...	...	8	1
22	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348	S34800	...	...	8	1
23	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348	S34800	...	...	8	1
24	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	1	...	8	1
25	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	3	...	8	1
26	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	4	...	8	1
27	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348	S34800	...	...	8	1
28	18Cr-10Ni-Cb	Fittings	SA-403	348	S34800	...	...	8	1
29	18Cr-10Ni-Cb	Fittings	SA-403	348	S34800	CR	...	8	1
30	18Cr-10Ni-Cb	Fittings	SA-403	348	S34800	WP-S	...	8	1
31	18Cr-10Ni-Cb	Wld. fittings	SA-403	348	S34800	WP-W	...	8	1
32	18Cr-10Ni-Cb	Wld. fittings	SA-403	348	S34800	WP-W	...	8	1
33	18Cr-10Ni-Cb	Wld. fittings	SA-403	348	S34800	WP-WX	...	8	1
34	18Cr-10Ni-Cb	Bar	SA-479	348	S34800	...	...	8	1
35	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348	S34800	...	...	8	1
36	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348	S34800	...	...	8	1
37	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	≤130	8	1
38	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H	S34809	...	...	8	1
39	18Cr-10Ni-Cb	Plate	SA-240	348H	S34809	...	...	8	1
40	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...	8	1
41	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...	8	1
42	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348H	S34809	...	...	8	1
43	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348H	S34809	...	...	8	1
44	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348H	S34809	...	...	8	1
45	18Cr-10Ni-Cb	Fittings	SA-403	348H	S34809	...	...	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	427	NP	HA-2	G7
2	515	205	NP	427	HA-2	G7, G18
3	515	205	427	NP	HA-2	G7
4	515	205	427	427	HA-2	G7
5	515	205	NP	427	HA-2	G7, G18
6	515	205	427	427	HA-2	G7
7	515	205	427	NP	HA-2	G7
8	515	205	NP	427	HA-2	G7, G14
9	515	205	NP	427	HA-2	G7
10	515	205	427	NP	HA-2	G7
11	515	205	NP	427	HA-2	G7, G18
12	515	205	NP	427	HA-2	G7, G18
13	515	205	427	NP	HA-2	G7
14	515	205	427	NP	HA-2	G7
15	515	205	427	NP	HA-2	G7
16	515	205	427	427	HA-2	G7, G9
17	515	205	427	427	HA-2	G7, G9
18	515	205	427	427	HA-2	G7, G9
19	515	205	427	NP	HA-2	G7
20	515	205	NP	427	HA-2	G7, G9, G18
21	515	205	427	NP	HA-2	G7
22	515	205	427	427	HA-2	G7, G9
23	515	205	NP	427	HA-2	G7, G9, G18
24	515	205	427	NP	HA-2	G7
25	515	205	427	NP	HA-2	G7
26	515	205	427	NP	HA-2	G7
27	515	205	427	427	HA-2	G7, G9
28	515	205	427	NP	HA-2	G7
29	515	205	NP	427	HA-2	G7, G18
30	515	205	NP	427	HA-2	G7
31	515	205	427	NP	HA-2	G7
32	515	205	NP	427	HA-2	G7, G18
33	515	205	NP	427	HA-2	G7, G18
34	515	205	427	NP	HA-2	G7
35	515	205	427	NP	HA-2	G7
36	515	205	427	NP	HA-2	G7
37	515	205	427	427	HA-2	G7
38	515	205	427	427	HA-2	G7
39	515	205	427	NP	HA-2	G7
40	515	205	427	NP	HA-2	G7
41	515	205	NP	427	HA-2	G7, G18
42	515	205	427	NP	HA-2	G7
43	515	205	427	427	HA-2	G7
44	515	205	NP	427	HA-2	G7, G18
45	515	205	427	NP	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
12	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	...	...
19	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...
20	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
33	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...
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	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
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	...	...
44	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
45	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Fittings	SA-403	348H	S34809	CR	...	8	1
2	18Cr-10Ni-Cb	Fittings	SA-403	348H	S34809	WP-S	...	8	1
3	18Cr-10Ni-Cb	Wld. fittings	SA-403	348H	S34809	WP-W	...	8	1
4	18Cr-10Ni-Cb	Wld. fittings	SA-403	348H	S34809	WP-W	...	8	1
5	18Cr-10Ni-Cb	Wld. fittings	SA-403	348H	S34809	WP-WX	...	8	1
6	18Cr-10Ni-Cb	Bar	SA-479	348H	S34809	...	...	8	1
7	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348H	S34809	...	...	8	1
8	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348H	S34809	...	...	8	1
9	18Cr-10Ni-Cb	Bar	SA/JIS G4303	SUS347	...	...	...	8	1
10	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	>9.5	8	1
11	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	>9.5	8	1
12	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	>9.5	8	1
13	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	>9.5	8	1
14	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	>130	8	1
15	18Cr-10Ni-Ti	Forgings	SA-965	F321	S32100	...	...	8	1
16	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	>130	8	1
17	18Cr-10Ni-Ti	Forgings	SA-965	F321H	S32109	...	...	8	1
18	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10	...	...	≤75	8	1
19	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	≤130	8	1
20	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...	...	8	1
21	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...	...	8	1
22	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...	8	1
23	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...	8	1
24	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	≤9.5	8	1
25	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	≤9.5	8	1
26	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	≤9.5	8	1
27	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	1	...	8	1
28	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	3	...	8	1
29	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	4	...	8	1
30	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	≤9.5	8	1
31	18Cr-10Ni-Ti	Fittings	SA-403	321	S32100	...	...	8	1
32	18Cr-10Ni-Ti	Fittings	SA-403	321	S32100	CR	...	8	1
33	18Cr-10Ni-Ti	Fittings	SA-403	321	S32100	WP-S	...	8	1
34	18Cr-10Ni-Ti	Wld. fittings	SA-403	321	S32100	WP-W	...	8	1
35	18Cr-10Ni-Ti	Wld. fittings	SA-403	321	S32100	WP-W	...	8	1
36	18Cr-10Ni-Ti	Wld. fittings	SA-403	321	S32100	WP-WX	...	8	1
37	18Cr-10Ni-Ti	Bar	SA-479	321	S32100	...	...	8	1
38	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321	S32100	...	...	8	1
39	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321	S32100	...	...	8	1
40	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	≤130	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
44	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...	8	1
45	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	≤9.5	8	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	NP	427	HA-2	G7, G18
2	515	205	NP	427	HA-2	G7
3	515	205	427	NP	HA-2	G7
4	515	205	NP	427	HA-2	G7, G18
5	515	205	NP	427	HA-2	G7, G18
6	515	205	427	NP	HA-2	G7
7	515	205	427	NP	HA-2	G7
8	515	205	427	NP	HA-2	G7
9	520	205	427	NP	HA-2	G7
10	485	170	NP	427	HA-2	G7, G9
11	485	170	427	427	HA-2	G7, G9
12	485	170	NP	427	HA-2	G7
13	485	170	427	427	HA-2	G7
14	485	205	427	427	HA-2	G7, G9
15	485	205	427	427	HA-2	G7, G9
16	485	205	427	427	HA-2	G7
17	485	205	427	427	HA-2	G7, G9
18	500	200	NP	427	HA-2	G7
19	515	205	427	427	HA-2	G7, G9
20	515	205	427	427	HA-2	G7, G9
21	515	205	427	427	HA-2	G7, G9
22	515	205	427	NP	HA-2	G7
23	515	205	NP	427	HA-2	G7, G9, G18
24	515	205	427	NP	HA-2	G7
25	515	205	427	427	HA-2	G7, G9
26	515	205	NP	427	HA-2	G7, G9, G18
27	515	205	427	NP	HA-2	G7
28	515	205	427	NP	HA-2	G7
29	515	205	427	NP	HA-2	G7
30	515	205	427	427	HA-2	G7, G9
31	515	205	427	NP	HA-2	G7
32	515	205	NP	427	HA-2	G7, G18
33	515	205	NP	427	HA-2	G7
34	515	205	427	NP	HA-2	G7
35	515	205	NP	427	HA-2	G7, G18
36	515	205	NP	427	HA-2	G7, G18
37	515	205	427	NP	HA-2	G7
38	515	205	427	NP	HA-2	G7
39	515	205	427	NP	HA-2	G7
40	515	205	427	427	HA-2	G7
41	515	205	427	427	HA-2	G7
42	515	205	427	427	HA-2	G7
43	515	205	427	NP	HA-2	G7
44	515	205	NP	427	HA-2	G7, G18
45	515	205	427	NP	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
2	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
3	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
4	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
5	117	117	117	117	117	117	117	115	112	111	109	108	108	107	...	...
6	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
7	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
8	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
9	138	138	138	138	138	138	138	138	135	132	130	129	128	126	125	...
10	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...
11	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...
12	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...
13	115	115	115	115	115	115	112	106	104	102	100	98.5	97.3	96.0	...	...
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	133	133	133	133	133	133	131	123	121	118	116	114	113	112	...	...
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	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
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	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
27	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
28	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
29	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
30	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
31	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
32	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
33	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
34	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
35	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
36	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
37	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
38	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
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	...	...
43	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...
44	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
45	138	138	138	138	138	138	134	128	125	123	120	119	117	115	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	...	≤9.5	8	1
2	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	≤9.5	8	1
3	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	≤9.5	8	1
4	18Cr-10Ni-Ti	Fittings	SA-403	321H	S32109	...	...	8	1
5	18Cr-10Ni-Ti	Fittings	SA-403	321H	S32109	CR	...	8	1
6	18Cr-10Ni-Ti	Fittings	SA-403	321H	S32109	WP-S	...	8	1
7	18Cr-10Ni-Ti	Wld. fittings	SA-403	321H	S32109	WP-W	...	8	1
8	18Cr-10Ni-Ti	Wld. fittings	SA-403	321H	S32109	WP-W	...	8	1
9	18Cr-10Ni-Ti	Wld. fittings	SA-403	321H	S32109	WP-WX	...	8	1
10	18Cr-10Ni-Ti	Bar	SA-479	321H	S32109	...	...	8	1
11	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321H	S32109	...	...	8	1
12	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321H	S32109	...	...	8	1
13	18Cr-10Ni-Ti	Bar	SA/JIS G4303	SUS321	...	...	...	8	1
14	18Cr-11Ni	Plate	SA-240	305	S30500	...	...	8	1
15	18Cr-12Ni-2Mo	Castings	SA-351	CF3M	J92800	...	...	8	1
16	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF3M	J92800	...	...	8	1
17	18Cr-12Ni-2Mo	Castings	SA-351	CF8M	J92900	...	...	8	1
18	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF8M	J92900	...	...	8	1
19	18Cr-13Ni-3Mo	Plate	SA-240	317	S31700	...	≤125	8	1
20	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...	8	1
21	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...	8	1
22	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317	S31700	...	...	8	1
23	18Cr-13Ni-3Mo	Smls. pipe	SA-312	TP317	S31700	...	≤125	8	1
24	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317	S31700	...	≤125	8	1
25	18Cr-13Ni-3Mo	Fittings	SA-403	317	S31700	WP-S	...	8	1
26	18Cr-13Ni-3Mo	Plate	SA-240	317L	S31703	...	...	8	1
27	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-S	...	8	1
28	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15	S38100	...	≤125	8	1
29	18Cr-18Ni-2Si	Plate	SA-240	XM-15	S38100	...	≤125	8	1
30	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15	S38100	...	≤125	8	1
31	18Cr-18Ni-2Si	Smls. pipe	SA-312	TPXM-15	S38100	...	≤125	8	1
32	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15	S38100	...	≤125	8	1
33	20Cr-10Ni	Bar	SA-479	ER308	S30880	...	...	8	1
34	21Cr-6Ni-9Mn	Forgings	SA-182	FXM-11	S21904	...	...	8	3
35	21Cr-6Ni-9Mn	Wld. pipe	SA-312	TPXM-11	S21904	...	...	8	3
36	21Cr-6Ni-9Mn	Smls. pipe	SA-312	TPXM-11	S21904	...	...	8	3
37	21Cr-6Ni-9Mn	Wld. pipe	SA-312	TPXM-11	S21904	...	...	8	3
38	21Cr-6Ni-9Mn	Plate	SA-666	XM-11	S21904	...	...	8	3
39	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11	S21904	...	...	8	3
40	22Cr-5Ni-3Mo-N	Forgings	SA-182	F51	S31803	...	...	10H	1
41	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...	...	10H	1
42	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S31803	...	...	10H	1
43	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S31803	...	...	10H	1
44	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S31803	...	...	10H	1
45	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S31803	...	...	10H	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	427	427	HA-2	G7
2	515	205	NP	427	HA-2	G7, G18
3	515	205	427	427	HA-2	G7
4	515	205	427	NP	HA-2	G7
5	515	205	NP	427	HA-2	G7, G18
6	515	205	NP	427	HA-2	G7
7	515	205	427	NP	HA-2	G7
8	515	205	NP	427	HA-2	G7, G18
9	515	205	NP	427	HA-2	G7, G18
10	515	205	427	NP	HA-2	G7
11	515	205	427	NP	HA-2	G7
12	515	205	427	NP	HA-2	G7
13	520	205	427	NP	HA-2	G7
14	515	205	427	NP	HA-1	G7
15	485	205	427	NP	HA-4	G7, G13
16	485	205	427	NP	HA-4	G7, G13
17	485	205	427	427	HA-2	G7, G9, G10, G13
18	485	205	427	NP	HA-2	G7, G13
19	515	205	NP	427	HA-2	G7, G9
20	515	205	427	NP	HA-2	G7
21	515	205	NP	427	HA-2	G7, G9, G18
22	515	205	427	NP	HA-2	G7
23	515	205	NP	427	HA-2	G7, G9
24	515	205	NP	427	HA-2	G7, G9, G18
25	515	205	NP	427	HA-2	G7
26	515	205	NP	427	HA-4	G7
27	515	205	NP	427	HA-4	G7
28	515	205	NP	427	HA-2	G7, G9
29	515	205	NP	427	HA-2	G7, G9
30	515	205	NP	427	HA-2	G7, G9, G18
31	515	205	NP	427	HA-2	G7, G9
32	515	205	NP	427	HA-2	G7, G9, G18
33	515	205	427	NP	HA-2	G7
34	620	345	316	316	HA-6	G7
35	620	345	316	NP	HA-6	G7
36	620	345	316	316	HA-6	G7
37	620	345	NP	316	HA-6	G7, G18
38	620	345	316	316	HA-6	G7
39	620	345	316	316	HA-6	G7
40	620	450	NP	316	HA-5	G13
41	620	450	NP	316	HA-5	G13
42	620	450	NP	316	HA-5	G13
43	620	450	NP	316	HA-5	G13, G18
44	620	450	NP	316	HA-5	G13
45	620	450	NP	316	HA-5	G13, G18

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	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	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
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	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
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	...	...
8	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
9	117	117	117	117	117	117	114	109	106	104	102	101	99.4	98.1	...	...
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	129	122	116	114	111	109	107	105	103	...	...
15	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...
16	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...
17	138	138	138	138	138	133	125	119	116	114	112	110	109	108	...	...
18	138	138	138	138	138	133	125	119	116	114	112	110	109	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	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
22	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
23	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
24	117	117	117	117	117	114	107	101	99.0	96.8	95.7	94.4	93.1	92.5	...	...
25	138	138	138	138	138	134	126	119	116	114	112	111	110	108	...	...
26	138	138	138	138	138	131	123	118	116	113	111	109	107	105	...	...
27	138	138	138	138	138	131	123	118	116	113	111	109	107	105	...	...
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	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
31	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
32	117	117	117	117	117	110	103	98.5	96.5	94.7	92.8	90.9	89.1	87.2	...	...
33	138	138	138	138	138	129	122	116	114	111	109	107	105	103	...	...
34	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...
35	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...
36	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...
37	176	176	175	170	164	156	145	137	135	...	...	...	...	...	...	...
38	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...
39	207	207	206	200	193	183	171	162	158	...	...	...	...	...	...	...
40	207	207	207	204	199	193	188	186	185	...	...	...	...	...	...	...
41	207	207	207	204	199	193	188	186	185	...	...	...	...	...	...	...
42	207	207	207	204	199	193	188	186	185	...	...	...	...	...	...	...
43	176	176	176	173	169	164	160	158	157	...	...	...	...	...	...	...
44	207	207	207	204	199	193	188	186	185	...	...	...	...	...	...	...
45	176	176	176	173	169	164	160	158	157	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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-5Ni-3Mo-N	Plate	SA-240	...	S32205	...	...	10H	1
2	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S32205	...	...	10H	1
3	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S32205	...	...	10H	1
4	22Cr-5Ni-3Mo-N	Forgings	SA-182	F60	S32205	...	...	10H	1
5	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S32205	...	O.D. ≤ 200	10H	1
6	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S32205	...	O.D. ≤ 200	10H	1
7	22Cr-13Ni-5Mn	Forgings	SA-182	FXM-19	S20910	...	...	8	3
8	22Cr-13Ni-5Mn	Plate	SA-240	XM-19	S20910	...	...	8	3
9	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...	...	8	3
10	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...	...	8	3
11	22Cr-13Ni-5Mn	Wld. pipe	SA-312	TPXM-19	S20910	...	...	8	3
12	22Cr-13Ni-5Mn	Smls. pipe	SA-312	TPXM-19	S20910	...	...	8	3
13	22Cr-13Ni-5Mn	Wld. pipe	SA-312	TPXM-19	S20910	...	...	8	3
14	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	1	...	8	3
15	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	3	...	8	3
16	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	4	...	8	3
17	22Cr-13Ni-5Mn	Fittings	SA-403	XM-19	S20910	...	...	8	3
18	22Cr-13Ni-5Mn	Fittings	SA-403	XM-19	S20910	CR	...	8	3
19	22Cr-13Ni-5Mn	Wld. fittings	SA-403	XM-19	S20910	WP-W	...	8	3
20	22Cr-13Ni-5Mn	Wld. fittings	SA-403	XM-19	S20910	WP-W	...	8	3
21	22Cr-13Ni-5Mn	Wld. fittings	SA-403	XM-19	S20910	WP-WX	...	8	3
22	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	...	...	8	3
23	22Cr-13Ni-5Mn	Wld. pipe	SA-813	TPXM-19	S20910	...	...	8	3
24	22Cr-13Ni-5Mn	Wld. pipe	SA-814	TPXM-19	S20910	...	...	8	3
25	22Cr-13Ni-5Mn	Forgings	SA-965	FXM-19	S20910	...	...	8	3
26	23Cr-4Ni-Mo-Cu	Plate	SA-240	...	S32304	...	...	10H	1
27	23Cr-12Ni	Fittings	SA-403	309	S30900	...	...	8	2
28	23Cr-12Ni	Fittings	SA-403	309	S30900	...	...	8	2
29	23Cr-12Ni	Fittings	SA-403	309	S30900	WP-S	...	8	2
30	23Cr-12Ni	Wld. fittings	SA-403	309	S30900	WP-W	...	8	2
31	23Cr-12Ni	Wld. fittings	SA-403	309	S30900	WP-W	...	8	2
32	23Cr-12Ni	Wld. fittings	SA-403	309	S30900	WP-WX	...	8	2
33	23Cr-12Ni	Smls. tube	SA-213	TP309S	S30908	...	...	8	2
34	23Cr-12Ni	Plate	SA-240	309S	S30908	...	...	8	2
35	23Cr-12Ni	Wld. tube	SA-249	TP309S	S30908	...	...	8	2
36	23Cr-12Ni	Smls. pipe	SA-312	TP309S	S30908	...	...	8	2
37	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...	8	2
38	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	1	...	8	2
39	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	3	...	8	2
40	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	4	...	8	2
41	23Cr-12Ni	Bar	SA-479	309S	S30908	...	...	8	2
42	23Cr-12Ni	Wld. pipe	SA-813	TP309S	S30908	...	...	8	2
43	23Cr-12Ni	Wld. pipe	SA-814	TP309S	S30908	...	...	8	2
44	23Cr-12Ni	Smls. tube	SA-213	TP309H	S30909	...	...	8	2
45	23Cr-12Ni	Plate	SA-240	309H	S30909	...	...	8	2

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	655	450	NP	316	HA-5	G7
2	655	450	NP	316	HA-5	G7
3	655	450	NP	316	HA-5	G7
4	655	480	NP	316	HA-5	G7
5	655	480	NP	316	HA-5	G7
6	655	480	NP	316	HA-5	G7
7	690	380	427	427	HA-6	G7
8	690	380	427	427	HA-6	G7
9	690	380	427	NP	HA-6	G7
10	690	380	NP	427	HA-6	G7, G18
11	690	380	427	NP	HA-6	G7
12	690	380	427	427	HA-6	G7
13	690	380	NP	427	HA-6	G7, G18
14	690	380	427	NP	HA-6	G7
15	690	380	427	NP	HA-6	G7
16	690	380	427	NP	HA-6	G7
17	690	380	427	NP	HA-6	G7
18	690	380	NP	427	HA-6	G7, G18
19	690	380	427	NP	HA-6	G7
20	690	380	NP	427	HA-6	G7, G18
21	690	380	NP	427	HA-6	G7, G18
22	690	380	427	427	HA-6	G7
23	690	380	427	NP	HA-6	G7
24	690	380	427	NP	HA-6	G7
25	690	380	427	427	HA-6	G7
26	600	400	NP	316	HA-6	G7, G13
27	515	205	427	NP	HA-2	G7
28	515	205	NP	427	HA-2	G7, G18
29	515	205	NP	427	HA-2	G7
30	515	205	427	NP	HA-2	G7
31	515	205	NP	427	HA-2	G7, G18
32	515	205	NP	427	HA-2	G7, G18
33	515	205	NP	427	HA-2	G7, G9
34	515	205	NP	427	HA-2	G7, G9
35	515	205	NP	427	HA-2	G7, G18
36	515	205	NP	427	HA-2	G7, G9
37	515	205	NP	427	HA-2	G7, G9, G18
38	515	205	427	NP	HA-2	G7
39	515	205	427	NP	HA-2	G7
40	515	205	427	NP	HA-2	G7
41	515	205	427	NP	HA-2	G7
42	515	205	NP	427	HA-2	G7, G9, G18
43	515	205	NP	427	HA-2	G7, G9, G18
44	515	205	NP	427	HA-2	G7
45	515	205	NP	427	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	218	218	218	214	210	203	199	196	196	...	...	...	...	...	...	...
2	218	218	218	214	210	203	199	196	196	...	...	...	...	...	...	...
3	186	186	186	182	179	173	169	167	166	...	...	...	...	...	...	...
4	218	218	218	214	210	203	199	196	196	...	...	...	...	...	...	...
5	218	218	218	214	210	203	199	196	196	...	...	...	...	...	...	...
6	186	186	186	182	179	173	169	167	166	...	...	...	...	...	...	...
7	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
8	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
9	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
10	195	190	182	175	169	160	153	147	145	144	142	140	138	136	...	...
11	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
12	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
13	195	195	194	189	184	178	174	172	171	170	169	167	166	164	...	...
14	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
15	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
16	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
17	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
18	195	195	194	189	184	178	174	172	171	170	169	167	166	164	...	...
19	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
20	195	195	194	189	184	178	174	172	171	170	169	167	166	164	...	...
21	195	195	194	189	184	178	174	172	171	170	169	167	166	164	...	...
22	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
23	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
24	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
25	230	229	228	222	216	210	206	202	201	200	198	196	195	194	...	...
26	200	197	192	186	180	175	172	170	168	...	...	...	...	...	...	...
27	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
28	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
29	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
30	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
31	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
32	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
33	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
34	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
35	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
36	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
37	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
38	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
39	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
40	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
41	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
42	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
43	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
44	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
45	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...	...	8	2
2	23Cr-12Ni	Smls. pipe	SA-312	TP309H	S30909	...	...	8	2
3	23Cr-12Ni	Wld. pipe	SA-312	TP309H	S30909	...	...	8	2
4	23Cr-12Ni	Bar	SA-479	309H	S30909	...	...	8	2
5	23Cr-12Ni	Bar	SA/JIS G4303	SUS309S	...	...	...	8	2
6	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb	S30940	...	...	8	2
7	23Cr-12Ni-Cb	Plate	SA-240	309Cb	S30940	...	...	8	2
8	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb	S30940	...	...	8	2
9	23Cr-12Ni-Cb	Smls. pipe	SA-312	TP309Cb	S30940	...	...	8	2
10	23Cr-12Ni-Cb	Wld. pipe	SA-312	TP309Cb	S30940	...	...	8	2
11	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb	S30940	...	...	8	2
12	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb	S30940	...	...	8	2
13	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-182	F58	S31266	...	...	45	...
14	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-240	...	S31266	...	...	45	...
15	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-358	...	S31266	...	...	45	...
16	25Cr-5Ni-3Mo-2Cu	Plate	SA-240	255	S32550	...	...	10H	1
17	25Cr-6Ni-Mo-N	Plate	SA-240	...	S31200	...	...	10H	1
18	25Cr-12Ni	Castings	SA-351	CH8	J93400	...	...	8	2
19	25Cr-12Ni	Cast pipe	SA-451	CPH8	J93400	...	...	8	2
20	25Cr-12Ni	Castings	SA-351	CH20	J93402	...	...	8	2
21	25Cr-12Ni	Cast pipe	SA-451	CPH20	J93402	...	...	8	2
22	25Cr-20Ni	Castings	SA-351	CK20	J94202	...	...	8	2
23	25Cr-20Ni	Cast pipe	SA-451	CPK20	J94202	...	...	8	2
24	25Cr-20Ni	Forgings	SA-182	F310	S31000	...	≤130	8	2
25	25Cr-20Ni	Forgings	SA-965	F310	S31000	...	...	8	2
26	25Cr-20Ni	Smls. tube	SA-213	TP310S	S31008	...	...	8	2
27	25Cr-20Ni	Plate	SA-240	310S	S31008	...	...	8	2
28	25Cr-20Ni	Wld. tube	SA-249	TP310S	S31008	...	...	8	2
29	25Cr-20Ni	Smls. 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	Wld. pipe	SA-358	310S	S31008	3	...	8	2
33	25Cr-20Ni	Wld. pipe	SA-358	310S	S31008	4	...	8	2
34	25Cr-20Ni	Fittings	SA-403	310S	S31008	...	...	8	2
35	25Cr-20Ni	Fittings	SA-403	310S	S31008	CR	...	8	2
36	25Cr-20Ni	Fittings	SA-403	310S	S31008	WP-S	...	8	2
37	25Cr-20Ni	Wld. fittings	SA-403	310S	S31008	WP-W	...	8	2
38	25Cr-20Ni	Wld. fittings	SA-403	310S	S31008	WP-W	...	8	2
39	25Cr-20Ni	Wld. fittings	SA-403	310S	S31008	WP-WX	...	8	2
40	25Cr-20Ni	Wld. pipe	SA-813	TP310S	S31008	...	...	8	2
41	25Cr-20Ni	Wld. pipe	SA-814	TP310S	S31008	...	...	8	2
42	25Cr-20Ni	Smls. tube	SA-213	TP310H	S31009	...	...	8	2
43	25Cr-20Ni	Plate	SA-240	310H	S31009	...	...	8	2
44	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...	...	8	2
45	25Cr-20Ni	Smls. pipe	SA-312	TP310H	S31009	...	...	8	2

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	NP	427	HA-2	G7, G18
2	515	205	NP	427	HA-2	G7
3	515	205	NP	427	HA-2	G7, G18
4	515	205	NP	427	HA-2	G7
5	520	205	427	NP	HA-2	G7
6	515	205	NP	427	HA-2	G7, G9
7	515	205	NP	427	HA-2	G7, G9
8	515	205	NP	427	HA-2	G7, G9, G18
9	515	205	NP	427	HA-2	G7, G9
10	515	205	NP	427	HA-2	G7, G9, G18
11	515	205	NP	427	HA-2	G7, G9, G18
12	515	205	NP	427	HA-2	G7, G9, G18
13	750	420	NP	427	HA-10	G7
14	750	420	NP	427	HA-10	G7
15	750	420	NP	427	HA-10	G7
16	760	550	NP	260	HA-5	G7
17	690	450	NP	316	HA-5	G7, G13
18	450	195	427	427	HA-3	G7, G9, G10, G13
19	450	195	427	NP	HA-3	G7, G13
20	485	205	427	427	HA-2	G7
21	485	205	427	NP	HA-2	G7
22	450	195	427	427	HA-3	G7
23	450	195	427	NP	HA-3	G7
24	515	205	NP	427	HA-2	G7, G9, G11, G12
25	515	205	427	427	HA-2	G7, G9, G11, G12
26	515	205	NP	427	HA-2	G7, G9, G11, G12
27	515	205	NP	427	HA-2	G7, G9, G11, G12
28	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
29	515	205	NP	427	HA-2	G7, G9, G11, G12
30	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
31	515	205	427	NP	HA-2	G7
32	515	205	427	NP	HA-2	G7
33	515	205	427	NP	HA-2	G7
34	515	205	427	NP	HA-2	G7
35	515	205	NP	427	HA-2	G7, G18
36	515	205	NP	427	HA-2	G7
37	515	205	427	NP	HA-2	G7
38	515	205	NP	427	HA-2	G7, G18
39	515	205	NP	427	HA-2	G7, G18
40	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
41	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
42	515	205	NP	427	HA-2	G7
43	515	205	NP	427	HA-2	G7
44	515	205	NP	427	HA-2	G7, G18
45	515	205	NP	427	HA-2	G7

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
2	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
3	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
4	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
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	...	...
8	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
9	138	138	138	138	138	138	135	131	129	127	125	124	122	121	...	...
10	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
11	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
12	117	117	117	117	117	117	115	111	109	108	107	105	104	102	...	...
13	250	248	245	239	232	223	217	213	211	209	208	206	205	202	...	...
14	250	248	245	239	232	223	217	213	211	209	208	206	205	202	...	...
15	213	211	209	203	197	190	184	181	179	178	177	175	174	172	...	...
16	253	252	251	244	237	230	227	226	...	...	...	...	...	...	...	...
17	230	230	229	224	218	212	210	210	210	...	...	...	...	...	...	...
18	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...
19	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...
20	138	138	138	138	137	134	131	128	125	123	120	117	114	111	...	...
21	138	138	138	138	137	134	131	128	125	123	120	117	114	111	...	...
22	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...
23	129	129	129	128	127	124	122	119	117	114	112	110	106	103	...	...
24	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
25	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
26	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
27	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
28	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
29	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
30	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
31	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
32	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
33	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
34	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
35	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
36	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
37	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
38	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
39	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
40	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
41	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
42	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
43	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...
44	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
45	138	138	138	138	138	138	134	129	127	125	123	122	120	118	...	...

INTENTIONALLY LEFT BLANK

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , 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	Wld. pipe	SA-312	TP310H	S31009	...	...	8	2
2	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb	S31040	...	...	8	2
3	25Cr-20Ni-Cb	Wld. pipe	SA-312	TP310Cb	S31040	...	...	8	2
4	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb	S31040	...	...	8	2
5	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb	S31040	...	...	8	2
6	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLn	S31050	...	...	8	2
7	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
8	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
9	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
10	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	...	8	2
11	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	≤ 6	8	2
12	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	≤ 6	8	2
13	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	≤ 6	8	2
14	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	$t \geq 10$	10H	1
15	29Cr-6.5Ni-2Mo-N	Bar	SA-479	...	S32906	...	...	10H	1
16	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	$t \geq 10$	10H	1
17	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	$t \geq 10$	10H	1
18	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	$t < 10$	10H	1
19	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	$t < 10$	10H	1
20	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	$t < 10$	10H	1

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	NP	427	HA-2	G7, G18
2	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
3	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
4	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
5	515	205	NP	427	HA-2	G7, G9, G11, G12, G18
6	540	255	NP	427	HA-2	G7
7	540	255	NP	427	HA-2	...
8	540	255	NP	427	HA-2	G18
9	540	255	NP	427	HA-2	G18
10	550	240	NP	316	HA-2	...
11	580	270	NP	427	HA-2	...
12	580	270	NP	427	HA-2	G18
13	580	270	NP	427	HA-2	G18
14	750	550	NP	316	HA-5	G8
15	750	550	NP	316	HA-5	G8
16	750	550	NP	316	HA-5	G8
17	750	550	NP	316	HA-5	G8
18	800	650	NP	316	HA-5	G8
19	800	650	NP	316	HA-5	G8
20	800	650	NP	316	HA-5	G8

Table 2A (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Ferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	200	250	300	325	350	375	400	425	450	475	500
1	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
2	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
3	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
4	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
5	117	117	117	117	117	117	114	109	108	106	105	103	102	101	...	...
6	170	170	170	170	167	162	157	150	147	144	140	137	134	131	...	...
7	170	170	170	169	167	162	158	151	147	144	140	137	134	131	...	...
8	145	145	145	144	143	138	134	128	125	122	120	116	114	111	...	...
9	145	145	145	144	143	138	134	128	125	122	120	116	114	111	...	...
10	161	161	161	161	161	157	149	142	139	...	...	...	...	...	...	...
11	179	179	179	179	179	174	166	159	155	151	148	145	142	138	...	...
12	152	152	152	152	152	148	141	135	132	129	126	123	120	118	...	...
13	152	152	152	152	152	148	141	135	132	129	126	123	120	118	...	...
14	250	250	249	243	238	231	228	228	228	...	...	...	...	...	...	...
15	250	250	249	243	238	231	228	228	228	...	...	...	...	...	...	...
16	250	250	249	243	238	231	228	228	228	...	...	...	...	...	...	...
17	250	250	249	243	238	231	228	228	228	...	...	...	...	...	...	...
18	267	266	265	259	253	246	243	242	242	...	...	...	...	...	...	...
19	267	266	265	259	253	246	243	242	242	...	...	...	...	...	...	...
20	267	266	265	259	253	246	243	242	242	...	...	...	...	...	...	...

NOTES TO TABLE 2A**GENERAL NOTES**

- (25) (a) The following abbreviations are used: N, Normalized; NT, Normalized and tempered; QT, Quenched and tempered; 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 through E4).
- (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.
- (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 or maximum allowable stress values are based on successful experience in service.
- E2 For values at 375°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E3 For values at 450°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- (25) E4 For values at 475°C and above, the design stress intensity values or maximum allowable stress 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 For Section III applications, 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 66²/₃% 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 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 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 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 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.
- G17 A factor of 4 was used for tensile strength to obtain the stress value.
- G18 A quality factor of 0.85 has been applied in arriving at the stress values for this material.
- G19 The tensile strength shall not be in excess of 140 MPa above the specified minimum.
- G20 For Section VIII applications, SA-723 is exempt from the requirement in Section VIII, Division 2, 6.7.6.3(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.
- G21 See Section VIII, Division 2, 3.4.
- G22 The allowable stress value at 65°C shall be used at 66°C.

NOTES TO TABLE 2A (CONT'D)**NOTES – GENERAL REQUIREMENTS (CONT'D)**

- (25) G23 Use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.
- (25) G24 Stress values for 40°C may be used at temperatures down to –200°C without additional specification requirements.

NOTES – HEAT TREATMENT REQUIREMENTS

- H1 Annealed.
- H2 Quenched and tempered at 650°C.
- H3 For Section III applications, 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.
- H4 Liquid quenched and tempered.
- H5 Normalized, normalized and tempered, or quenched and tempered.
- H6 For Section VIII applications involving consideration of heat treatment after forming or welding, see Section VIII, Division 2, Table 6.15 for P-No. 10K, Group No. 1 materials.

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.
- S4 For Section III applications, 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.
- S5 Either DN 200 and larger and less than schedule 140 wall, or less than DN 200 and all wall thicknesses.
- S6 The maximum section thickness shall not exceed 75 mm for double-normalized-and-tempered forgings, or 125 mm for quenched-and-tempered forgings.

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 $2T$
- 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 For Section VIII applications, welding 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 6.
- W6 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 Section VIII, Division 2, Part 6.
- W7 Nonwelded, or welded if the tensile strength of the Section IX reduced section tension test is not less than 690 MPa.
- (25) W8 Not for welded construction in Section III.

INTENTIONALLY LEFT BLANK

Table 2B
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	...	Drawn smls. tube	SB-210	...	Alclad 3003	O	0.25-12.7	21
2	...	Drawn smls. tube	SB-210	...	Alclad 3003	H113	1.27-12.7	21
3	...	Smls. extr. tube	SB-241	...	Alclad 3003	O	...	21
4	...	Smls. extr. tube	SB-241	...	Alclad 3003	H112	...	21
5	...	Plate, sheet	SB-209	...	A93003	O	0.15-76.2	21
6	...	Plate, sheet	SB-209	...	A93003	H112	6.35-12.69	21
7	...	Plate, sheet	SB-209	...	A93003	H112	12.70-50.80	21
8	...	Plate, sheet	SB-209	...	A93003	H112	50.81-76.2	21
9	...	Drawn smls. tube	SB-210	...	A93003	O	0.25-12.7	21
10	...	Drawn smls. tube	SB-210	...	A93003	H113	0.25-12.7	21
11	...	Bar, rod, shapes	SB-221	...	A93003	O	...	21
12	...	Bar, rod, shapes	SB-221	...	A93003	H112	...	21
13	...	Smls. extr. tube	SB-241	...	A93003	O	...	21
14	...	Smls. pipe	SB-241	...	A93003	H112	≥25.4	21
15	...	Smls. extr. tube	SB-241	...	A93003	H112	...	21
16	...	Plate, sheet	SB-209	...	A93004	O	0.15-76.2	22
17	...	Plate, sheet	SB-209	...	A93004	H112	6.35-76.2	22
18	...	Plate, sheet	SB-209	...	A95052	O	1.30-76.2	22
19	...	Plate, sheet	SB-209	...	A95052	H112	6.35-12.69	22
20	...	Plate, sheet	SB-209	...	A95052	H112	12.70-76.20	22
21	...	Plate, sheet	SB-209	...	A95083	O	1.30-38.10	25
22	...	Plate, sheet	SB-209	...	A95083	O	38.11-76.20	25
23	...	Plate, sheet	SB-209	...	A95083	O	76.21-127.00	25
24	...	Plate, sheet	SB-209	...	A95083	O	127.01-177.80	25
25	...	Plate, sheet	SB-209	...	A95083	O	177.81-203.2	25
26	...	Plate, sheet	SB-209	...	A95083	H112	6.35-38.10	25
27	...	Plate, sheet	SB-209	...	A95083	H112	38.11-76.20	25
28	...	Bar, rod, shapes	SB-221	...	A95083	H111	≤127.0	25
29	...	Smls. extr. tube	SB-241	...	A95083	H111	...	25
30	...	Plate, sheet	SB-209	...	A95086	O	1.30-50.8	25
31	...	Plate, sheet	SB-209	...	A95086	H112	1.60-12.69	25
32	...	Plate, sheet	SB-209	...	A95086	H112	12.70-25.40	25
33	...	Plate, sheet	SB-209	...	A95086	H112	25.41-50.80	25
34	...	Plate, sheet	SB-209	...	A95086	H112	50.81-76.2	25
35	...	Plate, sheet	SB-209	...	A95454	O	1.30-76.2	22
36	...	Plate, sheet	SB-209	...	A95454	H112	6.35-12.69	22
37	...	Plate, sheet	SB-209	...	A95454	H112	12.70-76.20	22
38	...	Bar, rod, shapes	SB-221	...	A95454	O	≤127.0	22
39	...	Bar, rod, shapes	SB-221	...	A95454	H112	≤127.0	22
40	...	Smls. extr. tube	SB-241	...	A95454	O	≤127.0	22
41	...	Smls. extr. tube	SB-241	...	A95454	H112	≤127.0	22
42	...	Plate, sheet	SB-209	...	A96061	T4	1.30-6.34	23
43	...	Plate, sheet	SB-209	...	A96061	T451	6.35-76.2	23
44	...	Plate, sheet	SB-209	...	A96061	T6	1.30-6.34	23
45	...	Plate, sheet	SB-209	...	A96061	T651	6.35-101.60	23

Table 2B
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	90	31	NP	121	NFA-7	G8
2	90	31	NP	121	NFA-7	G8, W2
3	90	31	NP	121	NFA-7	G8
4	90	31	NP	121	NFA-7	G8, W2
5	97	34	NP	121	NFA-1	G8
6	120	69	NP	121	NFA-1	G8, W2
7	100	41	NP	93	NFA-1	G8, W2
8	100	41	NP	93	NFA-1	G8, W2
9	97	34	NP	121	NFA-1	G8
10	97	34	NP	121	NFA-1	G8, W2
11	97	34	NP	121	NFA-1	G2, G8
12	97	34	NP	121	NFA-1	G2, G8, W2
13	97	34	NP	121	NFA-1	G8
14	97	34	NP	121	NFA-1	G8
15	97	34	NP	121	NFA-1	G8, W2
16	150	59	NP	121	NFA-3	G8
17	160	62	NP	121	NFA-3	G8, W2
18	170	65	NP	93	NFA-8	G8
19	195	110	NP	93	NFA-8	G8, W2
20	170	65	NP	93	NFA-8	G8, W2
21	275	125	NP	66	NFA-11	G7, G8, G11
22	270	120	NP	66	NFA-11	G7, G8, G11
23	260	110	NP	66	NFA-11	G7, G8, G11
24	255	100	NP	66	NFA-11	G7, G8, G11
25	250	97	NP	66	NFA-11	G7, G8, G11
26	275	125	NP	66	NFA-11	G7, G8, G11, W2
27	270	120	NP	66	NFA-11	G7, G8, G11, W2
28	275	165	NP	66	NFA-11	G2, G7, G8, G11, W2
29	275	165	NP	66	NFA-11	G7, G8, G11, W2
30	240	97	NP	66	NFA-9	G7, G8, G11
31	250	125	NP	66	NFA-9	G7, G8, G11, W2
32	240	110	NP	66	NFA-9	G7, G8, G11, W2
33	240	97	NP	66	NFA-9	G7, G8, G11, W2
34	235	97	NP	66	NFA-9	G7, G8, G11, W2
35	210	83	NP	121	NFA-6	E2, G8
36	220	125	NP	121	NFA-6	E2, G8, W2
37	210	83	NP	121	NFA-6	E2, G8, W2
38	210	83	NP	121	NFA-6	E2, G2, G8
39	210	83	NP	121	NFA-6	E2, G2, G8, W2
40	210	83	NP	121	NFA-6	E2, G8
41	210	83	NP	121	NFA-6	E2, G8, W2
42	205	110	NP	149	NFA-13	G8, G9, W3
43	205	110	NP	149	NFA-13	G8, G9, W3
44	290	240	NP	149	NFA-12	G8, G9, W3
45	290	240	NP	149	NFA-12,13	G8, G9, W3

Table 2B
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	20.7	20.7	20.2	18.3	...	...	...	...	...	...	...	...	...	...	...	...
2	20.7	20.7	20.2	18.3	...	...	...	...	...	...	...	...	...	...	...	...
3	20.7	20.7	20.2	18.3	...	...	...	...	...	...	...	...	...	...	...	...
4	20.7	20.7	20.2	18.3	...	...	...	...	...	...	...	...	...	...	...	...
5	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
6	39.3	39.3	39.0	36.1	...	...	...	...	...	...	...	...	...	...	...	...
7	27.6	27.6	27.6	...	...	...	...	...	...	...	...	...	...	...	...	...
8	27.6	27.6	27.6	...	...	...	...	...	...	...	...	...	...	...	...	...
9	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
10	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
11	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
12	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
13	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
14	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
15	22.8	22.8	22.4	20.4	...	...	...	...	...	...	...	...	...	...	...	...
16	39.3	39.3	39.1	37.6	...	...	...	...	...	...	...	...	...	...	...	...
17	41.4	41.4	41.2	39.6	...	...	...	...	...	...	...	...	...	...	...	...
18	43.4	43.4	43.4	...	...	...	...	...	...	...	...	...	...	...	...	...
19	64.1	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...
20	43.4	43.4	43.4	...	...	...	...	...	...	...	...	...	...	...	...	...
21	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	78.6	77.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	73.8	73.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	64.1	64.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	82.7	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	77.9	77.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	91.7	91.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	91.7	91.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	82.7	81.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	73.8	72.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
36	73.8	73.8	71.0	48.1	...	...	...	...	...	...	...	...	...	...	...	...
37	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
38	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
39	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
40	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
41	55.2	55.2	54.9	50.7	...	...	...	...	...	...	...	...	...	...	...	...
42	68.9	68.9	67.5	58.3	55.8	...	...	...	...	...	...	...	...	...	...	...
43	68.9	68.9	67.5	58.3	55.8	...	...	...	...	...	...	...	...	...	...	...
44	96.5	96.5	96.3	90.9	77.3	...	...	...	...	...	...	...	...	...	...	...
45	96.5	96.5	96.3	90.9	77.3	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	...	Plate, sheet	SB-209	...	A96061	T651	101.61–152.4	23
2	...	Drawn smls. tube	SB-210	...	A96061	T4	0.64–12.7	23
3	...	Drawn smls. tube	SB-210	...	A96061	T6	0.64–12.7	23
4	...	Bar, rod, shapes	SB-221	...	A96061	T4	...	23
5	...	Bar, rod, shapes	SB-221	...	A96061	T6	...	23
6	...	Smls. extr. tube/pipe	SB-241	...	A96061	T4	...	23
7	...	Smls. extr. tube/pipe	SB-241	...	A96061	T6	...	23
8	...	Smls. drawn pipe	SB-241	...	A96061	T6	DN < 25	23
9	...	Smls. drawn pipe	SB-241	...	A96061	T6	DN ≥ 25	23
(25) 10	...	Shapes	SB-308	...	A96061	T6	...	23
(25) 11	...	Die forgings	SB-247	...	A96061	T6	≤101.60	23
(25) 12	...	Hand forgings	SB-247	...	A96061	T6	≤101.60	23
(25) 13	...	Hand forgings	SB-247	...	A96061	T6	101.61–203.20	23
(25) 14	...	Die & hand forgings	SB-247	...	A96061	T6 wld.	≤203.20	23
15	...	Drawn smls. tube	SB-210	...	A96063	T6	0.64–12.7	23
16	...	Bar, rod, shapes	SB-221	...	A96063	T5	≤12.70	23
17	...	Bar, rod, shapes	SB-221	...	A96063	T5	12.71–25.4	23
18	...	Bar, rod, shapes	SB-221	...	A96063	T6	≤25.4	23
19	...	Smls. extr. tube	SB-241	...	A96063	T5	≤12.70	23
20	...	Smls. extr. tube	SB-241	...	A96063	T5	12.71–25.4	23
21	...	Smls. extr. tube	SB-241	...	A96063	T6	≤25.4	23
(25) 22	...	Bar, rod	SB-187	...	C10200	O60	All	31
(25) 23	...	Bar, rod	SB-187	...	C10200	O60	All	31
(25) 24	...	Bar, rod	SB-187	...	C11000	O60	All	31
(25) 25	...	Bar, rod	SB-187	...	C11000	O60	All	31
26	...	Smls. tube	SB-111	...	C28000	O61	...	32
(25) 27	...	Smls. tube	SB-111	...	C44300	O61	...	32
(25) 28	...	Smls. tube	SB-111	...	C44400	O61	...	32
(25) 29	...	Smls. tube	SB-111	...	C44500	O61	...	32
30	...	Plate	SB-171	...	C46400	M10, M20, O20, O25	75 < t ≤ 125	32
(25) 31	...	Plate, sheet	SB-171	...	C46400	M10, M20, O20, O25	≤75	32
(25) 32	...	Smls. tube	SB-111	...	C60800	O61	...	35
(25) 33	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	50 < t ≤ 140	35
(25) 34	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	50 < t ≤ 140	35
(25) 35	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	12 < t ≤ 50	35
(25) 36	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	12 < t ≤ 50	35
(25) 37	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	t ≤ 12	35
(25) 38	...	Plate, sheet, bar	SB-169	...	C61400	O25 or O60 or M20	t ≤ 12	35
(25) 39	...	Bar, rod	SB-98	...	C65100	O60	All	33
(25) 40	...	Bar, rod	SB-98	...	C65100	O60	All	33
41	...	Bar, rod	SB-98	...	C65100	H02	≤50	33
42	...	Bar, rod	SB-98	...	C65100	H02	≤50	33
(25) 43	...	Plate, sheet, strip, bar	SB-96	...	C65500	O61	≤50	33
(25) 44	...	Plate, sheet, strip, bar	SB-96	...	C65500	O61	≤50	33
(25) 45	...	Bar, rod	SB-98	...	C65500	O60	All	33

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	275	240	NP	149	NFA-12,13	G8, G9, W3
2	205	110	NP	149	NFA-13	G8, W3
3	290	240	NP	149	NFA-12,13	G8, W3
4	180	110	NP	149	NFA-13	G2, G8, G9, W3
5	260	240	NP	149	NFA-12,13	G2, G8, G9, W3
6	180	110	NP	149	NFA-13	G8, G9, W3
7	260	240	NP	149	NFA-12,13	G8, G9, W3
8	290	240	NP	149	NFA-12,13	G8, W3
9	260	240	NP	149	NFA-12,13	G8, W3
10	260	240	NP	149	NFA-12,13	G2, G8, W3
11	260	240	NP	149	NFA-12,13	G8, W3
12	255	230	NP	149	NFA-12,13	G8, W3
13	240	220	NP	149	NFA-12,13	G8, W3
14	165	...	NP	149	NFA-12,13	G8
15	230	195	NP	149	NFA-1	G8, W3
16	150	110	NP	149	NFA-1	E2, G2, G8, W3
17	145	100	NP	149	NFA-1	E2, G2, G8, W3
18	205	170	NP	149	NFA-1	G2, G8, W3
19	150	110	NP	149	NFA-1	E2, G8, W3
20	145	100	NP	149	NFA-1	E2, G8, W3
21	205	170	NP	149	NFA-1	G8, W3
22	195	55	NP	149	NFC-1	G4
23	195	55	NP	149	NFC-1	G1, G4
24	195	55	NP	149	NFC-1	G4
25	195	55	NP	149	NFC-1	G1, G4
26	345	140	NP	260	NFC-3	E3, G4, G6
27	310	105	NP	260	NFC-2	E3, G4, G6
28	310	105	NP	260	NFC-2	E3, G4, G6
29	310	105	NP	260	NFC-2	E3, G4, G6
30	345	125	NP	38	NFC-2	G4
31	345	140	NP	38	NFC-2	G4
32	345	130	NP	38	NFC-2	G4, G6
33	450	195	NP	260	NFC-8	G4
34	450	195	NP	260	NFC-8	G1, G4
35	485	205	NP	260	NFC-8	G4
36	485	205	NP	260	NFC-8	G1, G4
37	495	220	NP	260	NFC-8	G4
38	495	220	NP	260	NFC-8	G1, G4
39	275	85	NP	177	NFC-1	G4, G10
40	275	85	NP	177	NFC-1	G1, G4, G10
41	380	140	NP	177	NFC-2	G4, G10, W2
42	380	140	NP	177	NFC-2	G1, G4, G10, W2
43	345	125	NP	149	NFC-2	G4, G10
44	345	125	NP	149	NFC-2	G1, G4, G10
45	360	105	NP	177	NFC-2	G4, G10

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	91.7	91.7	91.5	86.8	73.9	...	...	...	...	...	...	...	...	...	...	...
2	68.9	68.9	67.5	58.3	55.8	...	...	...	...	...	...	...	...	...	...	...
3	96.5	96.5	96.3	90.9	77.3	...	...	...	...	...	...	...	...	...	...	...
4	60.0	60.0	59.8	58.2	55.0	...	...	...	...	...	...	...	...	...	...	...
5	87.6	87.6	87.2	82.0	69.8	...	...	...	...	...	...	...	...	...	...	...
6	60.0	60.0	59.8	58.2	55.0	...	...	...	...	...	...	...	...	...	...	...
7	87.6	87.6	87.2	82.0	69.8	...	...	...	...	...	...	...	...	...	...	...
8	96.5	96.5	96.3	90.9	77.3	...	...	...	...	...	...	...	...	...	...	...
9	87.6	87.6	87.2	82.0	69.8	...	...	...	...	...	...	...	...	...	...	...
10	87.3	87.3	87.2	82.0	69.8	...	...	...	...	...	...	...	...	...	...	(25)
11	87.6	87.6	87.2	82.0	69.8	...	...	...	...	...	...	...	...	...	...	(25)
12	85.0	85.0	85.0	79.9	69.2	...	...	...	...	...	...	...	...	...	...	(25)
13	80.4	80.4	80.4	75.6	65.4	...	...	...	...	...	...	...	...	...	...	(25)
14	55.0	55.0	55.0	53.0	37.3	...	...	...	...	...	...	...	...	...	...	(25)
15	75.8	75.8	73.8	57.4	43.5	...	...	...	...	...	...	...	...	...	...	...
16	50.3	50.3	47.1	34.5	31.6	...	...	...	...	...	...	...	...	...	...	...
17	48.3	48.3	46.1	32.4	30.3	...	...	...	...	...	...	...	...	...	...	...
18	68.9	68.9	67.1	52.1	39.4	...	...	...	...	...	...	...	...	...	...	...
19	50.3	50.3	47.1	34.5	31.6	...	...	...	...	...	...	...	...	...	...	...
20	48.3	48.3	46.1	32.4	30.3	...	...	...	...	...	...	...	...	...	...	...
21	68.9	68.9	67.1	52.1	39.4	...	...	...	...	...	...	...	...	...	...	...
22	36.7	36.7	32.3	32.3	32.2	...	...	...	...	...	...	...	...	...	...	(25)
23	36.7	36.7	36.7	36.7	36.7	...	...	...	...	...	...	...	...	...	...	(25)
24	36.7	36.7	32.3	32.3	32.2	...	...	...	...	...	...	...	...	...	...	(25)
25	36.7	36.7	36.7	36.7	36.7	...	...	...	...	...	...	...	...	...	...	(25)
26	91.7	91.7	91.7	91.7	91.6	76.3	42.3	17.6	8.70	3.45	...	...	...	...	...	...
27	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.6	3.29	...	...	...	...	...	(25)
28	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.6	3.29	...	...	...	...	...	(25)
29	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	4.6	3.29	...	...	...	...	...	(25)
30	82.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	91.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	87.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	129	128	127	126	126	125	124	123	121	120	...	...	...	...	...	(25)
34	129	129	129	129	129	129	129	129	129	129	...	...	...	...	...	(25)
35	137	137	136	135	135	134	133	131	130	130	...	...	...	...	...	(25)
36	137	137	137	137	137	137	137	137	137	137	...	...	...	...	...	(25)
37	147	147	145	144	144	143	142	140	139	139	...	...	...	...	...	(25)
38	147	147	147	147	147	147	147	147	147	147	...	...	...	...	...	(25)
39	55.2	54.8	54.3	54.0	53.6	53.1	50.8	...	...	...	...	...	...	...	...	(25)
40	55.2	55.2	55.2	55.2	55.2	55.2	50.8	...	...	...	...	...	...	...	...	(25)
41	91.9	91.9	90.6	88.7	86.2	83.2	72.3	...	...	...	...	...	...	...	...	...
42	91.9	91.9	91.9	91.9	91.9	91.9	72.3	...	...	...	...	...	...	...	...	...
43	82.7	82.5	82.3	82.0	81.8	75.4	50.8	...	...	...	...	...	...	...	...	(25)
44	82.7	82.7	82.7	82.7	82.7	...	...	...	...	...	...	...	...	...	...	(25)
45	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	(25)

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy	Class/Condition/ Temper	Size/	P-No.
						Desig./UNS No.		Thickness, mm	
(25)	1	...	Bar, rod	SB-98	...	C65500	O60	All	33
	2	...	Bar, rod	SB-98	...	C65500	H02	≤50	33
(25)	3	...	Bar, rod	SB-98	...	C66100	O60	All	33
(25)	4	...	Bar, rod	SB-98	...	C66100	O60	All	33
	5	...	Bar, rod	SB-98	...	C66100	H02	≤50	33
	6	...	Plate	SB-171	...	C70600	M10, M20, O20, O25	≤140	34
	7	...	Plate	SB-171	...	C70600	M10, M20, O20, O25	≤140	34
	8	...	Cond. tube	SB-111	...	C70600	O61	...	34
	9	...	Cond. tube	SB-111	...	C70600	O61	...	34
	10	...	Smls. U-bend tube	SB-395	...	C70600	O61	...	34
	11	...	Smls. U-bend tube	SB-395	...	C70600	O61	...	34
	12	...	Plate	SB-171	...	C70620	M10, M20, O20, O25	≤140	34
	13	...	Plate	SB-171	...	C70620	M10, M20, O20, O25	≤140	34
	14	...	Cond. tube	SB-111	...	C70620	O61	...	34
	15	...	Cond. tube	SB-111	...	C70620	O61	...	34
	16	...	Smls. U-bend tube	SB-395	...	C70620	O61	...	34
	17	...	Smls. U-bend tube	SB-395	...	C70620	O61	...	34
	18	...	Plate	SB-171	...	C71500	M10, M20, O20, O25	60 < t ≤ 140	34
	19	...	Plate	SB-171	...	C71500	M10, M20, O20, O25	60 < t ≤ 140	34
	20	...	Plate	SB-171	...	C71500	M10, M20, O20, O25	≤60	34
	21	...	Plate	SB-171	...	C71500	M10, M20, O20, O25	≤60	34
	22	...	Cond. tube	SB-111	...	C71500	O61	...	34
	23	...	Cond. tube	SB-111	...	C71500	O61	...	34
	24	...	Smls. U-bend tube	SB-395	...	C71500	O61	...	34
	25	...	Smls. U-bend tube	SB-395	...	C71500	O61	...	34
(25)	26	...	Smls. tube	SB-111	...	C71500	HR50	...	34
	27	...	Plate	SB-171	...	C71520	M10, M20, O20, O25	60 < t ≤ 140	34
	28	...	Plate	SB-171	...	C71520	M10, M20, O20, O25	60 < t ≤ 140	34
	29	...	Plate	SB-171	...	C71520	M10, M20, O20, O25	≤60	34
	30	...	Plate	SB-171	...	C71520	M10, M20, O20, O25	≤60	34
	31	...	Smls. tube	SB-111	...	C71520	O61	...	34
	32	...	Smls. tube	SB-111	...	C71520	O61	...	34
	33	...	Smls. U-bend tube	SB-395	...	C71520	O61	...	34
	34	...	Smls. U-bend tube	SB-395	...	C71520	O61	...	34
	35	...	Smls. tube	SB-111	...	C71520	HR50	...	34
(25)	36	...	Castings	SB-584	...	C93700	M01	...	...
(25)	37	...	Castings	SB-584	...	C93700	M01	...	...
	38	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed	>125 O.D.	41
	39	99Ni	Bar, rod	SB-160	...	N02200	Annealed	...	41
	40	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed	≤125 O.D.	41
	41	99Ni	Plate, sheet, strip	SB-162	...	N02200	Annealed	...	41
	42	99Ni	Smls. tube	SB-163	...	N02200	Annealed	...	41
	43	99Ni	Plate, sheet, strip	SB-162	...	N02200	As rolled	...	41
	44	99Ni-Low C	Bar, rod	SB-160	...	N02201	Annealed	...	41
	45	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed	>125 O.D.	41

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	360	105	NP	177	NFC-2	G1, G4, G10
2	485	260	NP	177	NFC-2	G4, G10, W2
3	360	105	NP	177	NFC-2	G4, G10
4	360	105	NP	177	NFC-2	G1, G4, G10
5	485	260	NP	177	NFC-2	G4, G10, W2
6	275	105	NP	232	NFC-3	G4
7	275	105	NP	232	NFC-3	G1, G4
8	275	105	NP	232	NFC-3	G4
9	275	105	NP	232	NFC-3	G1, G4
10	275	105	NP	232	NFC-3	G4
11	275	105	NP	232	NFC-3	G1, G4
12	275	105	NP	232	NFC-3	G4
13	275	105	NP	232	NFC-3	G1, G4
14	275	105	NP	232	NFC-3	G4
15	275	105	NP	232	NFC-3	G1, G4
16	275	105	NP	232	NFC-3	G4
17	275	105	NP	232	NFC-3	G1, G4
18	310	125	260	343	NFC-4	G4
19	310	125	260	343	NFC-4	G1, G4
20	345	140	260	343	NFC-4	G4
21	345	140	260	343	NFC-4	G1, G4
22	360	125	260	343	NFC-4	G4
23	360	125	260	343	NFC-4	G1, G4
24	360	125	NP	343	NFC-4	G4
25	360	125	NP	343	NFC-4	G1, G4
26	495	345	260	260	NFC-4	G1, W2
27	310	125	260	343	NFC-4	G4
28	310	125	260	343	NFC-4	G1, G4
29	345	140	260	343	NFC-4	G4
30	345	140	260	343	NFC-4	G1, G4
31	360	125	260	343	NFC-4	G4
32	360	125	260	343	NFC-4	G1, G4
33	360	125	NP	343	NFC-4	G4
34	360	125	NP	343	NFC-4	G1, G4
35	495	345	260	260	NFC-4	...
36	207	83	204 (SPT)	NP	NFC-1	...
37	207	83	204 (SPT)	NP	NFC-1	G1
38	380	83	NP	316	NFN-2	G4
39	380	100	NP	316	NFN-2	G2, G4
40	380	100	NP	316	NFN-2	G4
41	380	100	NP	316	NFN-2	G4
42	380	100	NP	316	NFN-2	G4
43	380	140	NP	316	NFN-2	G4
44	345	69	NP	427	NFN-1	G2, G4
45	345	69	NP	427	NFN-1	G4

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425		
1	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	(25)	
2	161	161	161	161	161	161	160	...	...	...	...	...	...	...	...	...		
3	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...		(25)
4	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	(25)	
5	161	161	161	161	161	161	160	...	...	...	...	...	...	...	...	...		
6	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
7	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
8	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
10	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
11	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
12	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
13	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
14	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
15	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
16	68.9	66.9	65.2	63.9	62.0	60.7	60.1	59.1	56.8	...	...	...	...	...	...	...		
17	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...		
18	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	...	...	...		
19	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
20	91.9	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	74.1	73.6	72.8	...	...	...		
21	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...		
22	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	...	...	...		
23	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
24	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	...	...	...		
25	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
26	165	165	165	165	165	164	161	159	157	155	...	...	...	...	...	...	(25)	
27	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	...	...	...		
28	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
29	91.9	89.0	86.4	84.5	82.6	80.8	79.5	77.7	76.3	75.1	74.1	73.6	72.8	...	...	...		
30	82.7	80.0	77.4	75.6	74.4	72.5	71.2	70.0	68.7	67.9	...	...	...	...	...	...		
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	...	...	...		
32	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
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	...	...	...		
34	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...		
35	165	165	165	165	165	164	161	159	157	155	...	...	...	...	...	...		
36	55.2	51.0	48.8	47.8	47.1	46.6	46.1	45.7	...	...	...	...	...	...	...	...	(25)	
37	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...	...	...		(25)
38	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...		
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	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	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	68.9	...	...	...		
42	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...		
43	91.7	91.7	91.7	91.7	91.7	91.7	91.7	90.9	88.3	84.6	81.2	78.1	...	...	...	...		
44	46.2	44.8	43.9	43.4	43.4	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4		
45	46.2	44.8	43.9	43.4	43.4	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4		

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	99Ni-Low C	Bar, rod	SB-160	...	N02201	Hot fin.	...	41
2	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed	≤125 O.D.	41
3	99Ni-Low C	Plate, sheet, strip	SB-162	...	N02201	Annealed	...	41
4	99Ni-Low C	Smls. tube	SB-163	...	N02201	Annealed	...	41
5	67Ni-30Cu	Bar, rod	SB-164	...	N04400	HW or CW ann.	All	42
6	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed	>125 O.D.	42
7	67Ni-30Cu	Forgings	SB-564	...	N04400	Annealed	...	42
8	67Ni-30Cu	Plate	SB-127	...	N04400	Annealed	...	42
9	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Annealed	...	42
10	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed	≤125 O.D.	42
11	67Ni-30Cu	Hexagons, rings, discs	SB-164	...	N04400	Hot worked	54 < t ≤ 102	42
12	67Ni-30Cu	Plate	SB-127	...	N04400	As rolled	...	42
13	67Ni-30Cu	Rounds, squares, rectangles	SB-164	...	N04400	Hot worked	305 < t ≤ 356	42
14	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Stress rel.	...	42
15	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Stress rel.	...	42
16	67Ni-30Cu-S	Bar, rod	SB-164	...	N04405	Annealed	...	42
17	67Ni-30Cu-S	Bar, rod	SB-164	...	N04405	Hot worked	...	42
18	47Ni-22Cr-9Mo-18Fe	Plate	SB-435	...	N06002	Annealed	5 < t ≤ 64	43
19	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...	N06002	Annealed	1.5 < t ≤ 5	43
20	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...	N06002	Solution ann.	≥5	43
21	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.	...	43
22	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.	...	43
23	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...	N06002	Solution ann.	...	43
24	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.	...	43
25	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.	...	43
26	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.	>19	45
27	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.	>19	45
28	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.	8 < t ≤ 19	45
29	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.	5 < t ≤ 19	45
30	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...	N06007	Solution ann.	...	45
31	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...	N06007	Solution ann.	...	45
32	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...	N06007	Solution ann.	...	45
33	55Ni-21Cr-13.5Mo	Smls. & wld. fittings	SB-366	...	N06022	Solution ann.	...	43
34	55Ni-21Cr-13.5Mo	Forgings	SB-462	...	N06022	Solution ann.	...	43
35	55Ni-21Cr-13.5Mo	Forgings	SB-564	...	N06022	Solution ann.	...	43
36	55Ni-21Cr-13.5Mo	Rod	SB-574	...	N06022	Solution ann.	...	43
37	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...	N06022	Solution ann.	...	43
38	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...	N06022	Solution ann.	...	43
39	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...	N06022	Solution ann.	...	43
40	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...	N06022	Solution ann.	...	43
41	59Ni-23Cr-16Mo	Wld. fittings	SB-366	...	N06059	Solution ann.	...	43
42	59Ni-23Cr-16Mo	Wld. fittings	SB-366	...	N06059	Solution ann.	...	43
43	59Ni-23Cr-16Mo	Smls. fittings	SB-366	...	N06059	Solution ann.	...	43
44	59Ni-23Cr-16Mo	Forged fittings	SB-462	...	N06059	Solution ann.	...	43
45	59Ni-23Cr-16Mo	Forgings	SB-564	...	N06059	Solution ann.	...	43

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	345	69	NP	427	NFN-1	G2, G4
2	345	83	NP	427	NFN-1	E1, G4
3	345	83	NP	427	NFN-1	E1, G4
4	345	83	NP	427	NFN-1	E1, G4
5	480	170	427	427	NFN-3	G1, G2, G4
6	485	170	427	427	NFN-3	G1, G4
7	485	170	427	427	NFN-3	G1, G2, G4
8	485	195	427	427	NFN-3	G1, G4
9	485	195	427	427	NFN-3	G1, G4
10	485	195	427	427	NFN-3	G1, G4
11	517	207	427	NP	NFN-3	E1, G1
12	515	275	427	427	NFN-3	E1, G1, G4
13	517	276	427	NP	NFN-3	E1, G1
14	585	380	260	427	NFN-3	E4, G1, G4, W1
15	585	380	260	NP	NFN-3	G1
16	485	170	427	427	NFN-3	G1, G2, G4
17	515	240	427	NP	NFN-3	G1
18	655	240	427	427	NFN-15	G1, G4
19	655	240	427	427	NFN-15	G1, G4
20	655	240	427	427	NFN-15	G1, G2, G4
21	690	275	427	NP	NFN-15	G1
22	690	275	NP	427	NFN-15	G1, G4, G5
23	690	275	427	427	NFN-15	G1, G4
24	690	275	427	NP	NFN-15	G1
25	690	275	NP	427	NFN-15	G1, G4, G5
26	585	205	NP	427	NFN-11	G1, G2, G4
27	585	205	NP	427	NFN-11	G1, G4
28	620	240	NP	427	NFN-11	G1, G2, G4
29	620	240	NP	427	NFN-11	G1, G4
30	620	240	NP	427	NFN-11	G1, G4, G5
31	620	240	NP	427	NFN-11	G1, G4
32	620	240	NP	427	NFN-11	G1, G4, G5
33	690	310	427	427	NFN-10	G1
34	690	310	427	427	NFN-10	G1
35	690	310	427	427	NFN-10	G1
36	690	310	427	427	NFN-10	G1
37	690	310	427	427	NFN-10	G1
38	690	310	427	427	NFN-10	G1
39	690	310	427	427	NFN-10	G1
40	690	310	427	427	NFN-10	G1
41	690	310	427	NP	NFN-14	G1, G4
42	690	310	NP	427	NFN-14	G1, G4, G5
43	690	310	427	427	NFN-14	G1, G4
44	690	310	427	427	NFN-14	G1, G4
45	690	310	427	427	NFN-14	G1, G4

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	46.2	44.8	43.9	43.4	43.4	42.8	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.0	41.4
2	55.2	53.8	52.9	52.3	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	49.7
3	55.2	53.8	52.9	52.3	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	49.7
4	55.2	53.8	52.9	52.3	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.7	51.6	51.0	51.0	49.7
5	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
6	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
7	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
8	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
9	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
10	129	119	112	108	105	103	101	101	101	101	101	101	101	101	99.9	98.7
11	138	136	133	131	128	126	124	122	122	121	120	119	118	117	116	106
12	172	172	172	172	171	168	165	164	162	161	160	159	158	156	144	140
13	172	172	172	172	171	168	165	164	162	161	160	159	158	156	144	140
14	195	195	195	195	195	195	195	195	195	195	194	191	188	179	122	89.3
15	195	195	195	195	195	195	195	195	195	195	...	...	...	...	...	...
16	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
17	161	151	140	136	132	129	128	128	128	128	128	128	128	127	125	122
18	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
19	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
20	161	151	143	138	132	127	123	119	115	112	110	107	105	104	103	101
21	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
22	157	147	139	134	129	124	119	115	112	109	106	104	102	100	99.2	98.6
23	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
24	184	173	164	157	151	146	141	136	132	128	125	122	120	118	117	116
25	157	147	139	134	129	124	119	115	112	109	106	104	102	100	99.2	98.6
26	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129
27	138	138	138	138	138	138	138	138	138	137	136	134	132	131	130	129
28	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150
29	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150
30	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128
31	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	150
32	137	137	137	137	137	137	137	137	137	136	134	133	131	129	129	128
33	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
34	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
35	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
36	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
37	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
38	176	176	176	...	176	...	176	...	172	...	164	160	157	155	153	151
39	207	207	207	...	207	...	207	...	202	...	193	189	185	182	180	177
40	176	176	176	...	176	...	176	...	172	...	164	160	157	155	153	151
41	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
42	176	176	176	176	176	176	176	176	176	176	172	168	164	159	155	151
43	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
44	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
45	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	59Ni-23Cr-16Mo	Rod	SB-574	...	N06059	Solution ann.	...	43
2	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...	N06059	Solution ann.	...	43
3	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.	...	43
4	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.	...	43
5	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...	N06059	Solution ann.	...	43
6	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.	...	43
7	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.	...	43
8	61Ni-16Mo-16Cr	Rod	SB-574	...	N06455	Solution ann.	...	43
9	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...	N06455	Solution ann.	...	43
10	61Ni-16Mo-16Cr	Wld. pipe	SB-619	...	N06455	Solution ann.	...	43
11	61Ni-16Mo-16Cr	Wld. pipe & tube	SB-622	...	N06455	Solution ann.	...	43
12	61Ni-16Mo-16Cr	Wld. tube	SB-626	...	N06455	Solution ann.	...	43
13	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin.	>125 O.D.	43
14	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold worked/ann.	>125 O.D.	43
15	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed	...	43
16	72Ni-15Cr-8Fe	Bar, rod	SB-166	...	N06600	Annealed	...	43
17	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold worked/ann.	≤125 O.D.	43
18	72Ni-15Cr-8Fe	Plate	SB-168	...	N06600	Annealed	...	43
19	72Ni-15Cr-8Fe	Forgings	SB-564	...	N06600	Annealed	...	43
20	72Ni-15Cr-8Fe	Wld. tube	SB-516	...	N06600	Cold drawn/ann.	≤114	43
21	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...	N06600	Cold drawn/ann.	≤114	43
22	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed	6 < t ≤ 22	43
23	60Ni-22Cr-9Mo-3.5Cb	Bar, rod	SB-446	...	N06625	Annealed	100 < t ≤ 250	43
24	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet	SB-443	...	N06625	Hot rolled/ann.	≤70	43
25	60Ni-22Cr-9Mo-3.5Cb	Plate	SB-443	...	N06625	Cold rolled/ann.	≤9.5	43
26	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe & tube	SB-444	...	N06625	Annealed	...	43
27	60Ni-22Cr-9Mo-3.5Cb	Bar, rod	SB-446	...	N06625	Annealed	≤100	43
28	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Hot worked/ann.	>127 O.D.	43
29	58Ni-29Cr-9Fe	Smls. tube	SB-163	...	N06690	Annealed	...	43
30	58Ni-29Cr-9Fe	Plate	SB-168	...	N06690	Annealed	...	43
31	58Ni-29Cr-9Fe	Forgings	SB-564	...	N06690	Annealed	...	43
32	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Cold worked/ann.	...	43
33	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Hot worked	...	43
34	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Hot worked/ann.	...	43
35	58Ni-29Cr-9Fe	Smls. tube	SB-163	...	N06690	Annealed	6 < t ≤ 22	43
36	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold worked/ann.	>127 O.D.	43
37	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Hot worked/ann.	≤127 O.D.	43
38	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold worked/ann.	≤127 O.D.	43
39	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	Annealed	...	46
40	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. pipe	SB-535	...	N08330	Annealed	...	46
41	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate, sheet, strip	SB-536	...	N08330	Annealed	...	46
42	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08800	Annealed	...	45
43	42Fe-33Ni-21Cr	Smls. pipe & tube	SB-407	...	N08800	Annealed	...	45
44	42Fe-33Ni-21Cr	Plate	SB-409	...	N08800	Annealed	...	45
45	42Fe-33Ni-21Cr	Wld. pipe	SB-514	...	N08800	Annealed	...	45

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	690	310	427	427	NFN-14	G1, G4
2	690	310	427	427	NFN-14	G1, G4
3	690	310	427	NP	NFN-14	G1, G4
4	690	310	NP	427	NFN-14	G1, G4, G5
5	690	310	427	427	NFN-14	G1, G4
6	690	310	427	NP	NFN-14	G1, G4
7	690	310	NP	427	NFN-14	G1, G4, G5
8	690	275	NP	427	NFN-14	G1, G2, G4
9	690	275	NP	427	NFN-14	G1, G4
10	690	275	NP	427	NFN-14	G1, G4, G5
11	690	275	NP	427	NFN-14	G1, G4
12	690	275	NP	427	NFN-14	G1, G4, G5
13	515	170	427	NP	NFN-4	G1
14	550	205	427	427	NFN-4	G1, G4
15	550	240	427	427	NFN-4	G1, G4
16	550	240	427	427	NFN-4	G1, G2, G4
17	550	240	427	427	NFN-4	G1, G4
18	550	240	427	427	NFN-4	G1, G4
19	550	240	427	427	NFN-4	G1, G2, G4
20	550	240	NP	427	NFN-4	G1, G4
21	550	240	NP	427	NFN-4	G1, G4
22	550	275	427	NP	NFN-21	G1, G3, S1
23	760	345	427	NP	NFN-17	...
24	758	379	427	NP	NFN-17	...
25	758	379	427	NP	NFN-17	...
26	825	415	427	NP	NFN-17	...
27	825	415	427	NP	NFN-17	...
28	515	170	427	NP	NFN-4	G1
29	585	240	427	NP	NFN-4	G1
30	585	240	427	NP	NFN-4	G1
31	585	240	427	NP	NFN-4	G1
32	585	240	427	NP	NFN-4	G1
33	585	240	427	NP	NFN-4	G1
34	585	240	427	NP	NFN-4	G1
35	585	275	427	NP	NFN-21	G1, G3, S1
36	586	205	427	NP	NFN-4	G1
37	586	205	427	NP	NFN-4	G1
38	586	240	427	NP	NFN-4	G1
39	485	205	NP	427	NFN-13	G1, G2, G4
40	485	205	NP	427	NFN-13	G1, G4, G5
41	485	205	NP	427	NFN-13	G1, G4
42	515	205	427	427	NFN-8	G1, G4
43	515	205	427	427	NFN-8	G1, G4
44	515	205	427	427	NFN-8	G1, G4
45	515	205	NP	427	NFN-8	G1, G4

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
2	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
3	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
4	176	176	176	176	176	176	176	176	176	176	172	168	164	159	155	151
5	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
6	207	207	207	207	207	207	207	207	207	207	202	197	192	187	183	178
7	176	176	176	176	176	176	176	176	176	176	172	168	164	159	155	151
8	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178
9	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178
10	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151
11	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178
12	157	157	157	157	157	157	157	157	157	157	157	157	156	155	153	151
13	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
14	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
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	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
21	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
22	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
23	230	225	221	218	215	212	209	206	204	201	199	197	194	192	191	189
24	253	247	243	239	236	233	230	227	224	221	219	216	214	212	210	208
25	253	247	243	239	236	233	230	227	224	221	219	216	214	212	210	208
26	276	270	265	261	258	254	251	248	245	242	239	236	233	231	229	227
27	276	270	265	261	258	254	251	248	245	242	239	236	233	231	229	227
28	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
29	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
30	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
31	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
32	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
33	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
34	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
35	184	184	184	184	184	184	184	184	184	184	184	184	184	183	183	182
36	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
38	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
39	138	138	138	138	138	138	138	138	137	135	132	129	127	124	122	120
40	117	117	117	117	117	117	117	117	117	115	113	110	108	106	104	102
41	138	138	138	138	138	138	138	138	137	135	132	129	127	124	122	120
42	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
43	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
44	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
45	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	42Fe-33Ni-21Cr	Wld. tube	SB-515	...	N08800	Annealed	...	45
2	42Fe-33Ni-21Cr	Forgings	SB-564	...	N08800	Annealed	...	45
3	42Fe-33Ni-21Cr	Bar, rod	SB-408	...	N08800	Hot fin.	...	45
4	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08800	Annealed	$6 < t \leq 22$	45
5	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08800	Cold worked	...	45
6	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08810	Annealed	...	45
7	42Fe-33Ni-21Cr	Smls. pipe & tube	SB-407	...	N08810	Annealed	...	45
8	42Fe-33Ni-21Cr	Bar, rod	SB-408	...	N08810	Annealed	...	45
9	42Fe-33Ni-21Cr	Plate	SB-409	...	N08810	Annealed	...	45
10	42Fe-33Ni-21Cr	Wld. pipe	SB-514	...	N08810	Annealed	...	45
11	42Fe-33Ni-21Cr	Wld. tube	SB-515	...	N08810	Annealed	...	45
12	42Fe-33Ni-21Cr	Forgings	SB-564	...	N08810	Annealed	...	45
13	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...	N08825	Annealed	...	45
14	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...	N08825	Annealed	...	45
15	42Ni-21.5Cr-3Mo-2.3Cu	Plate, sheet, strip	SB-424	...	N08825	Annealed	...	45
16	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...	N08825	Annealed	...	45
17	62Ni-28Mo-5Fe	Plate, strip	SB-333	...	N10001	Solution ann.	$5 < t \leq 64$	44
18	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...	N10001	Solution ann.	...	44
19	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...	N10001	Solution ann.	...	44
20	62Ni-28Mo-5Fe	Wld. tube	SB-626	...	N10001	Solution ann.	...	44
21	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Solution ann.	$38 < t \leq 89$	44
22	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Solution ann.	$8 < t \leq 38$	44
23	62Ni-28Mo-5Fe	Plate, strip	SB-333	...	N10001	Solution ann.	< 5	44
24	70Ni-16Mo-7Cr-5Fe	Plate, sheet, strip	SB-434	...	N10003	Annealed	< 64	44
25	70Ni-16Mo-7Cr-5Fe	Rod	SB-573	...	N10003	Solution ann.	...	44
26	54Ni-16Mo-15Cr	Smls. fittings	SB-366	...	N10276	Solution ann.	...	43
27	54Ni-16Mo-15Cr	Wld. fittings	SB-366	...	N10276	Solution ann.	...	43
28	54Ni-16Mo-15Cr	Forgings	SB-462	...	N10276	Solution ann.	...	43
29	54Ni-16Mo-15Cr	Rod	SB-574	...	N10276	Solution ann.	...	43
30	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...	N10276	Solution ann.	...	43
31	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.	...	43
32	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...	N10276	Solution ann.	...	43
33	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.	...	43
34	65Ni-28Mo-2Fe	Plate, strip	SB-333	...	N10665	Solution ann.	...	44
35	65Ni-28Mo-2Fe	Rod	SB-335	...	N10665	Solution ann.	...	44
36	65Ni-28Mo-2Fe	Smls. fittings	SB-366	...	N10665	Solution ann.	...	44
37	65Ni-28Mo-2Fe	Wld. fittings	SB-366	...	N10665	Solution ann.	...	44
38	65Ni-28Mo-2Fe	Forgings	SB-462	...	N10665	Solution ann.	...	44
39	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Solution ann.	...	44
40	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...	N10665	Solution ann.	...	44
41	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Solution ann.	...	44
42	Ti	Plate, sheet, strip	SB-265	1	R50250	Annealed	...	51
43	Ti	Bar, billet	SB-348	1	R50250	Annealed	...	51
44	Ti	Forgings	SB-381	1	R50250	Annealed	...	51
45	Ti	Smls. tube	SB-338	1	R50250	Smls. ann.	...	51

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	515	205	NP	427	NFN-8	G1, G4
2	515	205	427	427	NFN-8	G1, G2, G4
3	515	205	427	427	NFN-8	G1, G2, G4
4	515	275	427	NP	NFN-8	G1, G3, S1
5	570	325	343	NP	NFN-23	G1
6	450	170	427	427	NFN-9	G1, G4
7	450	170	427	427	NFN-9	G1, G4
8	450	170	427	427	NFN-9	G1, G2, G4
9	450	170	427	427	NFN-9	G1, G4
10	450	170	NP	427	NFN-9	G1, G4, G5
11	450	170	NP	427	NFN-9	G1, G4, G5
12	450	170	427	427	NFN-9	G1, G2, G4
13	585	240	427	427	NFN-7	G1, G4
14	585	240	NP	427	NFN-7	G1, G4
15	585	240	NP	427	NFN-7	G4
16	585	240	427	427	NFN-7	G2, G4
17	690	310	NP	427	NFN-5	G1, G4
18	690	310	NP	427	NFN-5	G1, G4, G5
19	690	310	NP	427	NFN-5	G1, G4
20	690	310	NP	427	NFN-5	G1, G4, G5
21	690	315	NP	427	NFN-5	G1, G2, G4
22	795	315	NP	427	NFN-5	G1, G2, G4
23	795	345	NP	427	NFN-5	G1, G4
24	690	275	NP	427	NFN-6	G4
25	690	275	NP	427	NFN-6	G1, G2, G4
26	690	285	NP	427	NFN-10	G1, G4
27	690	285	NP	427	NFN-10	G1, G4, G5
28	690	285	NP	427	NFN-10	G1, G4
29	690	285	NP	427	NFN-10	G1, G2, G4
30	690	285	NP	427	NFN-10	G1, G4
31	690	285	NP	427	NFN-10	G1, G4, G5
32	690	285	NP	427	NFN-10	G1, G4
33	690	285	NP	427	NFN-10	G1, G4, G5
34	760	350	NP	427	NFN-16	G1, G4
35	760	350	NP	427	NFN-16	G1, G2, G4
36	760	350	NP	427	NFN-16	G1, G4
37	760	350	NP	427	NFN-16	G1, G4, G5
38	760	350	NP	427	NFN-16	G1, G4
39	760	350	NP	427	NFN-16	G1, G4, G5
40	760	350	NP	427	NFN-16	G1, G4
41	760	350	NP	427	NFN-16	G1, G4, G5
42	240	170	NP	316	NFT-3	...
43	240	170	NP	316	NFT-3	...
44	240	170	NP	316	NFT-3	...
45	240	170	NP	316	NFT-3	...

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
2	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
3	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
4	172	172	172	172	172	172	172	172	172	172	172	171	171	171	170	170
5	191	191	191	191	191	191	190	188	186	185	184	183	183	...	...	...
6	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
7	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
8	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
9	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
10	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3
11	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.5	95.9	93.8	91.3	89.6	88.3
12	115	115	115	115	115	115	115	115	115	115	115	113	110	108	105	104
13	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
14	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
15	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
16	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159
17	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206
18	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	175
19	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206
20	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	175
21	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	210
22	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	210
23	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	229
24	184	176	168	162	156	151	146	142	139	136	134	133	131	130	129	127
25	184	176	168	162	156	151	146	142	139	136	134	133	131	130	129	127
26	188	188	188	188	188	188	188	188	187	182	177	172	169	165	162	159
27	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	135
28	188	188	188	188	188	188	188	188	187	182	177	172	169	165	162	159
29	188	188	188	188	188	188	188	188	187	182	177	172	169	165	162	159
30	188	188	188	188	188	188	188	188	187	182	177	172	169	165	162	159
31	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	135
32	188	188	188	188	188	188	188	188	187	182	177	172	169	165	162	159
33	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	135
34	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
35	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
36	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
37	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
38	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
39	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
40	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234
41	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
42	80.7	75.3	64.3	58.4	52.9	48.5	44.7	41.7	37.6	33.9	30.9	27.8	...	...	...	...
43	80.7	75.3	64.3	58.4	52.9	48.5	44.7	41.7	37.6	33.9	30.9	27.8	...	...	...	...
44	80.7	75.3	64.3	58.4	52.9	48.5	44.7	41.7	37.6	33.9	30.9	27.8	...	...	...	...
45	80.7	75.3	64.3	58.4	52.9	48.5	44.7	41.7	37.6	33.9	30.9	27.8	...	...	...	...

INTENTIONALLY LEFT BLANK

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/ Thickness, mm	P-No.
1	Ti	Smls. pipe	SB-861	1	R50250	Smls. ann.	...	51
2	Ti	Wld. tube	SB-338	1	R50250	Wld. ann.	...	51
3	Ti	Wld. pipe	SB-862	1	R50250	Wld. ann.	...	51
4	Ti	Plate, sheet, strip	SB-265	2	R50400	Annealed	...	51
5	Ti	Bar, billet	SB-348	2	R50400	Annealed	...	51
6	Ti	Forgings	SB-381	2	R50400	Annealed	...	51
7	Ti	Smls. tube	SB-338	2	R50400	Smls. ann.	...	51
8	Ti	Smls. pipe	SB-861	2	R50400	Smls. ann.	...	51
9	Ti	Wld. tube	SB-338	2	R50400	Wld. ann.	...	51
10	Ti	Wld. pipe	SB-862	2	R50400	Wld. ann.	...	51
11	Ti	Plate, sheet, strip	SB-265	3	R50550	Annealed	...	52
12	Ti	Bar, billet	SB-348	3	R50550	Annealed	...	52
13	Ti	Forgings	SB-381	3	R50550	Annealed	...	52
14	Ti	Smls. tube	SB-338	3	R50550	Smls. ann.	...	52
15	Ti	Smls. pipe	SB-861	3	R50550	Smls. ann.	...	52
16	Ti	Wld. tube	SB-338	3	R50550	Wld. ann.	...	52
17	Ti	Wld. pipe	SB-862	3	R50550	Wld. ann.	...	52
18	Ti-Pd	Plate, sheet, strip	SB-265	7	R52400	Annealed	...	51
19	Ti-Pd	Bar, billet	SB-348	7	R52400	Annealed	...	51
20	Ti-Pd	Forgings	SB-381	7	R52400	Annealed	...	51
21	Ti-Pd	Smls. tube	SB-338	7	R52400	Smls. ann.	...	51
22	Ti-Pd	Smls. pipe	SB-861	7	R52400	Smls. ann.	...	51
23	Ti-Pd	Wld. tube	SB-338	7	R52400	Wld. ann.	...	51
24	Ti-Pd	Wld. pipe	SB-862	7	R52400	Wld. ann.	...	51
25	Ti-Pd	Plate, sheet, strip	SB-265	16	R52402	Annealed	...	51
26	Ti-0.3Mo-0.8Ni	Plate, sheet, strip	SB-265	12	R53400	Annealed	...	52
27	Ti-0.3Mo-0.8Ni	Bar, billet	SB-348	12	R53400	Annealed	...	52
28	Ti-0.3Mo-0.8Ni	Forgings	SB-381	F-12	R53400	Annealed	...	52
29	Ti-0.3Mo-0.8Ni	Smls. tube	SB-338	12	R53400	Smls. ann.	...	52
30	Ti-0.3Mo-0.8Ni	Smls. pipe	SB-861	12	R53400	Smls. ann.	...	52
31	Ti-0.3Mo-0.8Ni	Wld. tube	SB-338	12	R53400	Wld. ann.	...	52
32	Ti-0.3Mo-0.8Ni	Wld. pipe	SB-862	12	R53400	Wld. ann.	...	52
33	Ti-3Al-2.5V	Plate, sheet, strip	SB-265	9	R56320	Annealed	...	53
34	Ti-3Al-2.5V	Bar, billet	SB-348	9	R56320	Annealed	...	53
35	Ti-3Al-2.5V	Forgings	SB-381	F-9	R56320	Annealed	...	53
36	Ti-3Al-2.5V	Smls. & wld. tube	SB-338	9	R56320	Smls. ann.	...	53
37	Ti-3Al-2.5V	Wld. fittings	SB-363	9	R56320	Smls. ann.	...	53
38	Ti-3Al-2.5V	Smls. pipe	SB-861	9	R56320	Smls. ann.	...	53
39	Ti-3Al-2.5V	Smls. & wld. tube	SB-338	9	R56320	Wld. ann.	...	53
40	Ti-3Al-2.5V	Wld. fittings	SB-363	9	R56320	Wld. ann.	...	53
41	Ti-3Al-2.5V	Wld. pipe	SB-862	9	R56320	Wld. ann.	...	53

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Applicability and Max. Temperature Limits (NP = Not Permitted) (SPT = Supports Only)		External Pressure Chart No.	Notes
			III	VIII-2		
1	240	170	NP	316	NFT-3	...
2	240	170	NP	316	NFT-3	G5
3	240	170	NP	316	NFT-3	G5
4	345	275	NP	316	NFT-2	...
5	345	275	NP	316	NFT-2	...
6	345	275	NP	316	NFT-2	...
7	345	275	NP	316	NFT-2	...
8	345	275	NP	316	NFT-2	...
9	345	275	NP	316	NFT-2	G5
10	345	275	NP	316	NFT-2	G5
11	450	380	NP	316	NFT-1	...
12	450	380	NP	316	NFT-1	...
13	450	380	NP	316	NFT-1	...
14	450	380	NP	316	NFT-1	...
15	450	380	NP	316	NFT-1	...
16	450	380	NP	316	NFT-1	G5
17	450	380	NP	316	NFT-1	G5
18	345	275	NP	316	NFT-2	...
19	345	275	NP	316	NFT-2	...
20	345	275	NP	316	NFT-2	...
21	345	275	NP	316	NFT-2	...
22	345	275	NP	316	NFT-2	...
23	345	275	NP	316	NFT-2	G5
24	345	275	NP	316	NFT-2	G5
25	345	275	NP	316	NFT-2	...
26	485	345	NP	316	NFT-5	...
27	485	345	NP	316	NFT-5	...
28	485	345	NP	316	NFT-5	...
29	485	345	NP	316	NFT-5	...
30	485	345	NP	316	NFT-5	...
31	485	345	NP	316	NFT-5	G5
32	485	345	NP	316	NFT-5	G5
33	620	485	316	NP	NFT-4	...
34	620	485	316	NP	NFT-4	...
35	620	485	316	NP	NFT-4	...
36	620	485	316	NP	NFT-4	...
37	620	485	316	NP	NFT-4	...
38	620	485	316	NP	NFT-4	...
39	620	485	316	NP	NFT-4	G5
40	620	485	316	NP	NFT-4	G5
41	620	485	316	NP	NFT-4	G5

Table 2B (Cont'd)
Section III, Division 1, Classes 1, MC, and CS; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2, Class 1 Maximum Allowable
Stress Values, S , for Nonferrous Materials

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425
1	80.7	75.3	64.3	58.4	52.9	48.5	44.7	41.7	37.6	33.9	30.9	27.8	...	...	...	...
2	68.3	63.6	54.9	49.5	44.6	40.9	38.4	35.4	32.3	29.2	26.1	23.0	...	...	...	...
3	68.3	63.6	54.9	49.5	44.6	40.9	38.4	35.4	32.3	29.2	26.1	23.0	...	...	...	...
4	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
5	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
6	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
7	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
8	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
9	97.9	93.9	82.7	76.3	70.8	65.1	61.3	57.1	53.1	49.8	46.8	43.6	...	...	...	...
10	97.9	93.9	82.7	76.3	70.8	65.1	61.3	57.1	53.1	49.8	46.8	43.6	...	...	...	...
11	150	141	124	113	102	93.0	84.8	77.2	70.5	65.5	61.6	57.9	...	...	...	...
12	150	141	124	113	102	93.0	84.8	77.2	70.5	65.5	61.6	57.9	...	...	...	...
13	150	141	124	113	102	93.0	84.8	77.2	70.5	65.5	61.6	57.9	...	...	...	...
14	150	141	124	113	102	93.0	84.8	77.2	70.5	65.5	61.6	57.9	...	...	...	...
15	150	141	124	113	102	93.0	84.8	77.2	70.5	65.5	61.6	57.9	...	...	...	...
16	127	120	105	95.9	87.2	79.1	71.5	65.7	60.0	55.5	52.3	49.2	...	...	...	...
17	127	120	105	95.9	87.2	79.1	71.5	65.7	60.0	55.5	52.3	49.2	...	...	...	...
18	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
19	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
20	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
21	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
22	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
23	97.9	93.9	82.7	76.3	70.8	65.1	61.3	57.1	53.1	49.8	46.8	43.6	...	...	...	...
24	97.9	93.9	82.7	76.3	70.8	65.1	61.3	57.1	53.1	49.8	46.8	43.6	...	...	...	...
25	115	110	97.6	89.9	83.1	76.9	71.8	67.4	63.1	58.7	54.7	51.0	...	...	...	...
26	161	161	147	139	130	122	116	111	106	103	101	98.3	...	...	...	...
27	161	161	147	139	130	122	116	111	106	103	101	98.3	...	...	...	...
28	161	161	147	139	130	122	116	111	106	103	101	98.3	...	...	...	...
29	161	161	147	139	130	122	116	111	106	103	101	98.3	...	...	...	...
30	161	161	147	139	130	122	116	111	106	103	101	98.3	...	...	...	...
31	137	137	125	118	111	105	98.8	94.3	90.2	87.7	85.8	83.1	...	...	...	...
32	137	137	125	118	111	105	98.8	94.3	90.2	87.7	85.8	83.1	...	...	...	...
33	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
34	207	207	197	190	182	173	164	155	148	143	140	138	...	...	...	...
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	176	176	167	161	154	147	139	132	126	122	119	117	...	...	...	...
40	176	176	167	161	154	147	139	132	126	122	119	117	...	...	...	...
41	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 Notes E1 through E5).
- (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.
- (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 425°C, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E2 For values at 125°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E3 For values at 200°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E4 For values at 400°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E5 For values at 150°C and above, the design stress intensity values or maximum allowable stress values are based on successful experience in service.
- E6 For values at 175°C and above, 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 Stress 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 stress values for this material.
- G6 Maximum temperature for external pressure design not to exceed 175°C.
- G7 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.
- G8 Stress values for 40°C may be used at temperatures down to -270°C without additional specification requirements.
- G9 For stress relieved tempers (T451, T4510, T4511, T651, T6510, and T6511), stress values for materials in the basic temper shall be used.
- G10 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.
- G11 The allowable stress value at 65°C shall be used at 66°C.

NOTES – SIZE REQUIREMENTS

- S1 Thickness ≤ 2.5 mm.

NOTES – WELDING REQUIREMENTS

- W1 Welding except for seal welds is not permitted.
- W2 For welded construction, stress values for material of O temper shall be used.
- W3 The stress values given for this material are not applicable when either welding or thermal cutting is employed.

Table 3
Section III, Division 1, 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	A	...	...	$6 \leq t \leq 100$
2	Carbon steel	Bolting	SA-307	B	...	...	...
3	Carbon steel	Bolting	SA-449	1	K04200	...	$38 < t \leq 75$
(25) 4	...	...	...	...	...	...	...
(25) 5	Carbon steel	Bolting	SA-325	1	K02706	...	$25 < t \leq 38$
6	Carbon steel	Bolting	SA-449	1	K04200	...	$25 < t \leq 38$
7	Carbon steel	Bolting	SA-354	BC	K04100	...	$64 < t \leq 100$
8	Carbon steel	Bolting	SA-325	1	K02706	...	$13 \leq t \leq 25$
9	Carbon steel	Bolting	SA-449	1	K04200	...	≤ 25
10	Carbon steel	Bolting	SA-354	BC	K04100	...	$6 < t \leq 64$
11	Carbon steel	Bolting	SA-354	BD	K04100	...	$64 < t \leq 100$
12	Carbon steel	Bolting	SA-354	BD	K04100	...	$6 < t \leq 64$
13	C- $\frac{1}{4}$ Mo	Bolting	SA-320	L7A	G40370	...	≤ 65
14	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037	G40370	...	≥ 16
15	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042	G40420	...	≥ 16
16	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037	G40370	...	≤ 13
17	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042	G40420	...	≤ 13
18	$\frac{3}{4}$ Cr	Bolting	SA-574	5137M	...	...	≥ 16
19	$\frac{3}{4}$ Cr	Bolting	SA-574	51B37M	...	...	≥ 16
20	$\frac{3}{4}$ Cr	Bolting	SA-574	5137M	...	...	≤ 13
21	$\frac{3}{4}$ Cr	Bolting	SA-574	51B37M	...	...	≤ 13
22	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	5	$50 < t \leq 100$
23	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	5	≤ 50
24	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	4	≤ 100
25	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	3	≤ 100
26	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	2	≤ 75
27	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	H41420	1	≤ 38
28	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-193	B7	G41400	...	$100 < t \leq 180$
29	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-193	B7M	G41400	...	≤ 100
30	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-320	L7M	G41400	...	≤ 65
31	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-193	B7	G41400	...	$64 < t \leq 100$
32	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-193	B7	G41400	...	≤ 64
33	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-320	L7	G41400	...	≤ 65
34	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4137	G41370	...	≥ 16
35	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4140	G41400	...	≥ 16
36	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4142	G41420	...	≥ 16
37	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4145	G41450	...	≥ 16
38	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4137	G41370	...	≤ 13
39	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4140	G41400	...	≤ 13
40	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4142	G41420	...	≤ 13
41	1Cr- $\frac{1}{5}$ Mo	Bolting	SA-574	4145	G41450	...	≤ 13
42	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...	$100 < t \leq 200$
43	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...	$64 < t \leq 100$
44	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	5	$50 < t \leq 205$
45	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	5	≤ 50

Table 3
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
							Ferrous Materials
1	415	...	NP	232	NP	NP	G12
2	415	...	204	232	NP	232	...
3	620	400	371	343	343	343	...
4	...	...	...	...	...	...	...
5	725	560	343	343	343	343	...
6	725	560	371	371	371	343	...
7	795	685	343	343	343	343	...
8	825	635	NP	343	343	343	...
9	825	635	371	343	343	343	...
10	860	750	343	343	343	343	...
11	965	795	343	343	343	343	...
12	1035	895	343	343	343	343	...
13	860	725	NP	343	343	343	W3
14	1170	930	288	288	NP	288	G7, G11, W1
15	1170	930	288	288	NP	288	G7, G11, W1
16	1240	965	288	288	NP	288	G7, G11, W1
17	1240	965	288	288	NP	288	G7, G11, W1
18	1170	930	288	288	NP	NP	G7, G11, W1
19	1170	930	288	288	NP	NP	G7, G11, W1
20	1240	965	288	288	NP	NP	G7, G11, W1
21	1240	965	288	288	NP	NP	G7, G11, W1
22	795	690	371	NP	NP	NP	...
23	825	725	371	NP	NP	NP	...
24	930	825	371	NP	NP	NP	...
25	1000	895	371	371	NP	343	...
26	1070	965	371	NP	NP	NP	...
27	1140	1035	371	NP	NP	NP	...
28	690	515	427	538	427	343	T5
29	690	550	NP	538	427	343	T5
30	690	550	NP	538	427	343	T5
31	795	655	427	538	427	343	T5
32	860	725	427	538	427	343	T5
33	860	725	371	427	427	343	...
34	1170	930	288	NP	NP	NP	G7, G11, W1
35	1170	930	288	288	NP	288	G7, G11, W1
36	1170	930	288	NP	NP	NP	G7, G11, W1
37	1170	930	288	NP	NP	NP	G7, G11, W1
38	1240	965	288	NP	NP	NP	G7, G11, W1
39	1240	965	288	NP	NP	NP	G7, G11, W1
40	1240	965	288	NP	NP	NP	G7, G11, W1
41	1240	965	288	NP	NP	NP	G7, G11, W1
42	690	585	427	593	427	343	T8
43	760	655	427	593	427	343	T8
44	795	690	371	371	371	NP	...
45	825	725	371	371	371	NP	...

Table 3
Section III, Division 1, 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																	
	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	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	...	...	...	...	...	...	...	...	...
3	100	100	100	100	100	100	100	100	100	100	100	100	100	100	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	139	139	139	139	139	139	139	139	139	139	139	139	139	...	...	...	...	...
6	139	139	139	139	139	139	139	139	139	139	139	139	139	139	...	...	...	...
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	...	...	...	...	...
9	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
10	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...	...
11	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
12	207	207	207	207	207	207	207	207	207	207	207	207	207	...	...	...	...	...
13	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...	...
14	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
15	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
16	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
17	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
18	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
19	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
20	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
21	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
22	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
23	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
24	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
25	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
26	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
27	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
28	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	125	115	93.7
29	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	128	115	93.6
30	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	128	115	93.6
31	159	159	159	159	159	159	159	159	159	159	159	159	159	158	153	139	117	93.0
32	172	172	172	172	172	172	172	172	172	172	172	172	172	172	162	146	118	92.7
33	172	172	172	172	172	172	172	172	172	172	172	172	172	172	162	146	118	...
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	...	...	...	...	...	...	...
37	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
38	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
39	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
40	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
41	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
42	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	132	119
43	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	147	133
44	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
45	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...

Table 3
Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	68.4	43.8	18.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	68.4	43.7	18.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	68.4	43.7	18.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	68.6	43.7	18.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	68.8	43.6	18.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	105	87.7	61.7	34.3	13.8	...	...	...	...	...	...	...	...	...	...	...	...
43	114	90.4	61.1	34.5	13.7	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)
(25)

Table 3 (Cont'd)
Section III, Division 1, 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- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...	≤64
2	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	4	≤150
3	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	3	≤150
4	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	2	≤100
5	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	1	≤100
6	5Cr- $\frac{1}{2}$ Mo	Bolting	SA-193	B5	K50100	...	≤100
7	12Cr-1Mo-V-W	Bolting	SA-437	B4C	K91352	...	...
8	12Cr-1Mo-V-W	Bolting	SA-437	B4B	K91352	...	...
9	13Cr	Bolting	SA-193	B6	S41000	...	≤100
10	17Cr-4Ni-4Cu	Bolting	SA-564	630	S17400	H1150	≤200
11	17Cr-4Ni-4Cu	Bolting	SA-564	630	S17400	H1100	≤200
12	17Cr-4Ni-4Cu	Bolting	SA-705	630	S17400	H1100	≤200
13	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	8740	G87400	...	≥16
14	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	8740	G87400	...	≤13
15	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-320	L43	G43400	...	≤100
16	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340	G43400	...	≥16
17	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340	G43400	...	≤13
18	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	5	≤150
19	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	5	150 < t ≤ 240
20	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	4	≤240
21	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	3	≤240
22	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	2	≤240
23	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	1	≤200
24	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	5	≤150
25	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	5	150 < t ≤ 240
26	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	4	≤240
27	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	3	≤240
28	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	2	≤240
29	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	1	≤200
30	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo-V	Bolting	SA-540	B24V	K24070	3	≤280
31	$3\frac{1}{2}$ Ni- $1\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-508	5	K42365	2	...
32	25Ni-15Cr-2Ti	Bolting	SA-453	660	S66286	A	...
33	25Ni-15Cr-2Ti	Bolting	SA-453	660	S66286	B	...
34	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	1	...
35	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	1	...
36	16Cr-12Ni-2Mo	Bolting	SA-320	B8MA	S31600	1A	...
37	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B	64 < t ≤ 72
38	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2	30 < t ≤ 36
39	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2	32 < t ≤ 40
40	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B	48 < t ≤ 64
41	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2	24 < t ≤ 30
42	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2	25 < t ≤ 32
43	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B	≤48
44	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2	20 < t ≤ 24
45	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2	20 < t ≤ 25

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
			Ferrous Materials (Cont'd)				
1	860	725	427	593	427	343	T8
2	930	825	371	371	371	343	...
3	1000	895	371	371	371	343	...
4	1070	965	371	371	371	343	...
5	1140	1035	371	371	371	343	...
6	690	550	427	649	427	343	T5
7	795	585	371	371	371	343	...
8	1000	725	371	371	371	343	...
9	760	585	427	482	427	343	T5
10	930	725	NP	343	343	NP	G4
11	965	795	343	343	343	343	G4
12	965	795	343	343	343	343	G4
13	1170	930	288	NP	NP	NP	G7, G11, W1
14	1240	965	288	NP	NP	NP	G7, G11, W1
15	860	725	204	204	371	204	...
16	1170	930	288	288	NP	NP	G7, G11, W1
17	1240	965	288	288	NP	NP	G7, G11, W1
18	825	725	371	371	371	343	...
19	795	690	371	371	371	343	...
20	930	825	371	371	371	343	...
21	1000	895	371	371	371	343	...
22	1070	965	371	371	371	343	...
23	1140	1035	371	371	371	343	...
24	825	725	371	371	371	343	...
25	795	690	371	371	371	343	...
26	930	825	371	371	371	343	...
27	1000	895	371	371	371	343	...
28	1070	965	371	371	371	343	...
29	1140	1035	371	371	371	343	...
30	1000	895	371	371	371	343	...
31	795	690	NP	38	38	38	...
32	895	585	427	538	427	343	...
33	895	585	427	538	427	343	...
34	515	205	427	816	427	343	G5, G6, T11
35	515	205	204	427	427	38	...
36	515	205	NP	427	427	38	...
37	550	380	NP	538	427	343	G8, G9
38	620	345	427	427	NP	343	G8
39	620	345	NP	427	427	38	G8, G9
40	620	450	NP	538	427	343	G8, G9
41	655	450	427	427	NP	343	G8
42	655	450	NP	427	427	38	G8
43	655	515	NP	538	427	343	G8, G9
44	690	550	427	427	NP	343	G8
45	690	550	NP	427	427	38	G8

Table 3 (Cont'd)
Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	164	148
2	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
3	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
4	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
5	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
6	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	129	105	78.3
7	147	147	147	147	147	147	147	147	147	147	147	147	147	147	...	...	...	...
8	181	181	181	181	181	181	181	181	181	181	181	181	181	181	...	...	...	...
9	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	125	92.4
10	181	181	181	181	181	181	181	181	181	181	181	181	181	...	...	...	...	...
11	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
12	193	193	193	193	193	193	193	193	193	193	193	193	193	...	...	...	...	...
13	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
14	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
15	172	172	172	172	172	172	172	172	172	172	172	172	172	172	...	...	...	...
16	233	233	233	233	233	233	233	233	233	233	233	...	...	...	...	...	...	...
17	241	241	241	241	241	241	241	241	241	241	241	...	...	...	...	...	...	...
18	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
19	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
20	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
21	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
22	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
23	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
24	165	165	165	165	165	165	165	165	165	165	165	165	165	165	...	...	...	...
25	159	159	159	159	159	159	159	159	159	159	159	159	159	159	...	...	...	...
26	186	186	186	186	186	186	186	186	186	186	186	186	186	186	...	...	...	...
27	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
28	214	214	214	214	214	214	214	214	214	214	214	214	214	214	...	...	...	...
29	228	228	228	228	228	228	228	228	228	228	228	228	228	228	...	...	...	...
30	200	200	200	200	200	200	200	200	200	200	200	200	200	200	...	...	...	...
31	159	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147
33	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147
34	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
35	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	...
36	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	...
37	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
38	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	...
39	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	...
40	130	127	121	115	112	112	112	112	112	112	112	112	112	112	112	112	112	112
41	130	127	121	115	112	112	112	112	112	112	112	112	112	112	112	112	112	...
42	130	127	121	115	112	112	112	112	112	112	112	112	112	112	112	112	112	...
43	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
44	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	...
45	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	...

Table 3 (Cont'd)
Section III, Division 1, 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	122	91.8	60.8	34.6	13.7	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	58.5	44.4	33.9	26.3	19.5	13.0	8.79	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	68.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	147	147	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	147	147	147	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	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	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	95.1	95.1	95.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	130	130	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 3 (Cont'd)
Section III, Division 1, 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	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2	≤20
2	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2	≤20
3	16Cr-12Ni-2Mo-N	Bolting	SA-193	B8MNA	S31651	1A	...
4	18Cr-8Ni	Bolting	SA-193	B8	S30400	1	...
5	18Cr-8Ni	Bolting	SA-320	B8	S30400	1	...
6	18Cr-8Ni	Bolting	SA-320	B8A	S30400	1A	...
7	18Cr-8Ni	Bolting	SA-193	B8	S30400	2	30 < t ≤ 36
8	18Cr-8Ni	Bolting	SA-320	B8	S30400	2	32 < t ≤ 40
9	18Cr-8Ni	Bolting	SA-193	B8	S30400	2	24 < t ≤ 30
10	18Cr-8Ni	Bolting	SA-320	B8	S30400	2	25 < t ≤ 32
11	18Cr-8Ni	Bolting	SA-193	B8	S30400	2	20 < t ≤ 24
12	18Cr-8Ni	Bolting	SA-320	B8	S30400	2	20 < t ≤ 25
13	18Cr-8Ni	Bolting	SA-193	B8	S30400	2	≤20
14	18Cr-8Ni	Bolting	SA-320	B8	S30400	2	≤20
15	18Cr-8Ni-N	Bolting	SA-193	B8NA	S30451	1A	...
(25) 16	18Cr-8Ni-S	Bolting	SA-320	B8F	S30300	1	...
(25) 17	18Cr-8Ni-S	Bolting	SA-320	B8FA	S30300	1A	...
18	18Cr-8Ni-Se	Bolting	SA-320	B8F	S30323	1	...
19	18Cr-8Ni-Se	Bolting	SA-320	B8FA	S30323	1A	...
20	18Cr-8Ni-4Si-N	Bolting	SA-193	B8S	S21800	...	...
21	18Cr-8Ni-4Si-N	Bolting	SA-193	B8SA	S21800	...	...
22	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	1	...
23	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	1	...
24	18Cr-10Ni-Cb	Bolting	SA-320	B8CA	S34700	1A	...
25	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2	30 < t ≤ 36
26	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2	32 < t ≤ 40
27	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2	24 < t ≤ 30
28	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2	25 < t ≤ 32
29	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2	20 < t ≤ 24
30	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2	20 < t ≤ 25
31	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2	≤20
32	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2	≤20
(25) 33	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	1	...
34	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	1	...
35	18Cr-10Ni-Ti	Bolting	SA-320	B8TA	S32100	1A	...
36	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2	30 < t ≤ 36
37	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2	32 < t ≤ 40
38	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2	24 < t ≤ 30
39	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2	25 < t ≤ 32
40	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2	20 < t ≤ 24
41	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2	20 < t ≤ 25
42	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2	≤20
43	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2	≤20
44	18Cr-11Ni	Bolting	SA-193	B8P	S30500	1	...
45	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2	30 < t ≤ 36

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
			Ferrous Materials (Cont'd)				
1	760	655	427	427	NP	343	G8
2	760	655	NP	427	427	38	G8
3	515	205	427	538	427	343	G5
4	515	205	427	816	427	343	G5, G6, T10
5	515	205	204	427	427	38	...
6	515	205	NP	427	427	38	...
7	690	345	NP	538	427	343	G8, G9
8	690	345	NP	538	427	38	G8
9	725	450	NP	538	427	343	G8, G9
10	725	450	NP	538	427	38	G8
11	795	550	NP	538	427	343	G8, G9
12	795	550	NP	538	427	38	G8
13	860	690	NP	538	427	343	G8, G9
14	860	690	NP	538	427	38	G8
15	515	205	427	538	427	343	G5
16	515	205	204	204	204	38	...
17	515	205	NP	204	204	38	...
18	515	205	204	204	204	38	...
19	515	205	NP	204	204	38	...
20	655	345	NP	510	427	343	...
21	655	345	NP	510	427	343	...
22	515	205	427	816	427	343	G5, G6, T9
23	515	205	204	427	427	38	...
24	515	205	NP	427	427	38	...
25	690	345	NP	38	38	38	G8
26	690	345	NP	38	38	38	G8
27	725	450	NP	38	38	38	G8
28	725	450	NP	38	38	38	G8
29	795	550	NP	38	38	38	G8
30	795	550	NP	38	38	38	G8
31	860	690	NP	38	38	38	G8
32	860	690	NP	38	38	38	G8
33	515	205	427	816	427	343	G5, G6, T9
34	515	205	204	427	427	38	...
35	515	205	NP	427	427	38	...
36	690	345	NP	538	427	343	G8
37	690	345	NP	427	427	38	G8
38	725	450	NP	538	427	343	G8
39	725	450	NP	427	427	38	G8
40	795	550	NP	538	427	343	G8
41	795	550	NP	427	427	38	G8
42	860	690	NP	538	427	343	G8
43	860	690	NP	427	427	38	G8
44	515	205	NP	816	427	343	T10
45	690	345	NP	538	427	343	G8

Table 3 (Cont'd)
Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	...
2	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	...
3	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
4	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
5	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	...
6	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	...
7	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
8	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
9	130	121	115	114	112	112	112	112	112	112	112	112	112	112	112	112	112	112
10	130	121	115	114	112	112	112	112	112	112	112	112	112	112	112	112	112	112
11	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
12	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
13	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
14	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
15	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
16	130	115	101	96.6	93.6	90.6	87.4	84.3	...	...	...	...	...	...	...	...	...	...
17	130	115	101	96.6	93.6	90.6	87.4	84.3	...	...	...	...	...	...	...	...	...	...
18	130	115	101	96.6	93.6	90.6	87.4	84.3	...	...	...	...	...	...	...	...	...	...
19	130	115	101	96.6	93.6	90.6	87.4	84.3	...	...	...	...	...	...	...	...	...	...
20	164	163	160	156	150	143	137	132	129	126	123	121	119	118	116	115	115	115
21	164	163	160	156	150	143	137	132	129	126	123	121	119	118	116	115	115	115
22	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
23	130	127	122	118	113	109	107	106	104	102	99.7	98.1	96.7	95.0	94.4	93.8	93.1	...
24	130	127	122	118	113	109	107	106	104	102	99.7	98.1	96.7	95.0	94.4	93.8	95.1	...
25	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	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
34	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	...
35	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	...
36	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
37	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	...
38	130	127	122	117	114	113	112	112	112	112	112	112	112	112	112	112	112	112
39	130	127	122	117	114	113	112	112	112	112	112	112	112	112	112	112	112	...
40	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
41	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	...
42	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
43	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	...
44	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
45	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	129	127	125

Table 3 (Cont'd)
Section III, Division 1, 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	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)																
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	80.5	79.2	78.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	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	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	69.0	67.4	66.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	115	115	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	115	115	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	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	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	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	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	86.2	86.2	86.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	112	112	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	172	172	172	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	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	...	...	...
45	123	121	118	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

(25)

Table 3 (Cont'd)
Section III, Division 1, 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-11Ni	Bolting	SA-193	B8P	S30500	2	$24 < t \leq 30$
2	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2	$20 < t \leq 24$
3	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2	≤ 20
4	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B	> 76
5	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B	> 76
6	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B	≤ 76
7	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B	≤ 76
8	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A	> 76
9	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A	> 76
10	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A	≤ 76
11	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A	≤ 76
12	22Cr-13Ni-5Mn	Bolting	SA-479	XM-19	S20910	Annealed	...
13	22Cr-13Ni-5Mn	Bolting	SA-479	XM-19	S20910	Hot rolled	$76.2 < t \leq 203.2$
14	22Cr-13Ni-5Mn	Bolting	SA-479	XM-19	S20910	Hot rolled	$50.8 < t \leq 76.2$
15	22Cr-13Ni-5Mn	Bolting	SA-479	XM-19	S20910	Hot rolled	≤ 50.8
16	23Cr-25Ni-5.5Mo-N	Bolting	SA-193	...	S32053	...	...

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
							Ferrous Materials (Cont'd)
1	725	450	NP	538	427	343	G8
2	795	550	NP	538	427	343	G8
3	860	690	NP	538	427	343	G8
4	655	345	427	NP	NP	NP	...
5	655	345	NP	538	427	343	...
6	655	415	427	NP	NP	NP	...
7	655	415	NP	538	427	343	...
8	690	415	427	NP	NP	NP	...
9	690	415	NP	538	427	343	...
10	690	485	427	NP	NP	NP	...
11	690	485	NP	538	427	343	...
12	690	380	NP	621	427	343	T9
13	690	415	NP	621	427	343	T9
14	795	515	NP	621	427	343	T9
15	930	725	NP	621	427	343	T9
16	640	295	NP	662	NP	NP	...

Table 3 (Cont'd)
Section III, Division 1, 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	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Ferrous Materials (Cont'd)																	
1	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
2	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
3	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
4	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	...
5	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
6	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	...
7	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
8	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	...
9	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
10	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	...
11	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
12	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
13	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
14	172	172	171	167	163	159	157	155	154	153	152	151	150	149	147	146	144	143
15	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181
16	183	177	164	...	151	...	141	...	134	...	129	127	125	...	...	...	...	...

Table 3 (Cont'd)
Section III, Division 1, 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	130	130	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	138	138	138	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	172	169	164	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	54.7	53.8	52.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	65.3	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	65.3	64.1	62.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	76.4	74.8	72.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	141	139	134	121	80.1	53.1	...	...	...	...	...	...	...	...	...	...	...
13	141	139	134	121	80.1	53.1	...	...	...	...	...	...	...	...	...	...	...
14	141	139	134	121	80.1	53.1	...	...	...	...	...	...	...	...	...	...	...
15	181	181	165	114	81.8	52.7	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 3 (Cont'd)
Section III, Division 1, 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							
1	...	Bolting	SB-211	2014	A92014	T6	3–200
2	...	Bolting	SB-211	2014	A92014	T651	3–200
3	...	Bolting	SB-211	2024	A92024	T4	3.18–12.69
4	...	Bolting	SB-211	2024	A92024	T4	12.70–114.30
5	...	Bolting	SB-211	2024	A92024	T4	114.31–165.10
6	...	Bolting	SB-211	2024	A92024	T4	165.11–203.2
7	...	Bolting	SB-211	6061	A96061	T6	3–200
8	...	Bolting	SB-211	6061	A96061	T651	3–200
9	...	Bar, rod	SB-187	...	C10200	O60	All
10	...	Bar, rod	SB-187	...	C11000	O60	All
(25) 11	...	Round rod	SB-150	...	C61400	HR50	50 < t ≤ 80
(25) 12	...	Round rod	SB-150	...	C61400	HR50	25 < t ≤ 50
(25) 13	...	Round rod	SB-150	...	C61400	HR50	12 < t ≤ 25
(25) 14	...	Round rod	SB-150	...	C61400	HR50	≤12
15	...	Round rod	SB-150	...	C62300	HR50	>80
(25) 16	...	Round rod	SB-150	...	C62300	M20, M30	>80
(25) 17	...	...	...	...	...	...	...
(25) 18	...	Round rod	SB-150	...	C62300	O20, O25, O30	>80
19	...	Hex/oct rod & bar	SB-150	...	C62300	M20	>50
20	...	Hex/oct rod & bar	SB-150	...	C62300	HR50	25 < t ≤ 50
21	...	Hex/oct rod & bar	SB-150	...	C62300	HR50	≤25
22	...	Round rod	SB-150	...	C62300	HR50	50 < t ≤ 80
23	...	Round rod	SB-150	...	C62300	HR50	25 < t ≤ 50
24	...	Round rod	SB-150	...	C62300	HR50	12 < t ≤ 25
25	...	Round rod	SB-150	...	C62300	HR50	≤12
26	...	Bar, rod	SB-150	...	C63000	M20, M30	>100
27	...	Bar, rod	SB-150	...	C63000	O20, O25, O30	>100
28	...	Bar, rod	SB-150	...	C63000	HR50	>100
29	...	Bar, rod	SB-150	...	C63000	HR50	50 < t ≤ 100
30	...	Bar, rod	SB-150	...	C63000	M20, M30	50 < t ≤ 100
31	...	Bar, rod	SB-150	...	C63000	O20, O25, O30	50 < t ≤ 100
32	...	Bar, rod	SB-150	...	C63000	HR50	25 < t ≤ 50
33	...	Bar, rod	SB-150	...	C63000	HR50	12 < t ≤ 25
34	...	Bar, rod	SB-150	...	C64200	M10, M20, M30	>100
(25) 35	...	Bar, rod	SB-150	...	C64200	M10, M20, M30	80 < t ≤ 100
(25) 36	...	Bar, rod	SB-150	...	C64200	HR50	50 < t ≤ 80
37	...	Bar, rod	SB-150	...	C64200	HR50	25 < t ≤ 50
38	...	Bar, rod	SB-150	...	C64200	HR50	12 < t ≤ 25
39	...	Bar, rod	SB-150	...	C64200	HR50	≤12
(25) 40	...	Bar, rod	SB-98	...	C65100	O60	All
41	...	Rod	SB-98	...	C65100	H06	25 < t ≤ 38
42	...	Rod	SB-98	...	C65100	H06	12 < t ≤ 25
43	...	Rod	SB-98	...	C65100	H06	≤12
(25) 44	...	Bar, rod	SB-98	...	C65500	O60	All
(25) 45	...	Bar, rod	SB-98	...	C65500	H01	All

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
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	...	...	...	...	...	...	...
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	540	220	204 (Cl. 3 only)	316	204	316	T3, W1
21	550	240	204 (Cl. 3 only)	316	204	316	T3, W1
22	525	255	204 (Cl. 3 only)	316	204	316	T3, W1
23	580	275	204 (Cl. 3 only)	316	204	316	T3, W1
24	605	305	204 (Cl. 3 only)	316	204	316	T3, W1
25	620	345	204 (Cl. 3 only)	316	204	316	T3, W1
26	550	275	371 (Cl. 3 only)	371	260	343	T4, W4
27	550	275	371 (Cl. 3 only)	371	260	343	T4, W4
28	550	275	371 (Cl. 3 only)	371	260	343	T4, W4
29	585	295	371 (Cl. 3 only)	371	260	343	T4, W4
30	585	295	371 (Cl. 3 only)	371	260	343	T4, W4
31	585	295	371 (Cl. 3 only)	371	260	343	T4, W4
32	620	310	371 (Cl. 3 only)	371	260	343	T4, W4
33	690	345	371 (Cl. 3 only)	371	260	343	T4, W4
34	485	170	177 (Cl. 3 only)	316	177	316	T13, W1
35	485	205	177 (Cl. 3 only)	316	177	316	T13, W1
36	515	240	177 (Cl. 3 only)	316	177	316	T13, W1
37	550	290	177 (Cl. 3 only)	316	177	316	T13, W1
38	585	310	177 (Cl. 3 only)	316	177	316	T13, W1
39	620	310	177 (Cl. 3 only)	316	177	316	T13, W1
40	275	85	177 (Cl. 3 only)	177	177	177	G2
41	515	275	177 (Cl. 3 only)	177	177	177	G2, W2
42	515	310	177 (Cl. 3 only)	177	177	177	G2, W2
43	585	380	177 (Cl. 3 only)	177	177	177	G2, W2
44	360	105	177 (Cl. 3 only)	177	177	177	G2
45	380	165	177 (Cl. 3 only)	NP	177	NP	G2, W2

Table 3 (Cont'd)
Section III, Division 1, 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																	
	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	32.3	32.3	32.3	32.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
10	36.8	32.3	32.3	32.3	32.2	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	130	130	130	130	129	125	123	115	94.7	77.4	70.6	66.7	...	...	...	...	...	...
26	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
27	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
28	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
29	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
30	147	147	147	147	147	147	147	147	147	145	97.9	74.1	54.7	38.9	...	...	...	...
31	147	147	147	147	147	147	147	147	147	145	97.9	74.1	54.7	38.9	...	...	...	...
32	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
33	138	138	138	138	138	138	138	138	138	137	97.9	74.1	54.7	38.9	...	...	...	...
34	115	108	106	106	106	106	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
35	121	121	121	121	121	121	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
36	115	108	106	106	106	106	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
37	115	108	106	106	106	106	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
38	115	108	106	106	106	106	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
39	115	108	106	106	106	106	84.5	57.5	41.5	25.1	13.6	10.2	...	...	...	...	...	...
40	55.0	54.8	54.3	54.0	53.6	53.1	50.8	...	...	...	...	...	...	...	...	...	...	...
41	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...	...	...	...	...	...
42	77.6	77.6	77.6	77.6	77.6	77.6	77.6	...	...	...	...	...	...	...	...	...	...	...
43	94.8	94.8	94.8	94.8	94.8	94.8	94.8	...	...	...	...	...	...	...	...	...	...	...
44	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
45	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...

Table 3 (Cont'd)
Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table 3 (Cont'd)
Section III, Division 1, 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)							
(25) 1	...	Bar, rod	SB-98	...	C65500	H02	≤50
(25) 2	...	Bar, rod	SB-98	...	C66100	O60	All
(25) 3	...	Bar, rod	SB-98	...	C66100	H01	All
(25) 4	...	Bar, rod	SB-98	...	C66100	H02	≤50
5	99Ni	Bolting	SB-160	...	N02200	Annealed	...
6	99Ni	Bolting	SB-160	...	N02200	Hot fin./ann.	...
7	99Ni	Bolting	SB-160	...	N02200	Cold drawn	...
8	99Ni-Low C	Bolting	SB-160	...	N02201	Hot fin./ann.	...
9	67Ni-30Cu	Bolting	SB-164	...	N04400	HW or CW ann.	All
10	67Ni-30Cu	Bolting	SB-164	...	N04400	Hot worked	305 < t ≤ 356
11	67Ni-30Cu	Bolting	SB-164	...	N04400	Hot worked	≤305
12	67Ni-30Cu	Bolting	SB-164	...	N04400	CD-str. rel.	≤12.7
13	67Ni-30Cu	Bolting	SB-164	...	N04400	Cold worked	≤12.7
14	67Ni-30Cu	Bolting	SB-164	...	N04400	CD-str. rel.	12.7 < t ≤ 88.9
15	67Ni-30Cu-S	Bolting	SB-164	...	N04405	Annealed	...
16	67Ni-30Cu-S	Bolting	SB-164	...	N04405	Annealed	...
17	67Ni-30Cu-S	Bolting	SB-164	...	N04405	Hot worked	...
18	67Ni-30Cu-S	Bolting	SB-164	...	N04405	Hot worked	...
19	67Ni-30Cu-S	Bolting	SB-164	...	N04405	Cold worked	...
20	67Ni-28Cu-3Al	Bolting	SF-468	...	N05500	Ann./aged	25-38
21	67Ni-28Cu-3Al	Bolting	SF-468	...	N05500	Ann./aged	6-16
22	47Ni-22Cr-9Mo-18Fe	Bolting	SB-572	...	N06002	Annealed	...
23	47Ni-22Cr-19Fe-6Mo	Bolting	SB-581	...	N06007	Solution ann.	>19
24	47Ni-22Cr-19Fe-6Mo	Bolting	SB-581	...	N06007	Solution ann.	<19
25	55Ni-21Cr-13.5Mo	Bolting	SB-574	...	N06022	Solution ann.	...
26	40Ni-29Cr-15Fe-5Mo	Bolting	SB-581	...	N06030	Solution ann.	...
27	61Ni-16Mo-16Cr	Bolting	SB-574	...	N06455	Solution ann.	...
28	72Ni-15Cr-8Fe	Bolting	SB-166	...	N06600	Annealed	...
29	72Ni-15Cr-8Fe	Bolting	SB-166	...	N06600	Hot fin.	...
30	72Ni-15Cr-8Fe	Bolting	SB-166	...	N06600	Cold drawn	...
31	72Ni-15Cr-8Fe	Bolting	SB-166	...	N06600	Hot fin.	...
32	72Ni-15Cr-8Fe	Bolting	SB-166	...	N06600	Hot fin.	...
33	60Ni-22Cr-9Mo-3.5Cb	Bolting	SB-446	1	N06625	Annealed	...
34	49Ni-25Cr-18Fe-6Mo	Bolting	SB-581	...	N06975	Solution ann.	...
35	53Ni-19Cr-19Fe-Cb-Mo	Bolting	SB-637	...	N07718	Ann./aged	≤150
36	70Ni-16Cr-7Fe-Ti-Al	Bolting	SB-637	2	N07750	Ann./aged	...
37	26Ni-43Fe-22Cr-5Mo	Bolting	SB-621	...	N08320	Solution ann.	...
38	46Fe-24Ni-21Cr-6Mo-N	Bolting	SB-691	...	N08367	Solution ann.	...
39	33Ni-42Fe-21Cr	Bolting	SB-408	...	N08800	Annealed	...
40	33Ni-42Fe-21Cr	Bolting	SB-408	...	N08810	Annealed	...
41	42Ni-21.5Cr-3Mo-2.3Cu	Bolting	SB-425	...	N08825	Annealed	...
42	62Ni-28Mo-5Fe	Bolting	SB-335	...	N10001	Annealed	38 < t ≤ 89
43	62Ni-28Mo-5Fe	Bolting	SB-335	...	N10001	Annealed	≤38
44	70Ni-16Mo-7Cr-5Fe	Bolting	SB-573	...	N10003	Annealed	...
45	54Ni-16Mo-15Cr	Bolting	SB-574	...	N10276	Solution ann.	...

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
			Nonferrous Materials (Cont'd)				
1	485	260	177 (Cl. 3 only)	NP	177	NP	G2, W2
2	360	105	177 (Cl. 3 only)	177	177	177	G2
3	380	165	177 (Cl. 3 only)	NP	177	NP	G2, W2
4	485	260	177 (Cl. 3 only)	NP	177	NP	G2, W2
5	380	100	316 (Cl. 3 only)	316	316	316	...
6	415	100	316 (Cl. 3 only)	316	316	316	...
7	450	275	316 (Cl. 3 only)	316	316	316	...
8	345	69	316 (Cl. 3 only)	649	427	343	T5
9	480	170	427	482	427	343	T5
10	517	276	427	482	427	343	T5
11	552	276	427	482	427	343	T5
12	580	345	260	260	260	260	G3
13	585	380	260	260	260	260	G3
14	600	415	NP	260	260	260	G3
15	485	170	427	NP	NP	NP	...
16	485	170	NP	482	427	343	T5
17	515	240	427	NP	NP	NP	...
18	515	240	NP	482	427	343	T5
19	585	345	260	260	260	260	G3
20	895	585	NP	260	NP	NP	...
21	895	620	NP	260	NP	NP	...
22	655	240	NP	899	427	343	T11
23	585	205	NP	538	427	343	...
24	620	240	NP	538	427	343	...
25	690	310	NP	427	427	343	...
26	585	240	NP	427	427	343	...
27	690	275	NP	427	427	343	...
28	550	240	427	649	427	343	T6
29	585	240	427	649	427	343	T7
30	620	275	NP	260	260	260	G3, H1
31	620	275	427	NP	NP	NP	...
32	620	275	NP	649	427	343	T7
33	825	415	NP	649	427	343	G1, T11
34	585	220	NP	427	427	343	...
35	1275	1035	427	621	427	343	W4, W5
36	1170	795	427	427	427	343	...
37	515	195	NP	427	427	343	...
38	655	310	427	427	NP	NP	...
39	515	205	NP	816	427	343	T10
40	450	170	NP	899	427	343	T11
41	585	240	NP	538	427	343	...
42	690	315	427	427	427	343	...
43	795	315	427	427	427	343	...
44	690	275	NP	704	427	343	T10
45	690	285	NP	677	427	343	T10

Table 3 (Cont'd)
Section III, Division 1, 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																	
	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
	Nonferrous Materials (Cont'd)																	
1	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
2	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
3	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
4	68.9	68.8	68.6	68.4	68.1	67.8	50.8	...	...	...	...	...	...	...	...	...	...	...
5	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
6	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.0	66.4	63.4	59.5	55.8	...	...	...	...	...	...
7	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
8	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
9	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
10	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
11	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
12	115	107	99.4	95.9	93.7	92.1	91.1	90.6	90.4	90.3	...	...	...	...	...	...	...	...
13	115	107	99.5	96.4	95.1	95.1	95.1	95.1	95.1	95.1	...	...	...	...	...	...	...	...
14	115	107	103	103	103	103	103	103	103	103	...	...	...	...	...	...	...	...
15	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	...
16	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
17	129	129	129	129	129	129	129	129	129	129	129	128	127	123	112	101	89.6	...
18	129	129	129	129	129	129	129	129	129	129	129	129	128	123	118	102	65.1	34.9
19	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	...	...	...	...	...	...	...	...
20	147	147	147	147	147	147	147	147	147	147	...	...	...	...	...	...	...	...
21	155	155	155	155	155	155	155	155	155	155	...	...	...	...	...	...	...	...
22	161	152	142	137	132	128	123	119	115	112	109	107	105	103	103	101	101	100
23	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
24	155	150	143	139	134	130	126	123	121	119	117	115	114	113	112	111	110	110
25	172	172	172	171	169	164	158	152	148	144	141	137	134	132	130	128	127	...
26	147	143	137	131	126	122	119	116	114	112	110	108	106	105	103	101	98.9	...
27	172	172	169	164	158	154	150	147	145	143	140	138	136	135	134	132	130	...
28	138	138	138	138	138	138	138	138	138	138	138	138	136	135	134	132	130	118
29	146	146	146	146	146	146	146	146	146	146	146	146	146	145	145	141	140	135
30	138	138	138	138	138	138	138	138	138	138	...	...	...	...	...	...	...	...
31	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	...
32	146	146	146	146	146	146	146	146	146	146	146	146	146	145	145	141	140	135
33	207	207	207	207	207	203	196	190	187	185	183	182	180	179	179	170	168	166
34	147	141	134	130	127	124	122	119	115	112	109	107	105	104	103	101	100	...
35	255	252	247	245	243	241	239	237	236	235	234	233	232	232	231	230	228	227
36	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	...
37	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	...
38	164	164	163	158	155	151	149	147	143	139	136	133	130	128	126	124	122	...
39	129	129	129	126	123	121	119	117	116	114	113	112	111	109	108	107	106	104
40	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
41	146	146	146	144	140	137	133	130	127	125	123	122	121	119	119	118	117	116
42	172	172	172	172	172	172	171	169	168	166	165	163	161	158	157	155	153	...
43	198	198	191	185	181	177	174	171	168	166	163	161	160	159	157	156	155	...
44	172	169	165	162	158	152	146	141	138	138	138	137	134	131	127	124	122	121
45	172	172	171	164	158	152	147	143	139	136	132	128	125	122	120	118	116	115

Table 3 (Cont'd)
Section III, Division 1, 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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
8	27.9	22.7	18.7	15.6	13.0	9.96	8.20	...	...	...	...	...	...	...	...	...	...	
9	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
10	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
11	7.84	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	41.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
18	8.07	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
22	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	
23	93.8	93.5	92.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
24	110	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
28	86.5	58.0	40.0	26.8	18.9	15.2	15.2	...	...	...	...	...	...	...	...	...	...	
29	134	119	85.4	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...	
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
32	134	119	85.4	62.9	46.2	39.4	37.9	...	...	...	...	...	...	...	...	...	...	
33	165	164	163	163	160	139	88.7	...	...	...	...	...	...	...	...	...	...	
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
35	226	224	222	218	209	202	...	...	...	...	...	...	...	...	...	...	...	
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
39	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	...	...	...	
40	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	
41	115	115	114	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
44	120	119	114	100	80.1	61.3	44.9	33.7	25.5	17.5	...	...	...	...	...	...	...	
45	114	114	114	114	98.5	81.5	67.1	54.6	43.1	...	...	...	...	...	...	...	...	

Table 3 (Cont'd)
Section III, Division 1, 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	65Ni-28Mo-2Fe	Bolting	SB-335	...	N10665	Solution ann.	...
2	21Ni-30Fe-22Cr-18Co-3Mo-3W	Bolting	SB-572	...	R30556	Annealed	...

Table 3 (Cont'd)
Section III, Division 1, 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)				Notes
			III	VIII-1	VIII-2	XII	
1	760	350	NP	427	427	343	Nonferrous Materials (Cont'd) ...
2	690	310	NP	899	427	343	T12

Table 3 (Cont'd)
Section III, Division 1, 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		Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																	
No.		40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
		Nonferrous Materials (Cont'd)																	
1		190	190	190	190	190	190	190	190	190	189	189	187	184	183	180	177	174	...
2		172	172	172	166	159	153	148	143	140	137	134	132	130	129	127	126	124	123

Table 3 (Cont'd)
Section III, Division 1, 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	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																
No.	500	525	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	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

Nonferrous Materials (Cont'd)

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) 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.
- (c) 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.
- (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 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; 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.
- (i) An alternative typeface is used for stress values obtained from time-dependent properties (see Notes T1 through T12).

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.
- G11 The shipping lot testing method of SA-574, 11.3, is prohibited.
- G12 Since these bolts could be used in flanged joints, the maximum permitted temperature and maximum allowable stress are limited to reduce the potential for bolt relaxation and associated flange leakage.

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.

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.

NOTES TO TABLE 3 (CONT'D)

NOTES – TIME-DEPENDENT PROPERTIES [See General Note (i)] (CONT'D)

T11 Allowable stresses for temperatures of 620°C and above are values obtained from time-dependent properties.

T12 Allowable stresses for temperatures of 650°C and above are values obtained from time-dependent properties.

T13 Allowable stresses for temperatures of 200°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, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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- $\frac{1}{4}$ Mo	SA-540	B22	K41420	5	$50 < t \leq 100$
2	1Cr-1Mn- $\frac{1}{4}$ Mo	SA-540	B22	K41420	5	≤ 50
3	1Cr-1Mn- $\frac{1}{4}$ Mo	SA-540	B22	K41420	4	≤ 100
4	1Cr-1Mn- $\frac{1}{4}$ Mo	SA-540	B22	K41420	3	≤ 100
5	1Cr-1Mn- $\frac{1}{4}$ Mo	SA-540	B22	K41420	2	≤ 75
6	1Cr-1Mn- $\frac{1}{4}$ Mo	SA-540	B22	K41420	1	≤ 38
7	1Cr- $\frac{1}{5}$ Mo	SA-193	B7	G41400	...	$100 < t \leq 180$
8	1Cr- $\frac{1}{5}$ Mo	SA-193	B7M	G41400	...	≤ 100
9	1Cr- $\frac{1}{5}$ Mo	SA-193	B7	G41400	...	$64 < t \leq 100$
10	1Cr- $\frac{1}{5}$ Mo	SA-193	B7	G41400	...	≤ 64
11	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	$100 < t \leq 200$
12	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	$100 < t \leq 200$
13	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	$64 < t \leq 100$
14	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	$64 < t \leq 100$
15	1Cr- $\frac{1}{2}$ Mo-V	SA-540	B21	K14073	5	$50 < t \leq 205$
16	1Cr- $\frac{1}{2}$ Mo-V	SA-540	B21	K14073	5	≤ 50
17	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	≤ 64
18	1Cr- $\frac{1}{2}$ Mo-V	SA-193	B16	K14072	...	≤ 64
19	1Cr- $\frac{1}{2}$ Mo-V	SA-540	B21	K14073	4	≤ 150
20	1Cr- $\frac{1}{2}$ Mo-V	SA-540	B21	K14073	3	≤ 150
21	1Cr- $\frac{1}{2}$ Mo-V	SA-540	B21	K14073	2	≤ 100
22	1Cr- $\frac{1}{2}$ Mo-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	1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-320	L43	G43400	...	≤ 100
29	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	5	$150 < t \leq 240$
30	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	5	$150 < t \leq 240$
31	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	5	≤ 150
32	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	4	≤ 240
33	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	3	≤ 240
34	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	2	≤ 240
35	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	SA-540	B23	H43400	1	≤ 200
36	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	5	$150 < t \leq 240$
37	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	5	$150 < t \leq 240$
38	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	5	≤ 150
39	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	4	≤ 240
40	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	3	≤ 240
41	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	2	≤ 240
42	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	SA-540	B24	K24064	1	≤ 200
43	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo-V	SA-540	B24V	K24070	3	≤ 280
44	25Ni-15Cr-2Ti	SA-453	660	S66286	A	...
45	25Ni-15Cr-2Ti	SA-453	660	S66286	B	...

Table 4
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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	
					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
32	930	825	371	371	G4
33	1000	895	371	371	G3
34	1070	965	371	371	G3
35	1140	1035	316	316	G1
36	795	690	371	NP	G4
37	795	690	NP	371	G4
38	825	725	371	371	G4
39	930	825	371	371	G4
40	1000	895	371	371	G3
41	1070	965	371	371	G3
42	1140	1035	316	316	G1
43	1000	895	371	371	G3
44	895	585	427	427	...
45	895	585	427	427	...

Table 4
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line No.	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
	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	...	...
32	276	262	254	248	241	232	226	220	213	...	...
33	299	284	277	268	261	251	245	238	231	...	...
34	322	306	297	289	281	271	264	257	249	...	...
35	345	328	318	310	301	289	283	...	...	...	...
36	230	218	213	206	200	193	188	183	178	...	...
37	230	218	212	206	201	193	188	183	178	...	...
38	241	229	223	216	210	203	198	192	187	...	...
39	276	262	254	248	241	232	226	220	213	...	...
40	299	284	277	268	261	251	245	238	231	...	...
41	322	306	297	289	281	271	264	257	249	...	...
42	345	328	318	310	301	289	283	...	...	...	...
43	299	284	277	268	261	251	245	238	231	...	...
44	195	191	188	186	183	180	179	177	176	174	172
45	195	191	188	186	183	180	179	177	176	174	172

INTENTIONALLY LEFT BLANK

Table 4 (Cont'd)
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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	16Cr-12Ni-2Mo	SA-193	B8M	S31600	1/Sol. treat.	...
2	16Cr-12Ni-2Mo	SA-193	B8MA	S31600	1A/Sol. treat.	...
3	16Cr-12Ni-2Mo-N	SA-193	B8MNA	S31651	1A/Sol. treat.	...
4	18Cr-8Ni	SA-193	B8	S30400	1/Sol. treat.	...
5	18Cr-8Ni	SA-193	B8A	S30400	1A/Sol. treat.	...
6	18Cr-8Ni-N	SA-193	B8NA	S30451	1A/Sol. treat.	...
7	18Cr-8Ni-4Si-N	SA-193	B8S	S21800	Sol. treat.	...
8	18Cr-8Ni-4Si-N	SA-193	B8SA	S21800	Sol. treat.	...
9	18Cr-10Ni-Cb	SA-193	B8C	S34700	1/Sol. treat.	...
10	18Cr-10Ni-Ti	SA-193	B8T	S32100	1/Sol. treat.	...
11	19Cr-9Ni-Mo-W	SA-453	651	S63198	B	>76
12	19Cr-9Ni-Mo-W	SA-453	651	S63198	B	≤76
13	19Cr-9Ni-Mo-W	SA-453	651	S63198	A	>76
14	19Cr-9Ni-Mo-W	SA-453	651	S63198	A	≤76
15	22Cr-13Ni-5Mn	SA-193	B8R	S20910	1C/Sol. treat.	...
16	22Cr-13Ni-5Mn	SA-193	B8RA	S20910	Sol. treat.	...

Table 4 (Cont'd)
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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	
Ferrous Materials (Cont'd)					
1	515	205	427	427	...
2	515	205	427	427	...
3	515	205	427	427	...
4	515	205	427	427	...
5	515	205	427	427	...
6	515	205	427	427	...
7	655	345	427	427	...
8	655	345	427	427	...
9	515	205	427	427	...
10	515	205	427	427	...
11	655	345	427	427	...
12	655	415	427	427	...
13	690	415	427	427	...
14	690	485	427	427	...
15	690	380	427	427	...
16	690	380	427	427	...

Table 4 (Cont'd)
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
No.	40	100	150	200	250	300	325	350	375	400	425
	Ferrous Materials (Cont'd)										
1	130	121	107	99.2	92.8	88.1	86.1	84.4	83.2	82.0	80.7
2	68.9	58.4	53.7	49.9	46.8	44.1	43.0	42.1	41.3	40.6	40.0
3	130	122	112	105	99.1	93.7	91.7	89.8	87.9	86.1	84.9
4	130	114	103	95.7	90.1	84.5	83.1	81.1	79.2	77.3	76.0
5	68.9	56.3	51.6	47.9	45.3	42.7	41.8	41.2	40.6	39.7	38.7
6	130	112	99.0	89.6	83.7	79.6	75.6	74.4	73.2	71.9	70.8
7	164	160	150	137	129	123	121	119	118	116	115
8	164	160	150	137	129	123	121	119	118	116	115
9	130	122	113	107	104	99.7	98.1	96.7	95.0	94.4	93.8
10	130	122	114	106	99.8	94.2	92.7	91.1	88.7	87.5	86.3
11	115	104	97.8	92.1	88.3	84.0	82.0	80.4	79.1	77.8	76.6
12	138	125	117	111	105	101	99.2	97.0	94.8	92.9	91.1
13	138	125	117	111	105	101	99.2	97.0	94.8	92.9	91.1
14	161	146	136	129	123	118	116	113	111	108	106
15	126	107	99.8	94.2	89.7	86.2	85.3	84.5	83.2	82.0	81.4
16	126	107	99.8	94.2	89.7	86.2	85.3	84.5	83.2	82.0	81.4

INTENTIONALLY LEFT BLANK

Table 4 (Cont'd)
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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	HW or CW ann.	All
2	67Ni-30Cu	SB-164	...	N04400	Hot worked	$305 < t \leq 356$
3	67Ni-30Cu	SB-164	...	N04400	Hot worked	≤ 305
4	67Ni-30Cu	SB-164	...	N04400	CD-str. rel.	≤ 12.7
5	67Ni-30Cu	SB-164	...	N04400	CD-str. rel.	$88.9 < t \leq 101.6$
6	67Ni-30Cu	SB-164	...	N04400	As drawn	≤ 12.7
7	67Ni-30Cu	SB-164	...	N04400	CD-str. rel.	$12.7 < t \leq 88.9$
8	67Ni-30Cu	SB-164	...	N04400	As drawn	≤ 12.7
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	Sol. & precip. harden	≤ 150
13	70Ni-16Cr-7Fe-Ti-Al	SB-637	2	N07750	...	< 100

Table 4 (Cont'd)
Section III, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , 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	480	170	427	427	...
2	517	276	427	427	...
3	552	276	427	427	...
4	580	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, Division 1, Classes 1 and MC; Section III, Division 3; and Section III, Division 5
Design Stress Intensity Values, S_m , and Section VIII, Division 2* Maximum Allowable Stress
Values, S , for Bolting Materials
(*Use with Part 5 and Annex 5.F of Section VIII, Division 2)

Line	Design Stress Intensity or Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
No.	40	100	150	200	250	300	325	350	375	400	425
	Nonferrous Materials										
1	115	99.4	93.7	91.1	90.4	90.3	90.3	90.3	90.2	88.9	87.9
2	115	99.4	93.7	91.1	90.4	90.3	90.3	90.3	90.2	88.9	87.9
3	115	99.4	93.7	91.1	90.4	90.3	90.3	90.3	89.4	89.1	88.4
4	115	108	105	104	103	...	...	...	...	...	...
5	126	119	116	114	113	...	...	...	...	...	...
6	126	119	116	114	113	...	...	...	...	...	...
7	138	130	126	124	124	...	...	...	...	...	...
8	195	184	179	176	175	...	...	...	...	...	...
9	114	99.5	93.7	91.1	...	90.3	90.3	90.3	...	...	...
10	129	129	129	129	129	129	...	...	123	...	...
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 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, Subsection NB, NB-3230 and Section III Appendices, Nonmandatory Appendix E.
- (b) Stress values for 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; precip., precipitation; 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.
- (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, Class 2
Maximum Allowable Stress Values, S, 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-285	B	K02200	...	$t \leq 50$	1	1
6	Carbon steel	Bar, shapes	SA-675	55	...	...	...	1	1
7	Carbon steel	Plate	SA-285	C	K02801	...	$t \leq 50$	1	1
8	Carbon steel	Smls. pipe	SA-333	1	K03008	...	...	1	1
9	Carbon steel	Smls. 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	Plate, bar, shapes	SA-36	...	K02600	...	...	1	1
13	Carbon steel	Plate	SA-662	A	K01701	...	...	1	1
14	Carbon steel	Forgings	SA-181	...	K03502	60	...	1	1
15	Carbon steel	Castings	SA-216	WCA	J02502	...	...	1	1
16	Carbon steel	Forgings	SA-266	1	K03506	...	...	1	1
17	Carbon steel	Forgings	SA-350	LF1	K03009	1	...	1	1
18	Carbon steel	Bar, shapes	SA-675	60	...	...	...	1	1
19	Carbon steel	Forgings	SA-765	I	K03046	...	...	1	1
20	Carbon steel	Plate	SA-515	60	K02401	...	...	1	1
21	Carbon steel	Plate	SA-516	60	K02100	...	...	1	1
22	Carbon steel	Plate	SA-283	D	K02702	...	...	1	1
23	Carbon steel	Smls. pipe	SA-106	B	K03006	...	...	1	1
24	Carbon steel	Fittings	SA-234	WPB	K03006	...	...	1	1
25	Carbon steel	Smls. pipe	SA-333	6	K03006	...	...	1	1
26	Carbon steel	Forgings	SA-372	A	K03002	...	...	1	1
27	Carbon steel	Fittings	SA-420	WPL6	...	...	...	1	1
28	Carbon steel	Smls. pipe	SA-524	I	K02104	...	...	1	1
29	Carbon steel	Forgings	SA-727	...	K02506	...	...	1	1
30	Carbon steel	Wld. tube	SA-178	C	K03503	...	...	1	1
31	Carbon steel	Smls. tube	SA-210	A-1	K02707	...	...	1	1
32	Carbon steel	Bar, shapes	SA-675	65	...	...	...	1	1
33	Carbon steel	Castings	SA-352	LCB	J03003	...	...	1	1
34	Carbon steel	Plate	SA-515	65	K02800	...	...	1	1
35	Carbon steel	Plate	SA-516	65	K02403	...	...	1	1
36	Carbon steel	Plate	SA-662	B	K02203	...	...	1	1
37	Carbon steel	Plate	SA-537	...	K12437	1	$65 < t \leq 100$	1	2
(25) 38	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	$35 < t \leq 160$	1	1
(25) 39	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT	$t \leq 35$	1	1
40	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$150 < t \leq 250$	1	2
41	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	$100 < t \leq 150$	1	2
42	Carbon steel	Bar, shapes	SA-675	70	...	...	...	1	1
43	Carbon steel	Forgings	SA-105	...	K03504	...	...	1	2
44	Carbon steel	Forgings	SA-181	...	K03502	70	...	1	2
45	Carbon steel	Castings	SA-216	WCB	J03002	...	...	1	2

Table 5A
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	482	CS-1	T2
6	380	190	482	CS-1	G13, T4
7	380	205	538	CS-2	G13, T3
8	380	205	538	CS-2	T3
9	380	205	371	CS-2	...
10	380	205	538	CS-2	G13, T3
11	380	205	538	CS-2	G13, T3
12	400	250	371	CS-2	G13
13	400	275	371	CS-2	...
14	415	205	538	CS-2	G13, T3
15	415	205	538	CS-2	G13, T3
16	415	205	538	CS-2	G13, T3
17	415	205	371	CS-2	G13
18	415	205	482	CS-2	G13, T3
19	415	205	538	CS-2	G13, T3
20	415	220	538	CS-2	G13, T3
21	415	220	538	CS-2	G13, T3
22	415	230	343	CS-2	...
23	415	240	371	CS-2	G13
24	415	240	538	CS-2	G13, T2
25	415	240	538	CS-2	G13, T2
26	415	240	343	CS-2	G9, H2
27	415	240	454	CS-2	G13, T2
28	414	240	538	CS-2	G13, T2
29	415	250	538	CS-2	G13, T2
30	415	255	538	CS-2	G6, G13, T2
31	415	255	538	CS-2	G13, T2
32	450	225	538	CS-2	G13, T3
33	450	240	343	CS-2	...
34	450	240	538	CS-2	G13, T2
35	450	240	538	CS-2	G13, T2
36	450	275	371	CS-2	...
37	450	310	371	CS-2	T1
38	460	255	538	CS-2	G13, T3
39	460	280	538	CS-2	G13, T3
40	470	280	538	CS-2	G13, T2
41	480	295	538	CS-2	G13, T2
42	485	240	538	CS-2	G13, T3
43	485	250	538	CS-2	G13, T3
44	485	250	538	CS-2	G13, T3
45	485	250	538	CS-2	G13, T3

Table 5A
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	78.8	73.3	64.0	55.8	43.9
6	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
7	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	89.0	75.3	62.1	45.0
8	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	95.1	79.5	62.6	45.0
9	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	...	...	...	...
10	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	89.0	75.3	62.1	45.0
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	165	156	151	148	146	144	142	139	136	133	129	125	122	119	...	...	...	...
13	167	167	167	165	163	160	158	155	151	148	144	139	135	132	...	...	...	...
14	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	95.1	79.5	62.6	45.0
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	...	...	...	...
18	138	130	126	124	122	120	118	116	113	111	108	105	101	98.3	95.1	79.5	62.6	45.0
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	147	138	134	132	130	128	126	124	121	118	115	111	108	105	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	152	143	138	136	134	132	130	128	125	122	118	115	111	...	...	...	...	...
23	161	151	147	144	142	140	138	135	132	129	126	122	118	115	...	...	...	...
24	161	151	147	144	142	140	138	135	132	129	126	122	118	115	95.1	79.5	62.6	45.0
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	154	146	139	133	127	122	118	115	112	110	109	107	...	...	...	...	...
27	161	151	147	144	142	140	138	135	132	129	126	122	118	115	95.1	79.5	62.6	45.0
28	161	151	147	144	142	140	138	135	132	129	126	122	118	115	95.1	79.5	62.6	45.0
29	165	156	151	148	146	144	142	139	136	133	129	125	122	119	95.1	79.5	62.6	45.0
30	145	136	132	130	128	126	124	122	119	116	113	110	106	104	80.8	67.6	53.2	38.3
31	170	160	155	153	150	148	146	143	140	136	133	129	125	122	95.1	79.5	62.6	45.0
32	149	140	136	134	132	130	128	126	123	120	117	113	110	106	95.1	79.5	64.4	47.7
33	161	151	147	144	142	140	138	135	132	129	126	122	118	...	...	...	...	...
34	161	151	147	144	142	140	138	135	132	129	126	122	118	113	95.1	79.5	64.4	47.7
35	161	151	147	144	142	140	138	135	132	129	126	122	118	113	95.1	79.5	64.4	47.7
36	184	173	168	165	163	160	158	155	151	148	144	139	135	132	...	...	...	...
37	188	188	188	186	183	180	177	174	170	166	161	157	127	114	...	...	...	...
38	170	159	154	152	149	147	145	142	139	135	132	128	124	120	101	83.8	66.8	50.3
39	187	175	169	166	164	161	159	156	152	149	145	141	136	132	101	83.8	66.8	50.3
40	187	175	170	167	165	163	160	157	154	150	146	141	137	123	101	83.8	66.8	50.3
41	197	184	179	176	174	171	169	166	162	158	154	149	144	123	101	83.3	66.8	50.3
42	161	151	147	144	142	140	138	135	132	129	126	122	118	115	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
45	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, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
2	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
3	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
4	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
5	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
6	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
7	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
8	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
11	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
15	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
16	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	31.7	...	...	...	...	...	...	...	...	...	...	...	...	...
19	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
20	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
21	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
25	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
29	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
30	27.0	18.2	12.0	...	...	...	...	...	...	...	...	...	...	...
31	31.7	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
32	32.5	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	32.5	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
35	32.5	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
39	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
40	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...
45	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...

(25)
(25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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 ≤ 150	1	3
16	Carbon steel	Plate	SA-662	C	K02007	...	...	1	2
17	Carbon steel	Plate	SA-537	...	K12437	2	100 < t ≤ 150	1	3
18	Carbon steel	Plate	SA-738	C	K02008	...	100 < t ≤ 150	1	3
19	Carbon steel	Plate	SA-537	...	K12437	1	t ≤ 65	1	2
20	Carbon steel	Plate	SA-841	A	...	1	t ≤ 100	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	70 < t ≤ 160	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	35 < t ≤ 70	1	2
23	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	60 < t ≤ 100	1	2
(25)	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT	t ≤ 35	1	2
25	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	40 < t ≤ 60	1	2
26	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	16 < t ≤ 40	1	2
27	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...	≤16	1	2
28	Carbon steel	Forgings	SA-266	3	K05001	...	...	1	2
29	Carbon steel	Plate	SA-299	A	K02803	...	t > 25	1	2
30	Carbon steel	Plate	SA-299	A	K02803	...	t ≤ 25	1	2
31	Carbon steel	Forgings	SA-372	B	K04001	...	...	1	2
32	Carbon steel	Plate	SA-738	A	K12447	Normalized	t ≤ 65	1	2
33	Carbon steel	Plate	SA-738	A	K12447	QT	...	1	2
34	Carbon steel	Plate	SA-537	...	K12437	3	65 < t ≤ 100	1	3
35	Carbon steel	Plate	SA-537	...	K12437	2	65 < t ≤ 100	1	3
36	Carbon steel	Plate	SA-738	C	K02008	...	65 < t ≤ 100	1	3
37	Carbon steel	Plate	SA-299	B	K02803	...	t > 25	1	3
38	Carbon steel	Plate	SA-299	B	K02803	...	t ≤ 25	1	3
39	Carbon steel	Forgings	SA-765	IV	K02009	...	...	1	3
40	Carbon steel	Plate	SA-537	...	K12437	3	t ≤ 65	1	3
41	Carbon steel	Plate	SA-537	...	K12437	2	t ≤ 65	1	3
42	Carbon steel	Plate	SA-738	C	K02008	...	t ≤ 65	1	3
43	Carbon steel	Plate	SA-841	B	...	2	t ≤ 65	1	3
44	Carbon steel	Plate	SA-612	...	K02900	Normalized	12.5 < t ≤ 25	10C	1
45	Carbon steel	Plate	SA-612	...	K02900	Normalized	t ≤ 12.5	10C	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	...
16	485	295	371	CS-3	...
17	485	315	343	CS-3	T1
18	485	315	343	CS-3	T1
19	485	345	371	CS-3	...
20	485	345	343	CS-3	...
21	490	280	538	CS-2	G13, T3
22	510	285	538	CS-2	G13, T3
23	490	315	538	CS-2	G13, T2
24	510	305	538	CS-2	G13, T2
25	510	335	538	CS-2	G13, T2
26	510	345	538	CS-2	G13, T2
27	510	355	538	CS-2	G13, T2
28	515	260	538	CS-2	G13, T3, W6
29	515	275	538	CS-2	G13, T3
30	515	290	538	CS-2	G13, T2
31	515	310	343	CS-3	G9, H2, W2, W6
32	515	310	371	CS-2	T2
33	515	310	371	CS-2	T2
34	515	345	371	CS-5	T1
35	515	380	343	CS-5	T1
36	515	380	343	CS-5	...
37	550	310	538	CS-3	G13, T2
38	550	325	538	CS-3	G13, T2
39	550	345	371	CS-3	T1
40	550	380	371	CS-5	T1
41	550	415	343	CS-5	T1
42	550	415	371	CS-5	...
43	550	415	343	CS-3	...
44	560	345	371	CS-3	T2
45	570	345	371	CS-3	T2

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	171	161	155	149	143	139	135	131	129	126	123	121	118	...	...	...	...
16	198	186	180	177	175	172	169	166	163	159	154	150	145	142	...	...	...	...
17	202	196	185	177	171	165	160	155	151	147	144	141	133	...	...	...	...	...
18	201	199	193	190	187	184	181	178	174	170	165	160	148	...	...	...	...	...
19	202	202	201	193	186	179	174	169	165	161	157	154	133	125	...	...	...	...
20	201	201	201	201	201	197	195	193	191	189	186	183	179	...	...	...	...	...
21	187	175	169	166	164	161	159	156	152	149	145	141	136	132	101	83.8	66.8	50.3
22	190	178	172	169	167	164	162	159	155	151	147	143	139	134	101	83.8	66.8	50.3
23	204	197	191	188	186	183	180	177	173	169	164	159	154	123	101	83.8	66.8	50.3
24	203	190	184	181	179	176	173	170	166	162	158	153	148	136	101	83.8	66.8	50.3
25	213	209	203	200	197	195	192	188	184	179	174	169	164	123	101	83.8	66.8	50.3
26	213	213	209	206	203	201	197	194	189	185	180	174	169	123	101	83.8	66.8	50.3
27	213	213	213	212	209	206	203	199	195	190	185	179	174	123	101	83.8	66.8	50.3
28	172	162	157	155	152	150	148	145	142	138	135	131	127	123	107	88.0	67.3	50.3
29	184	173	168	165	163	160	158	155	151	148	144	139	135	131	107	88.1	67.6	50.8
30	193	182	176	173	171	168	165	162	159	155	151	146	142	133	107	88.1	67.6	50.8
31	207	195	189	186	183	180	177	174	170	166	161	157	152	...	...	...	...	...
32	207	192	181	174	167	162	156	152	148	144	141	138	135	131	...	...	...	...
33	207	192	181	174	167	162	156	152	148	144	141	138	135	131	...	...	...	...
34	215	213	201	193	186	179	174	169	165	161	157	154	142	123	...	...	...	...
35	215	215	215	212	204	197	191	185	181	177	173	169	143	...	...	...	...	...
36	215	215	215	215	215	215	211	207	204	200	197	194	168	...	...	...	...	...
37	207	194	188	185	183	180	177	174	170	166	161	157	152	133	107	88.1	67.6	50.8
38	216	203	197	194	191	188	185	182	178	173	169	164	159	133	107	88.1	67.6	50.8
39	230	216	210	206	203	200	197	193	189	184	179	174	160	131	...	...	...	...
40	229	229	221	212	204	197	191	185	181	177	173	169	151	132	...	...	...	...
41	229	229	229	229	223	215	209	202	197	192	189	185	151	...	...	...	...	...
42	230	230	230	230	230	230	230	226	222	218	215	211	177	166	...	...	...	...
43	230	230	230	230	230	230	230	230	229	226	223	220	215	...	...	...	...	...
44	230	220	208	199	190	182	174	168	164	160	157	155	153	133	...	...	...	...
45	230	220	208	199	190	182	174	168	164	160	157	155	153	133	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
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	...	...	...	...	...	...	...	...	...	...	... (25)
22	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	... (25)
23	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
24	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	... (25)
25	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
26	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
27	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
28	33.2	21.4	14.2	...	...	...	...	...	...	...	...	...	...	...
29	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...
30	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...
38	33.7	21.3	12.9	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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-738	B	K12007	...	...	1	3
2	Carbon steel	Forgings	SA-372	C	K04801	...	...	...	...
3	Carbon steel	Plate	SA-724	A	K11831	...	...	1	4
4	Carbon steel	Plate	SA-724	C	K12037	...	...	1	4
5	Carbon steel	Plate	SA-724	B	K12031	...	...	1	4
6	C-Mn-Si-Cb	Plate	SA-737	B	K12001	...	...	1	2
7	C-Mn-Si-V	Plate	SA-737	C	K12202	...	...	1	3
8	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1b	K11422	...	...	3	1
9	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1	K11522	...	...	3	1
10	C- $\frac{1}{2}$ Mo	Fittings	SA-234	WP1	K12821	...	...	3	1
11	C- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P1	K11522	...	...	3	1
12	C- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP1	K11522	...	...	3	1
13	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1a	K12023	...	...	3	1
14	C- $\frac{1}{2}$ Mo	Castings	SA-217	WC1	J12524	...	...	3	1
15	C- $\frac{1}{2}$ Mo	Castings	SA-352	LC1	J12522	...	...	3	1
16	C- $\frac{1}{2}$ Mo	Plate	SA-204	A	K11820	...	...	3	1
17	C- $\frac{1}{2}$ Mo	Forgings	SA-182	F1	K12822	...	...	3	2
18	C- $\frac{1}{2}$ Mo	Plate	SA-204	B	K12020	...	...	3	2
19	C- $\frac{1}{2}$ Mo	Forgings	SA-336	F1	K12520	...	...	3	2
20	C- $\frac{1}{2}$ Mo	Plate	SA-204	C	K12320	...	...	3	2
21	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	70	...	11B	...
22	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	70	...	11B	...
23	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo-V	Plate	SA-517	B	K11630	...	$t \leq 32$	11B	4
24	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Plate	SA-517	A	K11856	...	$t \leq 32$	11B	1
25	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Forgings	SA-592	A	K11856	...	$t \leq 65$	11B	1
26	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P2	K11547	...	...	3	1
27	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP2	K11547	...	...	3	1
28	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-387	2	K12143	1	...	3	1
29	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T2	K11547	...	...	3	1
30	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F2	K12122	...	...	3	2
31	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-387	2	K12143	2/NT	...	3	2
32	$\frac{3}{4}$ Cr- $\frac{1}{2}$ Ni-Cu	Smls. tube	SA-423	1	K11535	...	...	4	2
33	$\frac{3}{4}$ Cr- $\frac{3}{4}$ Ni-Cu-Al	Smls. pipe	SA-333	4	K11267	...	...	4	2
34	1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	E	K13047	70	...	11B	1
35	1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	F	G41350	70	...	11B	1
36	1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	J	K13548	70	...	11B	1
37	1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	J	G41370	110	...	11B	1
38	1Cr- $\frac{1}{2}$ Mo	Plate	SA-387	12	K11757	1	...	4	1
39	1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12	K11562	1	...	4	1
40	1Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T12	K11562	...	...	4	1
41	1Cr- $\frac{1}{2}$ Mo	Fittings	SA-234	WP12	K12062	1	...	4	1
42	1Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P12	K11562	...	...	4	1
43	1Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP12	K11562	...	...	4	1
44	1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	$250 < t \leq 500$	4	1
45	1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	$150 < t \leq 250$	4	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	585	415	343	CS-5	T1
2	620	380	343	CS-3	G9, H2, T1, W2, W6
3	620	485	371	CS-5	...
4	620	485	371	CS-5	...
5	655	515	371	CS-5	...
6	485	345	371	CS-3	...
7	550	415	371	CS-3	...
8	365	195	538	CS-1	G14, T7
9	380	205	538	CS-2	G14, T7
10	380	205	538	CS-2	G14, T7
11	380	205	538	CS-2	G14, T7
12	380	210	538	CS-2	G14, T7
13	415	220	538	CS-2	G14, T7
14	450	240	538	CS-2	G14, T6
15	450	240	343	CS-2	...
16	450	255	538	CS-2	G14, T6
17	485	275	538	CS-2	G14, T6
18	485	275	538	CS-2	G14, T6
19	485	275	538	CS-2	G14, T6
20	515	295	538	CS-2	G14, T6
21	825	485	93	CS-3	G9, H4, W2, W6
22	825	485	93	CS-3	G9, H4, W2, W6
23	795	690	343	HT-1	...
24	795	690	343	HT-1	...
25	795	690	343	HT-1	...
26	380	205	538	CS-2	T7
27	380	210	538	CS-2	T7
28	380	230	538	CS-2	T7
29	415	205	538	CS-2	T7
30	485	275	538	CS-2	G14, T7
31	485	310	538	CS-3	T7
32	415	255	343	CS-2	...
33	415	240	343	CS-2	...
34	825	485	343	CS-5	G9, H4, W2, W6
35	825	485	343	CS-5	G9, H4, W2, W6
36	825	485	343	CS-5	G9, H4, W2, W6
37	930	760	343	HT-1	H4, W2, W6
38	380	230	649	CS-2	T7
39	415	220	649	CS-2	T7
40	415	220	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	420	240	649	CS-2	T7
45	420	245	649	CS-2	T7

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	244	244	244	244	240	235	230	226	222	218	215	211	160	...	...	...	...	...
2	253	242	229	219	209	200	192	185	180	176	173	171	160	...	...	...	...	...
3	259	259	259	259	259	254	244	236	229	224	220	217	180	178	...	...	...	...
4	259	259	259	259	259	254	244	236	229	224	220	217	180	178	...	...	...	...
5	273	273	273	273	273	272	261	253	246	240	236	233	180	178	...	...	...	...
6	201	201	201	199	190	182	174	168	164	160	157	155	153	152	...	...	...	...
7	230	230	230	230	228	218	209	202	196	192	189	186	180	178	...	...	...	...
8	129	124	120	118	116	114	112	111	109	108	106	105	103	101	98.8	96.4	93.7	90.6
9	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
10	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
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	147	142	138	135	133	130	128	127	125	123	121	120	118	115	113	110	107	104
14	161	155	150	148	145	143	140	138	137	135	133	131	129	126	123	120	117	109
15	161	155	150	148	145	143	140	138	137	135	133	131	129	...	...	...	...	...
16	170	164	159	156	153	151	148	146	144	142	140	138	136	133	131	127	124	109
17	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	109
18	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	109
19	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	109
20	198	190	185	181	178	175	173	170	168	165	163	161	158	155	152	148	144	109
21	322	322	322	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	322	322	322	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
24	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
25	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
26	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
27	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
28	152	146	142	139	137	134	132	131	129	127	125	123	121	119	116	114	110	107
29	138	133	129	126	124	122	120	119	117	115	114	112	110	108	106	103	100	97.1
30	184	177	172	169	166	163	161	158	156	154	152	149	147	144	141	138	134	129
31	201	199	193	190	186	183	181	178	176	173	171	168	165	162	159	155	151	146
32	170	161	156	154	152	150	149	147	146	145	143	141	140	...	...	...	...	...
33	161	152	148	145	144	142	141	139	138	137	135	134	132	...	...	...	...	...
34	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
35	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
36	322	307	298	293	288	284	280	277	273	269	264	259	253	...	...	...	...	...
37	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
38	152	142	136	132	129	126	124	121	120	118	116	115	114	112	110	109	106	104
39	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
40	147	138	132	128	125	122	120	118	116	114	113	112	110	109	107	105	103	101
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	160	151	144	140	136	133	131	128	127	125	123	122	120	119	117	115	113	110
45	163	153	147	142	139	136	133	131	129	127	125	124	122	121	119	117	115	112

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
9	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
17	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
18	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
19	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
20	68.0	42.3	30.5	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	74.4	49.9	34.3	...	...	...	...	...	...	...	...	...	...	...
27	74.4	49.9	34.3	...	...	...	...	...	...	...	...	...	...	...
28	74.4	49.9	34.3	...	...	...	...	...	...	...	...	...	...	...
29	74.4	49.9	34.3	...	...	...	...	...	...	...	...	...	...	...
30	75.6	49.9	33.5	...	...	...	...	...	...	...	...	...	...	...
31	78.8	53.7	35.4	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	92.1	61.1	40.4	26.4	17.4	11.6	7.44	...	...	...	...	...	...	...
39	92.1	61.1	40.4	26.4	17.4	11.6	7.44	...	...	...	...	...	...	...
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	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...
45	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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.
(25)	1 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	100 < t ≤ 150	4	1
	2 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	100 < t ≤ 250	4	1
	3 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	60 < t ≤ 100	4	1
	4 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	70 < t ≤ 100	4	1
	5 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	35 < t ≤ 70	4	1
(25)	6 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT	t ≤ 35	4	1
	7 1Cr- $\frac{1}{2}$ Mo	Plate	SA-387	12	K11757	2	...	4	1
	8 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	16 < t ≤ 60	4	1
	9 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...	t ≤ 16	4	1
	10 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12	K11564	2	...	4	1
11	1Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F12	K11564	...	...	4	1
12	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC6	J12072	...	...	4	1
13	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Bar	SA-739	B11	K11797	...	...	4	1
14	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11597	1	...	4	1
15	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T11	K11597	...	...	4	1
16	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Fittings	SA-234	WP11	...	1	...	4	1
17	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P11	K11597	...	...	4	1
18	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forged pipe	SA-369	FP11	K11597	...	...	4	1
19	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	1	...	4	1
20	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11572	2	...	4	1
21	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	2	...	4	1
22	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	100 < t ≤ 250	4	1
23	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	60 < t ≤ 100	4	1
24	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT	≤ 60	4	1
25	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	3	...	4	1
26	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	2	...	4	1
27	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	65 < t ≤ 100	11B	2
28	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...	t ≤ 65	11B	2
29	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	65 < t ≤ 150	11B	2
30	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...	t ≤ 65	11B	2
31	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	1	...	5A	1
32	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA-213	T22	K21590	...	...	5A	1
33	2 $\frac{1}{4}$ Cr-1Mo	Fittings	SA-234	WP22	K21590	1	...	5A	1
34	2 $\frac{1}{4}$ Cr-1Mo	Smls. pipe	SA-335	P22	K21590	...	...	5A	1
35	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	1	...	5A	1
36	2 $\frac{1}{4}$ Cr-1Mo	Forged pipe	SA-369	FP22	K21590	...	...	5A	1
37	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	1	...	5A	1
38	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	150 < t ≤ 250	5A	1
39	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	200 < t ≤ 500	5A	1
40	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	100 < t ≤ 150	5A	1
41	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	60 < t ≤ 100	5A	1
42	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	40 < t ≤ 60	5A	1
43	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	16 < t ≤ 40	5A	1
44	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...	t ≤ 16	5A	1
45	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9	J21890	...	...	5A	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	430	255	649	CS-2	T7
2	440	265	649	CS-2	T7
3	440	270	649	CS-2	T7
4	440	275	649	CS-2	T7
5	440	285	649	CS-2	T7
6	440	295	649	CS-2	T7
7	450	275	649	CS-2	T7
8	450	290	649	CS-2	T7
9	450	300	649	CS-2	T7
10	485	275	649	CS-2	T7
11	485	275	649	CS-2	T7
12	485	275	593	CS-2	T7
13	483	310	649	CS-3	T7
14	415	205	649	CS-2	T7
15	415	205	649	CS-2	T7
16	415	205	649	CS-2	T7
17	415	205	649	CS-2	T7
18	415	210	649	CS-2	T7
19	415	240	649	CS-2	T7
20	485	275	649	CS-2	T7
21	485	275	649	CS-2	T7
22	490	380	570	CS-3	G15, T6
23	500	390	570	CS-3	G15, T6
24	510	400	570	CS-3	G15, T6
25	515	310	649	CS-3	T7
26	515	310	649	CS-3	T7
27	725	620	343	CS-5	S1
28	795	690	343	HT-1	...
29	725	620	343	CS-5	...
30	795	690	343	HT-1	...
31	415	205	649	CS-2	T6, W5
32	415	205	649	CS-2	T6, W5
33	415	205	649	CS-2	T6, W5
34	415	205	649	CS-2	T6, W5
35	415	205	649	CS-2	T6, W5
36	415	210	649	CS-2	T6, W5
37	415	210	649	CS-2	H1, T6, W5
38	450	250	593	CS-3	T7, W5
39	450	265	649	CS-3	T6, W5
40	460	260	593	CS-3	T7, W5
41	470	280	593	CS-3	T6, W5
42	480	290	593	CS-3	T6, W5
43	480	300	593	CS-3	T6, W5
44	480	310	593	CS-3	T5, W5
45	485	275	649	CS-2	T6, W5

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	170	160	153	148	145	141	139	136	134	132	131	129	127	126	124	122	119	116
2	177	167	159	155	151	147	144	142	140	138	136	135	133	131	129	127	124	121
3	180	169	161	157	153	150	147	144	142	140	138	137	135	133	131	129	126	123
4	183	173	165	161	156	153	150	147	145	143	141	140	138	136	134	132	129	126
5	183	179	171	166	162	158	155	152	150	148	146	145	143	141	139	136	134	130
6	183	183	177	172	168	164	161	158	155	153	152	150	148	146	144	141	138	135
7	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
8	188	181	173	169	164	161	158	155	152	150	148	147	145	143	141	138	136	132
9	188	188	179	174	170	166	163	160	158	156	154	152	150	148	146	143	140	137
10	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
11	184	173	165	160	156	153	150	147	145	143	141	139	138	136	134	132	129	126
12	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	106
13	201	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	108
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	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
17	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
18	138	131	126	124	121	119	116	115	113	111	109	107	106	104	102	99.6	97.2	94.5
19	161	153	148	144	141	138	136	134	131	129	127	125	123	121	119	116	113	106
20	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	105
21	184	175	169	165	161	158	155	153	150	148	146	143	141	138	136	133	130	105
22	204	204	204	204	204	204	204	204	204	204	204	204	204	202	198	194	189	104
23	208	208	208	208	208	208	208	208	208	208	208	208	208	208	203	199	194	104
24	213	213	213	213	213	213	213	213	213	213	213	213	213	213	209	204	199	104
25	207	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	105
26	207	197	190	185	181	178	175	172	169	166	164	161	159	156	153	149	146	105
27	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
28	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
29	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
30	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
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	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	99.6
36	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	99.6
37	138	132	128	126	125	124	124	124	124	124	124	124	124	124	123	122	121	99.6
38	167	157	152	148	146	143	142	140	139	137	136	135	133	132	130	127	124	121
39	177	167	161	157	154	152	150	148	147	146	144	143	142	140	138	135	132	116
40	173	164	158	154	151	149	147	146	144	143	142	140	139	137	135	132	129	126
41	187	176	170	166	163	161	158	157	155	154	152	151	149	148	145	143	139	128
42	193	183	176	172	169	166	164	162	161	159	158	156	155	153	150	148	144	128
43	200	189	182	178	175	172	170	168	166	165	163	162	160	158	156	153	149	128
44	200	195	188	184	181	178	175	174	172	170	169	167	165	163	161	158	151	128
45	184	174	169	167	165	163	161	160	159	157	156	154	153	151	149	147	144	119

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...
2	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...
3	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...
4	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...
5	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...
6	97.2	59.3	41.0	26.2	17.3	11.7	7.40	...	...	...	...	...	...	...
7	92.1	61.1	40.4	26.4	17.4	11.6	7.44	...	...	...	...	...	...	...
8	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...
9	94.4	60.2	40.8	26.3	17.3	11.7	7.40	...	...	...	...	...	...	...
10	92.1	61.1	40.4	26.4	17.4	11.6	7.44	...	...	...	...	...	...	...
11	92.1	61.1	40.4	26.4	17.4	11.6	7.44	...	...	...	...	...	...	...
12	73.7	52.0	36.3	25.2	17.6	...	...	...	...	...	...	...	...	...
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	17.6	12.3	8.12	...	...	...	...	...	...	...
20	73.7	52.0	36.3	25.2	17.6	12.3	8.12	...	...	...	...	...	...	...
21	73.7	52.0	36.3	25.2	17.6	12.3	8.12	...	...	...	...	...	...	...
22	73.7	52.0	36.3	25.2	...	...	...	...	...	...	...	...	...	...
23	73.7	52.0	36.3	25.2	...	...	...	...	...	...	...	...	...	...
24	73.7	52.0	36.3	25.2	...	...	...	...	...	...	...	...	...	...
25	73.7	52.0	36.3	25.2	17.6	12.3	8.12	...	...	...	...	...	...	...
26	73.7	52.0	36.3	25.2	17.6	12.3	8.12	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	80.9	63.3	47.5	34.2	23.5	15.3	9.45	...	...	...	...	...	...	...
36	80.9	63.3	47.5	34.2	23.5	15.3	9.45	...	...	...	...	...	...	...
37	80.9	63.3	47.5	34.2	23.5	15.3	9.45	...	...	...	...	...	...	...
38	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
39	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...
40	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
41	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
42	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
43	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
44	88.4	64.0	44.6	30.0	19.7	...	...	...	...	...	...	...	...	...
45	88.4	64.0	44.6	30.0	19.7	12.8	8.11	...	...	...	...	...	...	...

(25)

(25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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.
(25)	1 2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	3	...	5A	1
	2 2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	3	...	5A	1
	3 2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	2	...	5A	1
	4 2 $\frac{1}{4}$ Cr-1Mo	Bar	SA-739	B22	K21390	...	...	5A	1
	5 2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT	$t \leq 200$	5A	1
	6 2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-487	8	J22091	A	...	5C	1
	7 2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-508	22	K21590	3	...	5C	1
	8 2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	3	...	5C	1
	9 2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-542	B	K21590	4	...	5C	1
	10 2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-182	F22V	K31835	...	...	5C	1
	11 2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-336	F22V	K31835	...	...	5C	1
	12 2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-541	22V	K31835	...	...	5C	1
	13 2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-542	D	K31835	4a	...	5C	1
	14 2 $\frac{1}{4}$ Cr-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- $\frac{1}{4}$ V-Ti-B	Forgings	SA-182	F3V	K31830	...	...	5C	1
	24 3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-336	F3V	K31830	...	...	5C	1
	25 3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-508	3V	K31830	...	...	5C	1
	26 3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-541	3V	K31830	...	...	5C	1
	27 3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-542	C	K31830	4a	...	5C	1
	28 3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-832	21V	K31830	...	...	5C	1
	29 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-182	F3VCb	K31390	...	...	5C	1
	30 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-336	F3VCb	K31390	...	...	5C	1
	31 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-508	3VCb	K31390	...	...	5C	1
	32 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-541	3VCb	K31390	...	...	5C	1
	33 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-542	E	K31390	4a	...	5C	1
	34 3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-832	23V	K31390	...	...	5C	1
	35 5Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T5	K41545	...	...	5B	1
	36 5Cr- $\frac{1}{2}$ Mo	Fittings	SA-234	WP5	K41545	...	...	5B	1
	37 5Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P5	K41545	...	...	5B	1
	38 5Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP5	K41545	...	...	5B	1
	39 5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	1	...	5B	1
	40 5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5	K41545	...	...	5B	1
	41 5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5	K41545	...	...	5B	1
	42 5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	2	...	5B	1
	43 5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5A	K42544	...	...	5B	1
	44 5Cr- $\frac{1}{2}$ Mo	Castings	SA-217	C5	J42045	NT	...	5B	1
	45 5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5a	K42544	...	...	5B	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	515	310	649	CS-3	T6, W5
2	515	310	649	CS-3	T6, W5
3	515	310	649	CS-3	T6, W5
4	517	310	649	CS-3	T6, W5
5	520	310	649	CS-3	T6, W5
6	585	380	538	CS-3	T6, W5
7	585	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	585	415	482	CS-3	G12, T5
30	585	415	482	CS-3	G12, T5
31	585	415	482	CS-3	G12, T5
32	585	415	482	CS-3	G12, T5
33	585	415	482	CS-3	G12, T5
34	585	415	482	CS-3	G12, T5
35	415	205	649	CS-2	T6
36	415	205	649	CS-2	T6
37	415	205	649	CS-2	T6
38	415	210	649	CS-2	T6
39	415	210	649	CS-2	T6
40	415	250	649	CS-2	T6
41	485	275	649	CS-2	T6
42	515	310	649	CS-3	T6
43	550	345	649	CS-3	T6
44	620	415	649	CS-3	T6
45	620	450	649	CS-5	T6

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	207	196	188	184	181	178	176	174	172	170	169	167	165	163	161	158	154	128
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	175	173	172	170	169	167	166	163	161	158	154	116
6	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	162	119
7	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	162	119
8	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	162	119
9	244	240	232	229	226	224	222	220	218	217	215	213	210	208	205	202	162	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	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
30	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
31	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
32	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
33	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
34	244	244	244	244	244	244	244	244	244	244	244	243	239	234	229	223	183	153
35	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
36	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
37	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
38	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
39	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
40	165	155	149	146	144	143	142	142	141	141	140	139	137	134	131	128	123	80.6
41	184	172	165	162	160	159	158	157	157	156	155	154	152	149	146	142	137	80.6
42	207	193	186	182	180	179	178	177	177	176	175	173	171	168	164	160	154	80.6
43	230	215	206	203	200	199	198	197	196	195	194	193	190	187	183	177	171	80.6
44	259	258	248	243	240	238	237	236	235	235	233	231	228	224	219	213	205	80.6
45	259	259	259	259	259	258	257	256	255	254	253	250	247	243	237	230	222	80.6

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
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	89.4	64.3	44.9	30.1	19.7	12.9	8.06	...	...	...	...	...	...	...
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	125	...	...	...	...	...	...	...	...	...	...	...	...	...
30	125	...	...	...	...	...	...	...	...	...	...	...	...	...
31	125	...	...	...	...	...	...	...	...	...	...	...	...	...
32	125	...	...	...	...	...	...	...	...	...	...	...	...	...
33	125	...	...	...	...	...	...	...	...	...	...	...	...	...
34	125	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...
44	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...
45	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...

(25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	5Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T5b	K51545	...	...	5B	1
2	5Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P5b	K51545	...	...	5B	1
3	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. tube	SA-213	T5c	K41245	...	...	5B	1
4	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. pipe	SA-335	P5c	K41245	...	...	5B	1
5	9Cr-1Mo	Smls. tube	SA-213	T9	K90941	...	...	5B	1
6	9Cr-1Mo	Fittings	SA-234	WP9	K90941	...	...	5B	1
7	9Cr-1Mo	Smls. pipe	SA-335	P9	K90941	...	...	5B	1
8	9Cr-1Mo	Forged pipe	SA-369	FP9	K90941	...	...	5B	1
9	9Cr-1Mo	Forgings	SA-182	F9	K90941	...	...	5B	1
10	9Cr-1Mo	Forgings	SA-336	F9	K90941	...	...	5B	1
11	9Cr-1Mo	Castings	SA-217	C12	J82090	NT	...	5B	1
12	9Cr-1Mo-V	Smls. tube	SA-213	T91 Type 1	K90901	...	...	15E	1
13	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Type 1	K90901	...	...	15E	1
14	9Cr-1Mo-V	Plate	SA-387	91 Type 1	K90901	2	...	15E	1
15	9Cr-1Mo-V	Forgings	SA-182	F91 Type 1	K90901	...	...	15E	1
16	9Cr-1Mo-V	Forgings	SA-336	F91 Type 1	K90901	...	...	15E	1
17	12Cr-Al	Plate	SA-240	405	S40500	...	...	7	1
18	12Cr-Al	Smls. tube	SA-268	TP405	S40500	...	...	7	1
19	13Cr	Plate	SA-240	410S	S41008	...	...	7	1
20	13Cr	Smls. tube	SA-268	TP410	S41000	...	...	6	1
(25) 21	13Cr	Plate	SA-240	410	S41000	...	...	6	1
(25) 22	13Cr	Forgings	SA-182	F6a	S41000	1	...	6	3
(25) 23	13Cr	Forgings	SA-182	F6a	S41000	2	...	6	3
24	13Cr	Forgings	SA-336	F6	S41000	...	...	6	3
25	13Cr	Castings	SA-217	CA15	J91150	...	...	6	3
26	15Cr	Smls. tube	SA-268	TP429	S42900	...	...	6	2
27	15Cr	Plate	SA-240	429	S42900	...	...	6	2
28	17Cr	Smls. tube	SA-268	TP430	S43000	...	...	7	2
29	17Cr	Plate	SA-240	430	S43000	...	...	7	2
(25) 30	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1100	...	...	...
(25) 31	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1100	...	...	...
(25) 32	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1100	...	...	...
33	26Cr-3Ni-3Mo	Plate	SA-240	26-3-3	S44660	...	$t \leq 5$	10K	1
34	26Cr-3Ni-3Mo	Smls. tube	SA-268	26-3-3	S44660	...	$t \leq 5$	10K	1
35	26Cr-3Ni-3Mo	Wld. tube	SA-268	26-3-3	S44660	...	$t \leq 5$	10K	1
36	26Cr-3Ni-3Mo	Wld. tube	SA-803	26-3-3	S44660	...	$t \leq 5$	10K	1
37	29Cr-4Mo-Ti	Smls. tube	SA-268	...	S44735	...	...	10J	1
38	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	QT	...	11A	4
39	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	...	...	11A	4
40	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	A	K12021	...	...	3	2
41	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	B	K12022	...	...	3	3
42	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	1	...	3	3
43	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	2	...	3	3
44	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	2	...	3	3
45	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	3	...	11A	4

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	T6
2	415	205	649	CS-2	T6
3	415	205	649	CS-2	T6
4	415	205	649	CS-2	T6
5	415	205	649	CS-2	T7
6	415	205	649	CS-2	T7
7	415	205	649	CS-2	T7
8	415	210	649	CS-2	T7
9	585	380	649	CS-3	T7
10	585	380	649	CS-3	T7
11	620	415	649	CS-3	T7
12	585	415	649	CS-3	T8
13	585	415	649	CS-3	T8
14	585	415	649	CS-3	T8
15	620	415	649	CS-3	T8
16	620	415	649	CS-3	T8
17	415	170	538	CS-1	G8, T7
18	415	205	538	CS-2	G8, T7
19	415	205	649	CS-2	T6
20	415	205	649	CS-2	T6
21	450	205	649	CS-2	T6
22	485	275	649	CS-3	T5
23	585	380	649	CS-3	T5
24	585	380	649	CS-3	T5
25	620	450	649	CS-5	T5
26	415	240	649	CS-2	G8, T6
27	450	205	649	CS-2	G8, T6
28	415	240	649	CS-2	G8, T6
29	450	205	649	CS-2	G8, T6
30	965	795	316	HT-1	G8
31	965	795	316	HT-1	G8
32	965	795	316	HT-1	G8
33	585	450	371	HA-5	G8, H3
34	585	450	371	HA-5	G8, H3
35	585	450	371	HA-5	G6, G8, H3
36	585	450	316	HA-5	G6, G8, H3
37	515	415	427	HA-6	G8
38	725	450	343	CS-5	G9, T1, W2, W6
39	725	450	343	CS-5	G9, H2, W2, W6
40	515	319	538	CS-3	G14, T6
41	550	345	538	CS-3	G14, T6
42	550	345	538	CS-5	T6
43	620	485	427	CS-5	...
44	620	485	427	CS-5	...
45	690	570	399	CS-5	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	80.6
2	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
3	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
4	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	80.6
5	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
6	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
7	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
8	138	129	124	122	120	119	119	118	118	117	117	116	114	112	110	106	103	98.3
9	244	236	227	223	220	218	217	217	216	215	214	212	209	205	201	195	188	180
10	244	236	227	223	220	218	217	217	216	215	214	212	209	205	201	195	188	180
11	259	258	248	243	240	238	237	236	235	235	233	231	228	224	219	213	205	197
12	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
13	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
14	244	244	244	244	244	244	244	244	244	244	244	244	244	244	239	232	224	215
15	259	...	256	...	252	...	251	...	251	...	251	250	247	242	238	232	225	215
16	259	...	256	...	252	...	251	...	251	...	251	250	247	242	238	232	225	215
17	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
18	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	95.0
19	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	92.5
20	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	92.5
21	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	92.5
22	184	174	168	165	163	162	161	159	159	157	156	154	151	149	144	139	125	92.5
23	244	239	231	227	224	222	221	219	218	217	215	212	208	204	198	192	125	92.5
24	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	244	125	92.5
25	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	125	92.5
26	161	152	147	145	143	141	140	140	139	138	136	135	133	130	126	122	117	88.7
27	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	88.7
28	161	152	147	145	143	141	140	140	139	138	136	135	133	130	126	122	117	88.7
29	138	130	126	124	122	121	120	120	119	118	117	115	114	111	108	104	100	88.7
30	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
31	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
32	402	402	402	402	402	402	402	402	402	402	402	402	...	...	...	...	...	...
33	244	244	244	244	244	244	241	237	234	231	229	228	227	226	...	...	...	...
34	244	244	244	244	244	244	241	237	234	231	229	228	227	226	...	...	...	...
35	208	208	208	208	208	208	205	201	199	197	195	194	193	192	...	...	...	...
36	208	208	208	208	208	208	205	201	199	197	195	194	...	...	...	...	...	...
37	215	215	215	214	204	194	186	179	174	169	166	164	163	162	161	157	150	...
38	299	289	283	278	271	264	256	248	242	236	232	230	160	...	...	...	...	...
39	299	287	280	275	272	268	265	262	259	256	253	250	247	...	...	...	...	...
40	207	199	194	191	188	186	183	181	179	177	175	173	171	168	165	160	154	104
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	104
43	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
44	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
45	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...
2	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...
3	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...
4	61.7	46.4	34.7	25.5	17.8	11.4	6.73	...	...	...	...	...	...	...
5	83.2	60.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
6	83.2	60.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
7	83.2	60.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
8	83.2	60.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
9	87.5	61.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
10	87.5	61.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
11	87.5	61.2	42.9	29.9	20.6	14.4	10.2	...	...	...	...	...	...	...
12	204	151	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...
13	204	151	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...
14	204	151	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...
15	204	151	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...
16	204	151	98.5	75.5	54.3	36.8	24.0	...	...	...	...	...	...	...
17	70.1	38.8	19.9	...	...	...	...	...	...	...	...	...	...	...
18	70.1	38.8	19.9	...	...	...	...	...	...	...	...	...	...	...
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	68.4	51.1	37.4	26.3	17.8	11.4	6.73	...	...	...	...	...	...	...
22	68.4	51.1	37.4	26.3	17.8	11.4	6.73	...	...	...	...	...	...	(25)
23	68.4	51.1	37.4	26.3	17.8	11.4	6.73	...	...	...	...	...	...	(25)
24	68.4	51.1	37.4	26.3	17.8	11.4	6.73	...	...	...	...	...	...	...
25	68.4	51.1	37.4	26.3	17.8	11.4	6.73	...	...	...	...	...	...	...
26	69.8	52.6	38.1	27.6	20.6	15.9	12.3	...	...	...	...	...	...	...
27	69.8	52.6	38.1	27.6	20.6	15.9	12.3	...	...	...	...	...	...	...
28	69.8	52.6	38.1	27.6	20.6	15.9	12.3	...	...	...	...	...	...	...
29	69.8	52.6	38.1	27.6	20.6	15.9	12.3	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	68.0	42.3	26.1	...	...	...	...	...	...	...	...	...	...	...
41	68.0	42.3	26.1	...	...	...	...	...	...	...	...	...	...	...
42	68.0	42.3	26.1	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-302	C	K12039	...	...	3	3
2	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	1	...	3	3
3	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	2	...	3	3
4	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	3	...	11A	4
5	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-302	D	K12054	...	...	3	3
6	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	1	...	3	3
7	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	1	...	3	3
8	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	2	...	3	3
9	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	2	...	3	3
(25) 10	...	...	...	...	...	...	...	...	...
11	Mn- $\frac{1}{2}$ Ni-V	Plate	SA-225	C	K12524	...	...	10A	1
12	Mn-V	Castings	SA-487	1	J13002	A/NT	...	10A	1
13	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	A/NT	...	3	3
14	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	1	...	3	3
15	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	2	...	3	3
16	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	65 < t ≤ 100	11B	3
17	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Plate	SA-517	F	K11576	...	t ≤ 65	11B	3
18	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...	t ≤ 65	11B	3
19	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Smls. tube	SA-423	2	K11540	...	...	4	2
20	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	1	...	3	3
21	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	1	...	3	3
22	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	2	...	3	3
23	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	2	...	3	3
24	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	1	...	3	3
25	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	2	...	3	3
26	$\frac{3}{4}$ Ni-1Mo- $\frac{3}{4}$ Cr	Castings	SA-217	WC5	J22000	...	...	4	1
27	1Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC4	J12082	...	...	4	1
28	1 $\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...	65 < t ≤ 100	11B	8
29	1 $\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...	t ≤ 65	11B	8
30	2Ni-1Cu	Forgings	SA-182	FR	K22035	...	...	9A	1
31	2Ni-1Cu	Smls. pipe	SA-333	9	K22035	...	...	9A	1
32	2Ni-1Cu	Smls. pipe	SA-334	9	K22035	...	...	9A	1
33	2Ni-1Cu	Forgings	SA-350	LF9	K22036	...	...	9A	1
34	2Ni-1Cu	Fittings	SA-420	WPL9	K22035	...	...	9A	1
(25) 35	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N	K23550	100	...	...	...
36	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	1	...	11B	10
(25) 37	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N	K23550	120	...	...	...
38	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	2	...	11B	10
39	2 $\frac{1}{2}$ Ni	Plate	SA-203	A	K21703	...	...	9A	1
40	2 $\frac{1}{2}$ Ni	Plate	SA-203	B	K22103	...	...	9A	1
41	2 $\frac{1}{2}$ Ni	Castings	SA-352	LC2	J22500	...	...	9A	1
42	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	K34035	3	...	3	3
43	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	K34035	1	...	11A	5
44	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	K34035	2	...	11B	10
(25) 45	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-372	P	K34035	100	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	620	485	427	CS-5	...
4	690	570	427	CS-5	...
5	550	345	538	CS-3	G14, T6
6	550	345	427	CS-5	...
7	550	345	427	CS-5	...
8	620	485	427	CS-5	...
9	620	485	427	CS-5	...
10	...	...	...	...	...
11	725	485	371	CS-5	T1
12	585	380	343	CS-3	T1
13	620	415	343	CS-3	...
14	550	340	427	CS-5	...
15	620	450	371	CS-5	...
16	725	620	343	CS-5	S1
17	795	690	343	HT-1	...
18	795	690	343	HT-1	...
19	415	255	343	CS-2	...
20	550	345	427	CS-5	...
21	550	340	427	CS-5	...
22	620	450	371	CS-5	...
23	620	450	371	CS-5	...
24	550	345	427	CS-5	...
25	620	450	371	CS-5	...
26	485	275	593	CS-2	T6
27	485	275	538	CS-2	T7
28	725	620	343	CS-5	...
29	795	690	343	HT-1	...
30	435	315	40	CS-3	...
31	435	315	40	CS-3	...
32	435	315	40	CS-3	...
33	435	315	40	CS-3	...
34	435	315	40	CS-3	...
35	795	690	343	HT-1	W1
36	795	690	343	HT-1	G10, G11, W1
37	930	825	343	HT-1	W1
38	930	825	343	HT-1	G11, W1
39	450	255	538	CS-2	T2
40	485	275	538	CS-2	T2
41	485	275	343	CS-2	...
42	620	485	343	CS-5	...
43	725	585	343	CS-5	...
44	795	690	343	HT-1	...
45	795	690	343	HT-1	W1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
4	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	285	...
5	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	104
6	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
7	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
8	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
9	259	259	259	259	259	259	259	259	259	259	259	259	259	259	256	249	240	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	302	298	292	290	287	282	276	269	261	252	245	238	160	131	...	...	...	...
12	244	243	237	233	230	227	224	222	219	217	214	212	160	...	...	...	...	...
13	259	259	259	254	250	247	245	243	240	236	229	220	211	...	...	...	...	...
14	230	225	217	212	208	206	204	203	200	196	191	183	176	171	171	171	171	...
15	259	259	259	259	259	259	259	259	259	255	248	238	229	222	...	...	...	...
16	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
17	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
18	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
19	170	161	156	154	152	150	149	147	146	145	143	141	140	...	...	...	...	...
20	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
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	...	...	...	...
23	259	259	259	259	259	259	259	259	259	256	253	250	247	243	...	...	...	...
24	230	221	215	212	209	206	204	201	199	197	195	192	190	187	183	178	172	...
25	259	259	259	259	259	259	259	259	259	256	253	250	247	243	...	...	...	...
26	184	177	172	169	167	165	163	161	159	158	156	154	152	149	146	142	137	124
27	184	177	172	169	167	165	163	161	159	158	156	154	152	149	146	142	137	131
28	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
29	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
30	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	181	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
36	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
37	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
38	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
39	170	160	155	152	150	148	146	143	140	136	131	126	120	113	95.1	79.5	64.4	48.8
40	184	173	168	165	162	160	158	155	151	147	142	136	130	113	95.1	79.5	64.4	48.8
41	184	173	168	165	162	160	158	155	151	147	142	136	130	...	...	...	...	...
42	259	259	259	259	259	259	259	259	259	259	259	259	259	...	...	...	...	...
43	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
44	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
45	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	68.0	42.3	26.1	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	68.0	42.3	26.1	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	87.4	59.0	39.8	26.8	17.1	...	...	...	...	...	...	...	...	...
27	75.6	49.9	33.5	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	35.4	22.6	14.2	...	...	...	...	...	...	...	...	...	...	...
40	35.4	22.6	14.2	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

	Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy	Class/	Size/	P-No.	Group No.
						Desig./ UNS No.	Condition/ Temper	Thickness, mm		
(25)	1	2 ³ / ₄ Ni-1 ¹ / ₂ Cr- ¹ / ₂ Mo-V	Forgings	SA-723	2	K34035	1	...	11B	10
	2	2 ³ / ₄ Ni-1 ¹ / ₂ Cr- ¹ / ₂ Mo-V	Forgings	SA-372	P	K34035	120	...	...	...
	3	2 ³ / ₄ Ni-1 ¹ / ₂ Cr- ¹ / ₂ Mo-V	Forgings	SA-723	2	K34035	2	...	11B	10
	4	3Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo	Plate	SA-543	B	K42339	3	...	3	3
	5	3Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo	Plate	SA-543	B	K42339	1	...	11A	5
	6	3Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo	Plate	SA-543	B	K42339	2	...	11B	10
	7	3 ¹ / ₂ Ni	Smls. pipe	SA-333	3	K31918	...	...	9B	1
	8	3 ¹ / ₂ Ni	Smls. tube	SA-334	3	K31918	...	...	9B	1
	9	3 ¹ / ₂ Ni	Fittings	SA-420	WPL3	...	...	...	9B	1
	10	3 ¹ / ₂ Ni	Plate	SA-203	D	K31718	...	...	9B	1
	11	3 ¹ / ₂ Ni	Forgings	SA-350	LF3	K32025	...	...	9B	1
	12	3 ¹ / ₂ Ni	Forgings	SA-765	III	K32026	...	...	9B	1
	13	3 ¹ / ₂ Ni	Plate	SA-203	E	K32018	...	...	9B	1
	14	3 ¹ / ₂ Ni	Castings	SA-352	LC3	J31550	...	...	9B	1
	15	3 ¹ / ₂ Ni	Plate	SA-203	F	...	...	<i>t</i> > 50	9B	1
	16	3 ¹ / ₂ Ni	Plate	SA-203	F	...	...	<i>t</i> ≤ 50	9B	1
	17	3 ¹ / ₂ Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo-V	Forgings	SA-508	4N	K22375	3	...	3	3
	18	3 ¹ / ₂ Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo-V	Forgings	SA-508	4N	K22375	1	...	11A	5
	19	3 ¹ / ₂ Ni-1 ³ / ₄ Cr- ¹ / ₂ Mo-V	Forgings	SA-508	4N	K22375	2	...	11B	10
	20	4Ni-1 ¹ / ₂ Cr- ¹ / ₂ Mo-V	Forgings	SA-723	3	K44045	1	...	11B	10
21	4Ni-1 ¹ / ₂ Cr- ¹ / ₂ Mo-V	Forgings	SA-723	3	K44045	2	...	11B	10	
22	5Ni- ¹ / ₄ Mo	Plate	SA-645	A	K41583	...	...	11A	2	
23	7Ni	Plate	SA-553	III	K61365	...	<i>t</i> ≤ 50	11A	1	
24	7Ni	Plate	SA-553	III	K61365	...	<i>t</i> ≤ 50	11A	1	
25	8Ni	Plate	SA-553	II	K71340	...	...	11A	1	
26	8Ni	Plate	SA-553	II	K71340	...	...	11A	1	
27	9Ni	Smls. pipe	SA-333	8	K81340	...	...	11A	1	
28	9Ni	Smls. pipe	SA-333	8	K81340	...	...	11A	1	
29	9Ni	Smls. tube	SA-334	8	K81340	...	...	11A	1	
30	9Ni	Smls. tube	SA-334	8	K81340	...	...	11A	1	
31	9Ni	Plate	SA-353	...	K81340	...	...	11A	1	
32	9Ni	Plate	SA-353	...	K81340	...	...	11A	1	
33	9Ni	Fittings	SA-420	WPL8	K81340	...	...	11A	1	
34	9Ni	Fittings	SA-420	WPL8	K81340	...	...	11A	1	
35	9Ni	Forgings	SA-522	I	K81340	...	...	11A	1	
36	9Ni	Forgings	SA-522	I	K81340	...	...	11A	1	
37	9Ni	Plate	SA-553	I	K81340	...	...	11A	1	
38	9Ni	Plate	SA-553	I	K81340	...	...	11A	1	
(25)	39	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10	N08810	...	...	45	...
(25)	40	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H	N08810	...	...	45	...
(25)	41	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...	...	45	...
(25)	42	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H	N08810	...	...	45	...
(25)	43	42Fe-33Ni-21Cr	Bar	SA-276	800H	N08810	...	...	45	...
(25)	44	42Fe-33Ni-21Cr	Smls. pipe	SA-312	800H	N08810	...	...	45	...
(25)	45	42Fe-33Ni-21Cr	Wld. pipe	SA-312	800H	N08810	...	...	45	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	795	690	343	HT-1	G10, G11, W1
2	930	825	343	HT-1	W1
3	930	825	343	HT-1	G11, W1
4	620	485	343	CS-5	...
5	725	585	343	CS-5	W7
6	795	690	343	HT-1	...
7	450	240	343	CS-2	...
8	450	240	343	CS-2	...
9	450	240	343	CS-2	...
10	450	255	538	CS-2	T2
11	485	260	343	CS-2	...
12	485	260	343	CS-2	...
13	485	275	538	CS-2	T2
14	485	275	343	CS-2	...
15	515	345	343	CS-3	T1
16	550	380	343	CS-3	...
17	620	485	343	CS-5	...
18	725	585	343	CS-5	W7
19	795	690	343	HT-1	...
20	795	690	343	HT-1	G10, G11, W1
21	930	825	343	HT-1	G11, W1
22	655	450	121	CS-3	W4
23	690	515	66	CS-3	G17, W3
24	690	515	66	CS-3	G17, W4
25	690	585	121	CS-3	W3
26	690	585	121	CS-3	W4
27	690	515	121	CS-3	W3
28	690	515	121	CS-3	W4
29	690	515	121	CS-3	W3
30	690	515	121	CS-3	W4
31	690	515	121	CS-3	W3
32	690	515	121	CS-3	W4
33	690	515	121	CS-3	W3
34	690	515	121	CS-3	W4
35	690	515	121	CS-3	G9, S2, W3
36	690	515	121	CS-3	G9, S2, W4
37	690	585	121	CS-3	W3
38	690	585	121	CS-3	W4
39	450	170	899	NFN-9	G2, G18, G19, G20, T10
40	450	170	899	NFN-9	G2, G19, G20, T10
41	450	170	899	NFN-9	G2, G19, G20, T10
42	450	170	899	NFN-9	G2, G6, G19, G20, T10
43	450	170	899	NFN-9	G2, G18, G19, G20, T10
44	450	170	899	NFN-9	G2, G19, G20, T10
45	450	170	899	NFN-9	G2, G6, G19, G20, T10

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
2	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
3	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
4	259	259	259	259	259	259	259	259	259	259	259	259	259	...	...	...	...	...
5	302	302	302	302	302	302	302	302	302	302	302	302	302	...	...	...	...	...
6	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
7	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
8	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
9	161	151	147	144	142	140	138	135	132	128	124	119	113	...	...	...	...	...
10	170	160	155	152	150	148	146	143	140	136	131	126	120	113	95.1	79.5	64.4	48.8
11	172	162	157	154	152	150	148	145	141	137	133	127	121	...	...	...	...	...
12	172	162	157	154	152	150	148	145	141	137	133	127	121	...	...	...	...	...
13	184	173	168	165	162	160	158	155	151	147	142	136	130	122	101	83.8	66.8	49.2
14	184	173	168	165	162	160	158	155	151	147	142	136	130	...	...	...	...	...
15	215	215	209	206	203	200	197	193	189	183	177	170	148	...	...	...	...	...
16	230	230	230	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	259	259	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	302	302	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	330	330	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	330	330	330	330	330	330	330	330	330	330	330	330	330	...	...	...	...	...
21	388	388	388	388	388	388	388	388	388	388	388	388	388	...	...	...	...	...
22	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	287	287	287	287	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	273	273	273	273	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
40	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
41	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
42	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
43	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
44	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
45	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

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	35.4	22.6	14.2	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	35.4	22.6	13.3	...	...	...	...	...	...	...	...	...	...	...
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	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 (25)
40	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 (25)
41	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 (25)
42	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 (25)
43	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 (25)
44	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 (25)
45	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 (25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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.
(25)	1	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H	N08810	...	45	...
(25)	2	42Fe-33Ni-21Cr	Bar	SA-479	800H	N08810	...	45	...
(25)	3	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H	N08810	...	45	...
(25)	4	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10	N08810	...	45	...
	5	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	8	3
	6	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...	8	3
	7	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	8	1
	8	16Cr-12Ni-2Mo	Forgings	SA-965	F316L	S31603	...	8	1
	9	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	8	1
	10	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	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	Smls. pipe	SA-312	TP316L	S31603	...	8	1
	14	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	8	1
	15	16Cr-12Ni-2Mo	Fittings	SA-403	316L	S31603	CR	8	1
	16	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316L	S31603	WP-W	8	1
	17	16Cr-12Ni-2Mo	Wld. fittings	SA-403	316L	S31603	WP-WX	8	1
	18	16Cr-12Ni-2Mo	Wld. pipe	SA-688	TP316L	S31603	...	8	1
	19	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	8	1
	20	16Cr-12Ni-2Mo	Forgings	SA-965	F316	S31600	...	8	1
	21	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	8	1
	22	16Cr-12Ni-2Mo	Forgings	SA-965	F316H	S31609	...	8	1
	23	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	8	1
	24	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...	8	1
	25	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...	8	1
	26	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	8	1
	27	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316	S31600	...	8	1
	28	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	8	1
	29	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316	S31600	...	8	1
	30	16Cr-12Ni-2Mo	Fittings	SA-403	316	S31600	WP-S	8	1
	31	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...	8	1
	32	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...	8	1
	33	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316H	S31609	...	8	1
	34	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...	8	1
	35	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316H	S31609	...	8	1
	36	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316H	S31609	...	8	1
	37	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H	S31609	...	8	1
	38	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2	...	...	8	1
	39	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...	8	1
	40	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N	S31651	...	8	1
	41	16Cr-12Ni-2Mo-N	Plate	SA-240	316N	S31651	...	8	1
	42	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...	8	1
	43	16Cr-12Ni-2Mo-N	Smls. pipe	SA-312	TP316N	S31651	...	8	1
	44	16Cr-12Ni-2Mo-N	Wld. pipe	SA-312	TP316N	S31651	...	8	1
	45	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N	S31651	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	899	NFN-9	G2, G6, G19, G20, T10
2	450	170	899	NFN-9	G2, G18, G19, G20, T10
3	450	170	899	NFN-9	G2, G6, G19, G20, T10
4	450	170	899	NFN-9	G2, G18, G19, G20, T10
5	655	310	427	HA-6	...
6	655	310	427	HA-6	G2
7	450	170	454	HA-4	G2
8	450	170	454	HA-4	G2
9	485	170	454	HA-4	G2
10	485	170	454	HA-4	G2
11	485	170	454	HA-4	G2
12	485	170	454	HA-4	G2, G6
13	485	170	454	HA-4	G2
14	485	170	454	HA-4	G2, G6
15	485	170	454	HA-4	G2, G6
16	485	170	454	HA-4	G2, G6
17	485	170	454	HA-4	G2, G6
18	485	175	454	HA-4	G2, G6
19	485	205	816	HA-2	G2, T10
20	485	205	816	HA-2	G2, T10
21	485	205	816	HA-2	G2, T10
22	485	205	816	HA-2	G2, T10
23	515	205	816	HA-2	G2, G3, T10
24	515	205	816	HA-2	G2, G3, T10
25	515	205	816	HA-2	G2, G3, G4, T10
26	515	205	816	HA-2	G2, G3, G6, T10
27	515	205	816	HA-2	G2, G3, G4, T10
28	515	205	816	HA-2	G2, G3, G4, G6, T10
29	515	205	816	HA-2	G2, G3, G4, T10
30	515	205	816	HA-2	G2, T10
31	515	205	816	HA-2	G2, G3, G6, T10
32	515	205	816	HA-2	G2
33	515	205	816	HA-2	G2, T10
34	515	205	816	HA-2	G2, G6, T10
35	515	205	816	HA-2	G2, T10
36	515	205	816	HA-2	G2, G6, T10
37	515	205	816	HA-2	G2, G4, T10
38	520	220	454	HA-4	G2, G16
39	520	220	550	HA-2	G2, G3, G4, G16
40	550	240	649	HA-2	G2, T10
41	550	240	649	HA-2	G2, T10
42	550	240	649	HA-2	G2, G6, T10
43	550	240	649	HA-2	G2, T10
44	550	240	649	HA-2	G2, G6, T10
45	550	240	649	HA-2	G2, G4, T10

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	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
2	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
3	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
4	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
5	207	179	164	157	151	147	143	141	139	137	134	131	127	123	119	115	112	...
6	207	207	207	207	203	198	194	190	187	185	181	176	172	167	161	156	151	...
7	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
8	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
9	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
10	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
11	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
12	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
13	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
14	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
15	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
16	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
17	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
18	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
19	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
20	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
21	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
22	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
23	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
24	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
25	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
26	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
27	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
28	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
29	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
30	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
31	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
32	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
33	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
34	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
35	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
36	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
37	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
38	147	147	147	147	147	145	139	135	131	128	125	123	121	119	116	114	112	110
39	147	147	147	147	147	147	142	137	133	130	127	124	122	120	118	117	116	115
40	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
41	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
42	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
43	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
44	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
45	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	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 (25)
2	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 (25)
3	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 (25)
4	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 (25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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
21	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
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	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
24	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
25	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
26	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
27	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
28	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
29	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
30	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
31	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
32	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
33	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
34	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
35	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
36	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
37	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
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	113	113	112	...	...	...	...	...	...	...	...	...	...	...
40	126	124	122	100	80.3	65.0	50.5	...	...	...	...	...	...	...
41	126	124	122	100	80.3	65.0	50.5	...	...	...	...	...	...	...
42	107	105	103	85.0	68.3	55.2	42.9	...	...	...	...	...	...	...
43	126	124	122	100	80.3	65.0	50.5	...	...	...	...	...	...	...
44	107	105	103	85.0	68.3	55.2	42.9	...	...	...	...	...	...	...
45	126	124	122	100	80.3	65.0	50.5	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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-N	Fittings	SA-403	316N	S31651	CR	...	8	1
2	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316N	S31651	WP-W	...	8	1
3	16Cr-12Ni-2Mo-N	Wld. fittings	SA-403	316N	S31651	WP-WX	...	8	1
4	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N	S31651	...	...	8	1
5	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-11-2	...	...	≤75	8	1
6	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-13-3	...	...	≤75	8	1
7	17.5Cr-17.5Ni-5.3Si	Plate	SA-240	...	S30601	...	...	8	1
8	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	$t \geq 5$	8	3
9	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...	$t < 5$	8	3
10	18Cr-5Ni-3Mo	Smls. tube	SA-789	...	S31500	...	...	10H	1
11	18Cr-5Ni-3Mo	Wld. tube	SA-789	...	S31500	...	...	10H	1
12	18Cr-5Ni-3Mo	Smls. pipe	SA-790	...	S31500	...	...	10H	1
13	18Cr-5Ni-3Mo	Wld. pipe	SA-790	...	S31500	...	...	10H	1
14	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	$t > 130$	8	1
15	18Cr-8Ni	Forgings	SA-965	F304L	S30403	...	...	8	1
16	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	$t \leq 130$	8	1
17	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	...	...	8	1
18	18Cr-8Ni	Plate	SA-240	304L	S30403	...	...	8	1
19	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...	...	8	1
20	18Cr-8Ni	Smls. pipe	SA-312	TP304L	S30403	...	...	8	1
21	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...	8	1
22	18Cr-8Ni	Fittings	SA-403	304L	S30403	WP-S	...	8	1
23	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...	...	8	1
24	18Cr-8Ni	Castings	SA-351	CF3	J92500	...	...	8	1
25	18Cr-8Ni	Castings	SA-351	CF10	J92590	...	...	8	1
26	18Cr-8Ni	Castings	SA-351	CF8	J92600	...	...	8	1
27	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	$t > 130$	8	1
28	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	≥200	8	1
29	18Cr-8Ni	Forgings	SA-965	F304	S30400	...	...	8	1
30	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...	$t > 130$	8	1
31	18Cr-8Ni	Forgings	SA-965	F304H	S30409	...	...	8	1
32	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9	...	...	≤75	8	1
33	18Cr-8Ni	Plate	SA-240	302	S30200	...	...	8	1
34	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	$t \leq 130$	8	1
35	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...	...	8	1
36	18Cr-8Ni	Plate	SA-240	304	S30400	...	...	8	1
37	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...	8	1
38	18Cr-8Ni	Smls. pipe	SA-312	TP304	S30400	...	...	8	1
39	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...	8	1
40	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...	<200	8	1
41	18Cr-8Ni	Fittings	SA-403	304	S30400	CR	...	8	1
42	18Cr-8Ni	Fittings	SA-403	304	S30400	WP-S	...	8	1
43	18Cr-8Ni	Wld. fittings	SA-403	304	S30400	WP-W	...	8	1
44	18Cr-8Ni	Wld. fittings	SA-403	304	S30400	WP-WX	...	8	1
45	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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-2	G2, G6, T10
2	550	240	649	HA-2	G2, G6, T10
3	550	240	649	HA-2	G2, G6, T10
4	550	240	649	HA-2	G2, T10
5	580	280	427	HA-2	G2, G16
6	580	280	427	HA-2	G2, G16
7	540	255	204	HA-1	...
8	690	380	427	HA-6	G2
9	690	415	427	HA-6	G2
10	630	440	343	HA-5	G8
11	630	440	343	HA-5	G6, G8
12	630	440	343	HA-5	G8
13	630	440	343	HA-5	G6, G8
14	450	170	649	HA-3	G2, T10
15	450	170	649	HA-3	G2, T10
16	485	170	649	HA-3	G2, T10
17	485	170	649	HA-3	G2, T10
18	485	170	649	HA-3	G2, T10
19	485	170	649	HA-3	G2, G6, T10
20	485	170	649	HA-3	G2, T10
21	485	170	649	HA-3	G2, G6, T10
22	485	170	649	HA-3	G2, T10
23	485	175	649	HA-3	G2, G6, T10
24	485	205	427	HA-3	G2, G8
25	485	205	816	HA-3	G2, G4, G8, T8
26	485	205	816	HA-1	G2, G3, G4, G8, T8
27	485	205	816	HA-1	G2, G3, G4, T10
28	485	205	816	HA-1	G2, G3, G4, S3, T10
29	485	205	816	HA-1	G2, G3, G4, T10
30	485	205	816	HA-1	G2, T10
31	485	205	816	HA-1	G2, T10
32	500	200	550	HA-3	G2, G16, T9
33	515	205	399	HA-1	G2, G3
34	515	205	816	HA-1	G2, G3, G4, T10
35	515	205	816	HA-1	G2, G3, T10
36	515	205	816	HA-1	G2, G3, G4, T10
37	515	205	816	HA-1	G2, G3, G6, T10
38	515	205	816	HA-1	G2, G3, G4, T10
39	515	205	816	HA-1	G2, G3, G4, G6, T10
40	515	205	816	HA-1	G2, G3, G4, S4, T10
41	515	205	816	HA-1	G2, G6, T10
42	515	205	816	HA-1	G2, T10
43	515	205	816	HA-1	G2, G6, T10
44	515	205	816	HA-1	G2, G6, T10
45	515	205	816	HA-1	G2, G3, G6, T10

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
2	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
3	137	137	137	137	137	137	137	136	132	128	125	122	120	117	115	113	111	109
4	161	161	161	161	161	161	161	160	155	151	147	144	141	138	135	133	130	128
5	187	187	187	187	187	184	177	171	166	161	156	152	149	145	142	139	136	...
6	187	187	187	187	187	184	177	171	166	161	156	152	149	145	142	139	136	...
7	170	170	170	170	168	161	154	149	...	...	...	...	...	...	...	...	...	...
8	253	253	253	249	232	218	206	197	190	184	180	177	174	172	169	166	162	...
9	276	276	276	272	253	238	225	215	207	201	197	193	190	187	184	181	176	...
10	264	264	264	264	264	264	264	264	264	264	264	264	264	...	...	...	...	...
11	225	225	225	225	225	225	225	225	225	225	225	225	225	...	...	...	...	...
12	264	264	264	264	264	264	264	264	264	264	264	264	264	...	...	...	...	...
13	225	225	225	225	225	225	225	225	225	225	225	225	225	...	...	...	...	...
14	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
15	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
16	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
17	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
18	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
19	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
20	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
21	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
22	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
23	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
24	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	...
25	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
26	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
27	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
28	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
29	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
30	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
31	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
32	133	133	133	133	133	132	127	123	119	116	113	111	109	107	106	105	103	101
33	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	...	...	...
34	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
35	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
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	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
43	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
44	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
45	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, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	107	105	103	85.0	68.3	55.2	42.9	...	...	...	...	...	...	...
2	107	105	103	85.0	68.3	55.2	42.9	...	...	...	...	...	...	...
3	107	105	103	85.0	68.3	55.2	42.9	...	...	...	...	...	...	...
4	126	124	122	100	80.3	65.0	50.5	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
15	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
16	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
17	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
18	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
19	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
20	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
21	72.8	71.1	69.2	34.4	28.2	22.7	18.6	...	...	...	...	...	...	...
22	85.6	83.7	81.4	40.4	33.2	26.7	21.9	...	...	...	...	...	...	...
23	72.8	71.1	69.2	34.4	28.2	22.7	18.6	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	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
26	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
27	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
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	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
30	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
31	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
32	99.0	96.7	94.4	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	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
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	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
43	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
44	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
45	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, Class 2
Maximum Allowable Stress Values, S, 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	F304H	S30409	...	$t \leq 130$	8	1
2	18Cr-8Ni	Smls. tube	SA-213	TP304H	S30409	...	...	8	1
3	18Cr-8Ni	Plate	SA-240	304H	S30409	...	...	8	1
4	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...	...	8	1
5	18Cr-8Ni	Smls. pipe	SA-312	TP304H	S30409	...	...	8	1
6	18Cr-8Ni	Wld. pipe	SA-312	TP304H	S30409	...	...	8	1
7	18Cr-8Ni	Smls. pipe	SA-376	TP304H	S30409	...	...	8	1
8	18Cr-8Ni	Fittings	SA-403	304H	S30409	CR	...	8	1
9	18Cr-8Ni	Fittings	SA-403	304H	S30409	WP-S	...	8	1
10	18Cr-8Ni	Wld. fittings	SA-403	304H	S30409	WP-W	...	8	1
11	18Cr-8Ni	Wld. fittings	SA-403	304H	S30409	WP-WX	...	8	1
12	18Cr-8Ni	Plate	SA/EN 10028-7	X5CrNi18-10	...	...	≤ 75	8	1
13	18Cr-8Ni-N	Smls. tube	SA-213	TP304N	S30451	...	...	8	1
14	18Cr-8Ni-N	Plate	SA-240	304N	S30451	...	...	8	1
15	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...	...	8	1
16	18Cr-8Ni-N	Smls. pipe	SA-312	TP304N	S30451	...	...	8	1
17	18Cr-8Ni-N	Wld. pipe	SA-312	TP304N	S30451	...	...	8	1
18	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N	S30451	...	...	8	1
19	18Cr-8Ni-N	Fittings	SA-403	304N	S30451	CR	...	8	1
20	18Cr-8Ni-N	Wld. fittings	SA-403	304N	S30451	WP-W	...	8	1
21	18Cr-8Ni-N	Wld. fittings	SA-403	304N	S30451	WP-WX	...	8	1
22	18Cr-8Ni-N	Forgings	SA-965	F304N	S30451	...	...	8	1
23	18Cr-8Ni-N	Plate	SA/EN 10028-7	X2CrNiN18-10	...	...	≤ 75	8	1
24	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9	...	...	≤ 75	8	1
25	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	...	8	1
26	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	$t > 130$	8	1
27	18Cr-10Ni-Cb	Forgings	SA-965	F347	S34700	...	...	8	1
28	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	$t > 130$	8	1
29	18Cr-10Ni-Cb	Forgings	SA-965	F347H	S34709	...	...	8	1
30	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	$t > 130$	8	1
31	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	$t > 130$	8	1
32	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...	$t \leq 130$	8	1
33	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347	S34700	...	...	8	1
34	18Cr-10Ni-Cb	Plate	SA-240	347	S34700	...	...	8	1
35	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...	...	8	1
36	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347	S34700	...	...	8	1
37	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347	S34700	...	...	8	1
38	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347	S34700	...	...	8	1
39	18Cr-10Ni-Cb	Fittings	SA-403	347	S34700	CR	...	8	1
40	18Cr-10Ni-Cb	Fittings	SA-403	347	S34700	WP-S	...	8	1
41	18Cr-10Ni-Cb	Wld. fittings	SA-403	347	S34700	WP-W	...	8	1
42	18Cr-10Ni-Cb	Wld. fittings	SA-403	347	S34700	WP-WX	...	8	1
43	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...	$t \leq 130$	8	1
44	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H	S34709	...	...	8	1
45	18Cr-10Ni-Cb	Plate	SA-240	347H	S34709	...	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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-1	G2, T10
2	515	205	816	HA-1	G2, T10
3	515	205	816	HA-1	G2, T10
4	515	205	816	HA-1	G2, G6, T10
5	515	205	816	HA-1	G2, T10
6	515	205	816	HA-1	G2, G6, T10
7	515	205	816	HA-1	G2, G4, T10
8	515	205	816	HA-1	G2, G6, T10
9	515	205	816	HA-1	G2, T10
10	515	205	816	HA-1	G2, G6, T10
11	515	205	816	HA-1	G2, G6, T10
12	520	210	550	HA-1	G2, G3, G4, G16, T9
13	550	240	649	HA-1	G2, T9
14	550	240	649	HA-1	G2, T9
15	550	240	649	HA-1	G2, G6, T9
16	550	240	649	HA-1	G2, T9
17	550	240	649	HA-1	G2, G6, T9
18	550	240	649	HA-1	G2, G4, T9
19	550	240	649	HA-1	G2, G6, T9
20	550	240	649	HA-1	G2, G6, T9
21	550	240	649	HA-1	G2, G6, T9
22	550	240	649	HA-1	G2, T9
23	550	270	427	HA-1	G2, G16
24	550	270	550	HA-1	G2, G16, T9
25	485	205	816	HA-2	G2, G3, G8, T9
26	485	205	816	HA-2	G2, G3, T9
27	485	205	816	HA-2	G2, G3, T9
28	485	205	816	HA-2	G1, G2, T10
29	485	205	816	HA-2	G1, G2, T10
30	515	205	816	HA-2	G2, G3, T9
31	515	205	816	HA-2	G2, T10
32	515	205	816	HA-2	G2, G3, G4, T9
33	515	205	816	HA-2	G2, G3, G4, T9
34	515	205	816	HA-2	G2, G3, T9
35	515	205	816	HA-2	G2, G3, G6, T9
36	515	205	816	HA-2	G2, G3, T9
37	515	205	816	HA-2	G2, G3, G6, T9
38	515	205	816	HA-2	G2, G3, G4, T9
39	515	205	816	HA-2	G2, G6, T9
40	515	205	816	HA-2	G2, T9
41	515	205	816	HA-2	G2, G6, T9
42	515	205	816	HA-2	G2, G6, T9
43	515	205	816	HA-2	G1, G2, T10
44	515	205	816	HA-2	G1, G2, T10
45	515	205	816	HA-2	G1, G2, T10

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
2	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
3	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
4	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
5	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
6	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
7	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
8	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
9	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
10	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
11	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
12	140	140	140	140	140	136	131	127	123	120	118	115	113	111	108	106	105	103
13	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
14	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
15	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
16	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
17	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
18	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
19	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
20	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
21	137	137	137	137	132	125	120	116	112	109	106	104	102	101	99.0	97.4	95.8	94.0
22	161	161	161	161	155	147	141	136	132	128	125	123	120	118	117	115	113	111
23	180	180	180	180	179	174	168	163	159	155	151	148	145	142	139	137	134	...
24	180	180	180	180	174	165	158	152	147	143	140	137	135	133	130	128	126	124
25	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
26	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
27	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
28	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
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	128	127	126	126	125
31	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
32	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
33	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
34	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
35	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
36	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
37	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
38	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
39	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
40	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
41	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
42	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
43	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
44	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
45	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	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
2	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
3	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
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	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
12	101	98.9	96.8	...	...	...	...	...	...	...	...	...	...	...
13	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
14	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
15	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
16	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
17	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
18	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
19	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
20	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
21	92.2	90.3	82.9	67.1	54.3	43.9	35.4	...	...	...	...	...	...	...
22	108	106	97.5	78.9	63.8	51.6	41.6	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	121	119	97.5	...	...	...	...	...	...	...	...	...	...	...
25	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
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	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
28	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
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	97.6	75.9	57.2	40.2	30.3	23.2	16.2	11.4	8.97	7.08	5.89	5.30
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	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
33	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
34	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
35	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
36	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
37	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
38	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
39	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
40	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
41	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
42	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
43	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
44	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
45	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	Wld. tube	SA-249	TP347H	S34709	...	...	8	1
2	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347H	S34709	...	...	8	1
3	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP347H	S34709	...	...	8	1
4	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347H	S34709	...	...	8	1
5	18Cr-10Ni-Cb	Fittings	SA-403	347H	S34709	CR	...	8	1
6	18Cr-10Ni-Cb	Fittings	SA-403	347H	S34709	WP-S	...	8	1
7	18Cr-10Ni-Cb	Wld. fittings	SA-403	347H	S34709	WP-W	...	8	1
8	18Cr-10Ni-Cb	Wld. fittings	SA-403	347H	S34709	WP-WX	...	8	1
9	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...	$t \leq 130$	8	1
10	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348	S34800	...	...	8	1
11	18Cr-10Ni-Cb	Plate	SA-240	348	S34800	...	...	8	1
12	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...	...	8	1
13	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348	S34800	...	...	8	1
14	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348	S34800	...	...	8	1
15	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348	S34800	...	...	8	1
16	18Cr-10Ni-Cb	Fittings	SA-403	348	S34800	CR	...	8	1
17	18Cr-10Ni-Cb	Fittings	SA-403	348	S34800	WP-S	...	8	1
18	18Cr-10Ni-Cb	Wld. fittings	SA-403	348	S34800	WP-W	...	8	1
19	18Cr-10Ni-Cb	Wld. fittings	SA-403	348	S34800	WP-WX	...	8	1
20	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...	$t \leq 130$	8	1
21	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H	S34809	...	...	8	1
22	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...	...	8	1
23	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP348H	S34809	...	...	8	1
24	18Cr-10Ni-Cb	Wld. pipe	SA-312	TP348H	S34809	...	...	8	1
25	18Cr-10Ni-Cb	Fittings	SA-403	348H	S34809	CR	...	8	1
26	18Cr-10Ni-Cb	Fittings	SA-403	348H	S34809	WP-S	...	8	1
27	18Cr-10Ni-Cb	Wld. fittings	SA-403	348H	S34809	WP-W	...	8	1
28	18Cr-10Ni-Cb	Wld. fittings	SA-403	348H	S34809	WP-WX	...	8	1
29	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	$t > 9.5$	8	1
30	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	$t > 9.5$	8	1
31	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	$t > 9.5$	8	1
32	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	$t > 9.5$	8	1
33	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	$t > 130$	8	1
34	18Cr-10Ni-Ti	Forgings	SA-965	F321	S32100	...	...	8	1
35	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	$t > 130$	8	1
36	18Cr-10Ni-Ti	Forgings	SA-965	F321H	S32109	...	...	8	1
37	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10	...	...	≤ 75	8	1
38	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...	$t \leq 130$	8	1
39	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...	...	8	1
40	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...	...	8	1
41	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...	...	8	1
42	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321	S32100	...	$t \leq 9.5$	8	1
43	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321	S32100	...	...	8	1
44	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...	$t \leq 9.5$	8	1
45	18Cr-10Ni-Ti	Fittings	SA-403	321	S32100	CR	...	8	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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, T10
2	515	205	816	HA-2	G1, G2, T10
3	515	205	816	HA-2	G1, G2, G6, T10
4	515	205	816	HA-2	G1, G2, T10
5	515	205	816	HA-2	G1, G2, G6, T10
6	515	205	816	HA-2	G1, G2, T10
7	515	205	816	HA-2	G1, G2, G6, T10
8	515	205	816	HA-2	G1, G2, G6, T10
9	515	205	816	HA-2	G2, G3, T9
10	515	205	816	HA-2	G2, G3, T9
11	515	205	816	HA-2	G2, G3, T9
12	515	205	816	HA-2	G2, G3, G6, T9
13	515	205	816	HA-2	G2, G3, T9
14	515	205	816	HA-2	G2, G3, G6, T9
15	515	205	816	HA-2	G2, G3, G4, T9
16	515	205	816	HA-2	G1, G2, G6, T9
17	515	205	816	HA-2	G1, G2, T9
18	515	205	816	HA-2	G1, G2, G6, T9
19	515	205	816	HA-2	G1, G2, G6, T9
20	515	205	816	HA-2	G2, T10
21	515	205	816	HA-2	G1, G2, T10
22	515	205	816	HA-2	G2, G6, T10
23	515	205	816	HA-2	G1, G2, T10
24	515	205	816	HA-2	G1, G2, G6, T10
25	515	205	816	HA-2	G1, G2, G6, T10
26	515	205	816	HA-2	G1, G2, T10
27	515	205	816	HA-2	G1, G2, G6, T10
28	515	205	816	HA-2	G1, G2, G6, T10
29	485	170	816	HA-2	G2, G3, T9
30	480	170	816	HA-2	G2, G3, G4, T9
31	480	170	816	HA-2	G2, T10
32	480	170	816	HA-2	G1, G2, T10
33	485	205	816	HA-2	G2, G3, T9
34	485	205	816	HA-2	G2, G3, T9
35	485	205	816	HA-2	G1, G2, T9
36	485	205	816	HA-2	G1, G2, G3, T9
37	500	200	550	HA-2	G2, G3, G16, T9
38	515	205	816	HA-2	G2, G3, T9
39	515	205	816	HA-2	G2, G3, T9
40	515	205	816	HA-2	G2, G3, T9
41	515	205	816	HA-2	G2, G3, G6, T9
42	515	205	816	HA-2	G2, G3, T9
43	515	205	816	HA-2	G2, G3, G6, T9
44	515	205	816	HA-2	G2, G3, G4, T9
45	515	205	816	HA-2	G2, G6, T9

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	117	117	117	117	115	112	111	109	108	107	107	106
2	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
3	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
4	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
5	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
6	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
7	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
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	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
11	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
12	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
13	138	138	138	138	138	138	138	138	138	138	135	132	130	128	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	128	127	126	126	125
16	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
17	138	138	138	138	138	138	138	138	138	138	135	132	130	128	127	126	126	125
18	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
19	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
20	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
21	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
22	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
23	138	138	138	138	138	138	138	138	138	138	135	132	130	129	127	126	126	125
24	117	117	117	117	117	117	117	117	117	117	115	112	111	109	108	107	107	106
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	129	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	115	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3
30	115	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3
31	115	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3
32	115	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3
33	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
34	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
35	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
36	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
37	133	133	133	133	133	133	133	133	133	130	127	124	121	118	116	114	113	111
38	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
39	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
40	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
41	117	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2
42	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
43	117	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2
44	138	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116
45	117	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	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
2	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
3	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
4	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
5	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
6	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
7	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
8	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
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	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
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	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
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	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
15	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
16	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
17	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
18	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
19	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
20	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
21	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
22	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
23	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
24	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
25	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
26	125	125	125	112	90.6	69.6	53.8	41.4	31.8	24.0	18.8	14.6	10.9	7.96
27	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
28	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
29	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
30	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
31	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
32	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
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	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
35	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
36	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
37	110	109	88.7	...	...	...	...	...	...	...	...	...	...	...
38	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
39	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
40	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
41	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
42	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
43	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
44	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
45	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

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	Fittings	SA-403	321	S32100	WP-S	...	8	1
2	18Cr-10Ni-Ti	Wld. fittings	SA-403	321	S32100	WP-W	...	8	1
3	18Cr-10Ni-Ti	Wld. fittings	SA-403	321	S32100	WP-WX	...	8	1
4	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...	$t \leq 130$	8	1
5	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321H	S32109	...	...	8	1
6	18Cr-10Ni-Ti	Plate	SA-240	321H	S32109	...	...	8	1
7	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...	...	8	1
8	18Cr-10Ni-Ti	Smls. pipe	SA-312	TP321H	S32109	...	$t \leq 9.5$	8	1
9	18Cr-10Ni-Ti	Wld. pipe	SA-312	TP321H	S32109	...	$t \leq 9.5$	8	1
10	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...	$t \leq 9.5$	8	1
11	18Cr-10Ni-Ti	Fittings	SA-403	321H	S32109	CR	...	8	1
12	18Cr-10Ni-Ti	Fittings	SA-403	321H	S32109	WP-S	...	8	1
13	18Cr-10Ni-Ti	Wld. fittings	SA-403	321H	S32109	WP-W	...	8	1
14	18Cr-10Ni-Ti	Wld. fittings	SA-403	321H	S32109	WP-WX	...	8	1
15	18Cr-12Ni-2Mo	Castings	SA-351	CF8M	J92900	...	...	8	1
16	18Cr-13Ni-3Mo	Plate	SA-240	317	S31700	...	$t \leq 125$	8	1
17	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...	...	8	1
18	18Cr-13Ni-3Mo	Smls. pipe	SA-312	TP317	S31700	...	$t \leq 125$	8	1
19	18Cr-13Ni-3Mo	Wld. pipe	SA-312	TP317	S31700	...	$t \leq 125$	8	1
20	18Cr-13Ni-3Mo	Fittings	SA-403	317	S31700	WP-S	...	8	1
21	18Cr-13Ni-3Mo	Plate	SA-240	317L	S31703	...	...	8	1
22	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	WP-S	...	8	1
23	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15	S38100	...	$t \leq 125$	8	1
24	18Cr-18Ni-2Si	Plate	SA-240	XM-15	S38100	...	$t \leq 125$	8	1
25	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15	S38100	...	$t \leq 125$	8	1
26	18Cr-18Ni-2Si	Smls. pipe	SA-312	TPXM-15	S38100	...	$t \leq 125$	8	1
27	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15	S38100	...	$t \leq 125$	8	1
28	21Cr-6Ni-9Mn	Forgings	SA-182	FXM-11	S21904	...	...	8	3
29	21Cr-6Ni-9Mn	Smls. pipe	SA-312	TPXM-11	S21904	...	...	8	3
30	21Cr-6Ni-9Mn	Wld. pipe	SA-312	TPXM-11	S21904	...	...	8	3
31	21Cr-6Ni-9Mn	Plate	SA-666	XM-11	S21904	...	...	8	3
32	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11	S21904	...	...	8	3
(25) 33	22Cr-5Ni-3Mo-N	Forgings	SA-182	F51	S31803	...	...	10H	1
(25) 34	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...	...	10H	1
(25) 35	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S31803	...	...	10H	1
(25) 36	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S31803	...	...	10H	1
(25) 37	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S31803	...	...	10H	1
(25) 38	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S31803	...	...	10H	1
39	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S32205	...	...	10H	1
40	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S32205	...	...	10H	1
41	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S32205	...	...	10H	1
42	22Cr-5Ni-3Mo-N	Forgings	SA-182	F60	S32205	...	...	10H	1
43	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S32205	...	O.D. ≤ 200	10H	1
44	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S32205	...	O.D. ≤ 200	10H	1
45	22Cr-13Ni-5Mn	Forgings	SA-182	FXM-19	S20910	...	...	8	3

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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, T9
2	515	205	816	HA-2	G2, G6, T9
3	515	205	816	HA-2	G2, G6, T9
4	515	205	816	HA-2	G1, G2, T9
5	515	205	816	HA-2	G1, G2, T9
6	515	205	816	HA-2	G1, G2, T9
7	515	205	816	HA-2	G2, G6, T9
8	515	205	816	HA-2	G2, T9
9	515	205	816	HA-2	G2, G6, T9
10	515	205	816	HA-2	G1, G2, T9
11	515	205	816	HA-2	G1, G2, G6, T9
12	515	205	816	HA-2	G1, G2, T9
13	515	205	816	HA-2	G1, G2, G6, T9
14	515	205	816	HA-2	G1, G2, G6, T9
15	485	205	816	HA-2	G2, G3, G4, G8, T10
16	515	205	816	HA-2	G2, G3, T10
17	515	205	816	HA-2	G2, G3, G6, T10
18	515	205	816	HA-2	G2, G3, T10
19	515	205	816	HA-2	G2, G3, G6, T10
20	515	205	816	HA-2	G2, T10
21	515	205	454	HA-4	G2
22	515	205	454	HA-4	G2
23	515	205	538	HA-2	G2, G3
24	515	205	538	HA-2	G2, G3
25	515	205	538	HA-2	G2, G3, G6
26	515	205	538	HA-2	G2, G3
27	515	205	538	HA-2	G2, G3, G6
28	620	345	316	HA-6	G2
29	620	345	316	HA-6	G2
30	620	345	316	HA-6	G2, G6
31	620	345	316	HA-6	G2
32	620	345	316	HA-6	G2
33	620	450	316	HA-5	G8
34	620	450	316	HA-5	G8
35	620	450	316	HA-5	G8
36	620	450	316	HA-5	G6, G8
37	620	450	316	HA-5	G8
38	620	450	316	HA-5	G6, G8
39	650	450	204	HA-5	G8
40	650	450	204	HA-5	G8
41	650	450	204	HA-5	G6, G8
42	650	480	204	HA-5	G8
43	650	480	204	HA-5	G8
44	650	480	204	HA-5	G6, G8
45	690	380	649	HA-6	G2, T11

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
4	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
5	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
6	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
7	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
8	115	115	115	115	115	115	115	115	112	109	107	104	102	100	98.8	97.5	96.3	95.3
9	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
10	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
11	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
12	138	138	138	138	138	138	138	138	135	131	128	125	123	120	119	117	116	114
13	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
14	117	117	117	117	117	117	117	117	115	111	109	106	104	102	101	99.4	98.2	97.2
15	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
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	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
20	138	138	138	138	138	138	134	129	125	122	119	116	114	112	111	110	109	108
21	138	138	138	138	138	136	131	127	123	120	118	115	113	111	109	107	105	103
22	138	138	138	138	138	136	131	127	123	120	118	115	113	111	109	107	105	103
23	138	138	138	138	138	134	129	125	122	119	116	113	111	109	107	105	103	101
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	230	230	230	218	204	193	184	176	170	165	161	159	...	...	...	...	...	...
29	230	230	230	218	204	193	184	176	170	165	161	159	...	...	...	...	...	...
30	195	195	195	185	174	164	156	150	145	140	137	135	...	...	...	...	...	...
31	230	230	230	218	204	193	184	176	170	165	161	159	...	...	...	...	...	...
32	230	230	230	218	204	193	184	176	170	165	161	159	...	...	...	...	...	...
33	259	259	259	254	247	241	236	232	230	226	222	218	...	...	...	...	...	...
34	259	259	259	254	247	241	236	232	230	226	222	218	...	...	...	...	...	...
35	259	259	259	254	247	241	236	232	230	226	222	218	...	...	...	...	...	...
36	220	220	220	216	210	205	201	198	196	192	189	185	...	...	...	...	...	...
37	259	259	259	254	247	241	236	232	230	226	222	218	...	...	...	...	...	...
38	220	220	220	216	210	205	201	198	196	192	189	185	...	...	...	...	...	...
39	273	273	263	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
40	273	273	263	254	247	241	236	232	...	...	...	...	...	...	...	...	...	...
41	232	232	224	216	210	205	201	198	...	...	...	...	...	...	...	...	...	...
42	273	273	273	273	266	259	255	251	...	...	...	...	...	...	...	...	...	...
43	273	273	273	273	266	259	255	251	...	...	...	...	...	...	...	...	...	...
44	232	232	232	232	226	220	216	213	...	...	...	...	...	...	...	...	...	...
45	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	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
2	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
3	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
4	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
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	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
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	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
9	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
10	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
11	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
12	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
13	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
14	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
15	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
16	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
17	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
18	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
19	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
20	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
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...
24	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...
25	84.3	82.7	81.2	...	...	...	...	...	...	...	...	...	...	...
26	99.1	97.3	95.5	...	...	...	...	...	...	...	...	...	...	...
27	84.3	82.7	81.2	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	213	210	207	203	126	84.2	56.2	...	...	...	...	...	...	...

(25)

(25)

(25)

(25)

(25)

(25)

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	Plate	SA-240	XM-19	S20910	...	...	8	3
2	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...	...	8	3
3	22Cr-13Ni-5Mn	Smls. pipe	SA-312	TPXM-19	S20910	...	...	8	3
4	22Cr-13Ni-5Mn	Wld. pipe	SA-312	TPXM-19	S20910	...	...	8	3
5	22Cr-13Ni-5Mn	Fittings	SA-403	XM-19	S20910	CR	...	8	3
6	22Cr-13Ni-5Mn	Wld. fittings	SA-403	XM-19	S20910	WP-W	...	8	3
7	22Cr-13Ni-5Mn	Wld. fittings	SA-403	XM-19	S20910	WP-WX	...	8	3
8	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	...	...	8	3
9	22Cr-13Ni-5Mn	Forgings	SA-965	FXM-19	S20910	...	...	8	3
10	23Cr-4Ni-Mo-Cu-N	Plate	SA-240	...	S32304	...	...	10H	1
11	23Cr-12Ni	Fittings	SA-403	309	S30900	...	...	8	2
12	23Cr-12Ni	Fittings	SA-403	309	S30900	WP-S	...	8	2
13	23Cr-12Ni	Wld. fittings	SA-403	309	S30900	WP-W	...	8	2
14	23Cr-12Ni	Wld. fittings	SA-403	309	S30900	WP-WX	...	8	2
15	23Cr-12Ni	Smls. tube	SA-213	TP309S	S30908	...	...	8	2
16	23Cr-12Ni	Plate	SA-240	309S	S30908	...	...	8	2
17	23Cr-12Ni	Wld. tube	SA-249	TP309S	S30908	...	...	8	2
18	23Cr-12Ni	Smls. pipe	SA-312	TP309S	S30908	...	...	8	2
19	23Cr-12Ni	Wld. pipe	SA-312	TP309S	S30908	...	...	8	2
20	23Cr-12Ni	Wld. pipe	SA-813	TP309S	S30908	...	...	8	2
21	23Cr-12Ni	Wld. pipe	SA-814	TP309S	S30908	...	...	8	2
22	23Cr-12Ni	Smls. tube	SA-213	TP309H	S30909	...	...	8	2
23	23Cr-12Ni	Plate	SA-240	309H	S30909	...	...	8	2
24	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...	...	8	2
25	23Cr-12Ni	Smls. pipe	SA-312	TP309H	S30909	...	...	8	2
26	23Cr-12Ni	Wld. pipe	SA-312	TP309H	S30909	...	...	8	2
27	23Cr-12Ni	Bar	SA-479	309H	S30909	...	...	8	2
28	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb	S30940	...	...	8	2
29	23Cr-12Ni-Cb	Plate	SA-240	309Cb	S30940	...	...	8	2
30	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb	S30940	...	...	8	2
31	23Cr-12Ni-Cb	Smls. pipe	SA-312	TP309Cb	S30940	...	...	8	2
32	23Cr-12Ni-Cb	Wld. pipe	SA-312	TP309Cb	S30940	...	...	8	2
33	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb	S30940	...	...	8	2
34	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb	S30940	...	...	8	2
35	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-182	F58	S31266	...	...	45	...
36	24Cr-22Ni-6Mo-2W-Cu-N	Smls. tube	SA-213	...	S31266	...	...	45	...
37	24Cr-22Ni-6Mo-2W-Cu-N	Plate	SA-240	...	S31266	...	...	45	...
38	24Cr-22Ni-6Mo-2W-Cu-N	Wld. tube	SA-249	...	S31266	...	...	45	...
39	24Cr-22Ni-6Mo-2W-Cu-N	Smls. pipe	SA-312	...	S31266	...	...	45	...
40	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-312	...	S31266	...	...	45	...
41	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-358	...	S31266	...	...	45	...
42	24Cr-22Ni-6Mo-2W-Cu-N	Smls. fittings	SA-403	...	S31266	...	...	45	...
43	24Cr-22Ni-6Mo-2W-Cu-N	Wld. fittings	SA-403	...	S31266	...	...	45	...
44	24Cr-22Ni-6Mo-2W-Cu-N	Bar, shapes	SA-479	...	S31266	...	...	45	...
45	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-813	...	S31266	...	...	45	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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, T11
2	690	380	649	HA-6	G2, G6, T11
3	690	380	649	HA-6	G2, T11
4	690	380	649	HA-6	G2, G6, T11
5	690	380	649	HA-6	G2, G6, T11
6	690	380	649	HA-6	G2, G6, T11
7	690	380	649	HA-6	G2, G6, T11
8	690	380	649	HA-6	G2, T11
9	690	380	649	HA-6	G2, T11
10	600	400	316	HA-6	G2, G8
11	515	205	816	HA-2	G2, G6, T8
12	515	205	816	HA-2	G2, T8
13	515	205	816	HA-2	G2, G6, T8
14	515	205	816	HA-2	G2, G6, T8
15	515	205	816	HA-2	G2, G3, T8
16	515	205	816	HA-2	G2, G3, T8
17	515	205	816	HA-2	G2, G6, T8
18	515	205	816	HA-2	G2, G3, T8
19	515	205	816	HA-2	G2, G3, G6, T8
20	515	205	816	HA-2	G2, G3, G6, T8
21	515	205	816	HA-2	G2, G3, G6, T8
22	515	205	816	HA-2	G2, T8
23	515	205	816	HA-2	G2, G4, T8
24	515	205	816	HA-2	G2, G6, T8
25	515	205	816	HA-2	G2, T8
26	515	205	816	HA-2	G2, G6, T8
27	515	205	816	HA-2	G2, T8
28	515	205	816	HA-2	G2, G3, T8
29	515	205	816	HA-2	G2, G3, T8
30	515	205	816	HA-2	G2, G3, G6, T8
31	515	205	816	HA-2	G2, G3, T8
32	515	205	816	HA-2	G2, G3, G6, T8
33	515	205	816	HA-2	G2, G3, G6, T8
34	515	205	816	HA-2	G2, G3, G6, T8
35	750	420	427	HA-10	G2, G8
36	752	421	426	HA-10	G2, G8
37	750	420	427	HA-10	G2, G8
38	752	421	426	HA-10	G2, G6, G8
39	752	421	426	HA-10	G2, G8
40	752	421	426	HA-10	G2, G6, G8
41	750	420	427	HA-10	G2, G6, G8
42	752	421	426	HA-10	G2, G8
43	752	421	426	HA-10	G2, G6, G8
44	752	421	426	HA-10	G2, G8
45	752	421	426	HA-10	G2, G6, G8

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
2	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
3	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
4	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
5	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
6	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
7	215	215	215	215	215	215	215	211	207	203	199	196	193	191	189	187	185	183
8	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
9	253	253	253	253	253	253	253	248	243	239	234	231	227	225	222	219	217	215
10	250	242	227	219	213	208	205	202	200	198	195	192	...	...	...	...	...	...
11	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
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	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
15	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
16	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
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	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
20	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
21	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
22	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
23	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
24	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
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	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
29	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
30	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
31	138	138	138	138	138	138	138	138	135	133	131	129	127	125	124	122	121	119
32	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
33	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
34	117	117	117	117	117	117	117	117	115	113	111	109	108	106	105	104	103	101
35	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
36	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
37	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
38	238	238	238	238	238	238	238	238	238	238	238	238	238	237	236	235	234	...
39	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
40	238	238	238	238	238	238	238	238	238	238	238	238	238	237	236	235	234	...
41	238	238	238	238	238	238	238	238	238	238	238	238	238	237	236	235	234	...
42	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
43	238	238	238	238	238	238	238	238	238	238	238	238	238	237	236	235	234	...
44	280	280	280	280	280	280	280	280	280	280	280	280	280	279	278	277	275	...
45	238	238	238	238	238	238	238	238	238	238	238	238	238	237	236	235	234	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	213	210	207	203	126	84.2	56.2	...	...	...	...	...	...	...
2	181	179	176	172	107	71.5	47.8	...	...	...	...	...	...	...
3	213	210	207	203	126	84.2	56.2	...	...	...	...	...	...	...
4	181	179	176	172	107	71.5	47.8	...	...	...	...	...	...	...
5	181	179	176	172	107	71.5	47.8	...	...	...	...	...	...	...
6	181	179	176	172	107	71.5	47.8	...	...	...	...	...	...	...
7	181	179	176	172	107	71.5	47.8	...	...	...	...	...	...	...
8	213	210	207	203	126	84.2	56.2	...	...	...	...	...	...	...
9	213	210	207	203	126	84.2	56.2	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	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
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	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
15	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
16	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
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	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
19	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
20	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
21	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
22	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
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	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
25	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
26	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
27	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
28	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
29	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
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	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
32	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
33	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
34	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
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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-5Ni-3Mo-2Cu	Plate	SA-240	255	S32550	...	...	10H	1
2	25Cr-6Ni-Mo-N	Plate	SA-240	...	S31200	...	...	10H	1
3	25Cr-12Ni	Castings	SA-351	CH8	J93400	...	...	8	2
4	25Cr-12Ni	Castings	SA-351	CH20	J93402	...	...	8	2
5	25Cr-20Ni	Castings	SA-351	CK20	J94202	...	...	8	2
6	25Cr-20Ni	Forgings	SA-182	F310	S31000	...	$t \leq 130$	8	2
7	25Cr-20Ni	Forgings	SA-965	F310	S31000	...	...	8	2
8	25Cr-20Ni	Smls. tube	SA-213	TP310S	S31008	...	...	8	2
9	25Cr-20Ni	Plate	SA-240	310S	S31008	...	...	8	2
10	25Cr-20Ni	Wld. tube	SA-249	TP310S	S31008	...	...	8	2
11	25Cr-20Ni	Smls. pipe	SA-312	TP310S	S31008	...	...	8	2
12	25Cr-20Ni	Wld. pipe	SA-312	TP310S	S31008	...	...	8	2
13	25Cr-20Ni	Fittings	SA-403	310S	S31008	CR	...	8	2
14	25Cr-20Ni	Fittings	SA-403	310S	S31008	WP-S	...	8	2
15	25Cr-20Ni	Wld. fittings	SA-403	310S	S31008	WP-W	...	8	2
16	25Cr-20Ni	Wld. fittings	SA-403	310S	S31008	WP-WX	...	8	2
17	25Cr-20Ni	Wld. pipe	SA-813	TP310S	S31008	...	...	8	2
18	25Cr-20Ni	Wld. pipe	SA-814	TP310S	S31008	...	...	8	2
19	25Cr-20Ni	Smls. tube	SA-213	TP310H	S31009	...	...	8	2
20	25Cr-20Ni	Plate	SA-240	310H	S31009	...	...	8	2
21	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...	...	8	2
22	25Cr-20Ni	Smls. pipe	SA-312	TP310H	S31009	...	...	8	2
23	25Cr-20Ni	Wld. pipe	SA-312	TP310H	S31009	...	...	8	2
24	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb	S31040	...	...	8	2
25	25Cr-20Ni-Cb	Wld. pipe	SA-312	TP310Cb	S31040	...	...	8	2
26	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb	S31040	...	...	8	2
27	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb	S31040	...	...	8	2
28	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLN	S31050	...	...	8	2
29	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
30	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
31	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	$6 < t \leq 32$	8	2
32	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...	...	8	2
33	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...	$t \leq 6$	8	2
34	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...	$t \leq 6$	8	2
35	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...	$t \leq 6$	8	2
36	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	$t \geq 10$	10H	1
37	29Cr-6.5Ni-2Mo-N	Bar	SA-479	...	S32906	...	...	10H	1
38	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	$t \geq 10$	10H	1
39	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	$t \geq 10$	10H	1
40	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...	$t < 10$	10H	1
41	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...	$t < 10$	10H	1
42	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...	$t < 10$	10H	1

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	Maximum Use Temperature, °C	External Pressure Chart No.	Notes
1	760	550	260	HA-5	G8
2	690	450	343	HA-5	G2, G8
3	450	195	816	HA-3	G2, G3, G4, G8, T9
4	485	205	816	HA-2	G2, T9
5	485	205	816	HA-3	G2, T9
6	515	205	816	HA-2	G2, G3, G5, G7, T8
7	515	205	816	HA-2	G2, G3, G5, G7, T8
8	515	205	816	HA-2	G2, G3, G5, G7, T8
9	515	205	816	HA-2	G2, G3, G5, G7, T8
10	515	205	816	HA-2	G2, G3, G5, G6, G7, T6
11	515	205	816	HA-2	G2, G3, G5, G7, T8
12	515	205	40	HA-2	G2, G3, G5, G6, G7
13	515	205	816	HA-2	G2, G6, T6
14	515	205	816	HA-2	G2, T8
15	515	205	816	HA-2	G2, G6, T6
16	515	205	816	HA-2	G2, G6, T6
17	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
18	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
19	515	205	816	HA-2	G2, T8
20	515	205	816	HA-2	G2, T8
21	515	205	816	HA-2	G2, G6, T8
22	515	205	816	HA-2	G2, T8
23	515	205	816	HA-2	G2, G6, T8
24	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
25	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
26	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
27	515	205	816	HA-2	G2, G3, G5, G6, G7, T8
28	540	255	482	HA-2	...
29	540	255	482	HA-2	...
30	540	255	482	HA-2	G6
31	540	255	482	HA-2	G6
32	550	240	316	HA-2	...
33	580	270	482	HA-2	...
34	580	270	482	HA-2	G6
35	580	270	482	HA-2	G6
36	750	550	316	HA-5	G8
37	750	550	316	HA-5	G8
38	750	550	316	HA-5	G8
39	750	550	316	HA-5	G8
40	800	650	316	HA-5	G8
41	800	650	316	HA-5	G8
42	800	650	316	HA-5	G8

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	316	316	316	306	295	286	279	274	271	269	...	...	...	...	...	...	...	...
2	287	287	287	287	287	287	287	287	284	279	274	268	260	...	...	...	...	...
3	129	129	129	129	129	128	126	124	123	121	119	117	115	112	109	106	103	100
4	138	138	138	138	138	137	135	133	131	129	128	125	123	120	117	114	111	107
5	129	129	129	129	129	128	126	124	123	121	119	117	115	112	109	106	103	100
6	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
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	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
10	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	72.1
11	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
12	117	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	72.1
14	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
15	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	72.1
16	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6	98.2	72.1
17	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
18	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
19	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
20	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
21	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
22	138	138	138	138	138	138	138	137	134	131	129	127	125	123	122	120	119	117
23	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
24	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
25	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
26	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
27	117	117	117	117	117	117	117	117	114	112	110	108	106	105	104	102	101	99.6
28	170	170	170	170	170	170	166	162	158	154	150	147	144	140	137	134	131	128
29	170	170	170	170	170	170	166	162	158	154	150	147	144	140	137	134	131	128
30	145	145	145	145	145	145	141	138	134	131	128	125	122	119	117	114	111	109
31	145	145	145	145	145	145	141	138	134	131	128	125	122	119	117	114	111	109
32	161	161	161	161	161	161	157	153	149	146	142	139	...	...	...	...	...	...
33	179	179	179	179	179	179	175	171	166	162	159	155	151	148	145	141	138	135
34	152	152	152	152	152	152	149	145	141	138	135	132	129	126	123	120	117	115
35	152	152	152	152	152	152	149	145	141	138	135	132	129	126	123	120	117	115
36	313	313	313	297	287	280	276	272	265	257	253	253	...	...	...	...	...	...
37	313	313	312	297	287	280	276	272	265	257	253	253	...	...	...	...	...	...
38	313	313	312	297	287	280	276	272	265	257	253	253	...	...	...	...	...	...
39	313	313	312	297	287	280	276	272	265	257	253	253	...	...	...	...	...	...
40	333	333	333	333	333	329	325	319	311	302	297	297	...	...	...	...	...	...
41	333	333	333	333	333	329	325	319	311	302	297	297	...	...	...	...	...	...
42	333	333	333	333	333	329	325	319	311	302	297	297	...	...	...	...	...	...

Table 5A (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Ferrous Materials

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
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	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
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	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
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	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
14	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
15	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
16	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
17	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
18	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
19	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
20	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
21	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
22	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
23	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
24	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
25	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
26	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
27	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
28	126	...	...	...	...	...	...	...	...	...	...	...	...	...
29	126	...	...	...	...	...	...	...	...	...	...	...	...	...
30	107	...	...	...	...	...	...	...	...	...	...	...	...	...
31	107	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	133	...	...	...	...	...	...	...	...	...	...	...	...	...
34	113	...	...	...	...	...	...	...	...	...	...	...	...	...
35	113	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 5A**GENERAL NOTES**

- (25) (a) The following abbreviations are used: N, Normalized; NT, Normalized and tempered; QT, Quenched and tempered; 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.
- (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 66²/₃% 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, 6.7.6.3(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, 3.4.
- 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.
- G15 This material may be susceptible to temper embrittlement. See Nonmandatory Appendix A, A-203.
- G16 These stresses apply to all product forms (C, H, and P) as defined in SA/EN 10028-7.
- G17 The allowable stress value at 65°C shall be used at 66°C.
- (25) G18 Use of external pressure charts for material in the form of bar stock is permitted for stiffening rings only.
- (25) G19 Maximum allowable stress values for 40°C may be used at temperatures down to -200°C without additional specification requirements.
- (25) G20 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 Annealed.
- H2 Normalized, normalized and tempered, or quenched and tempered.
- H3 For applications involving consideration of heat treatment after forming or welding, see Section VIII, Division 2, Table 6.15 for P-No. 10K, Group No. 1 materials.
- H4 Liquid quenched and tempered.

NOTES - SIZE REQUIREMENTS

- S1 The maximum thickness of forgings shall not exceed 95 mm (100 mm as heat treated).

NOTES TO TABLE 5A (CONT'D)**NOTES – SIZE REQUIREMENTS (CONT'D)**

- 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.
- S4 Either DN 200 and larger and less than schedule 140 wall, or less than DN 200 and all wall thicknesses.

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 6.
- 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 6.
- 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, Class 2
Maximum Allowable Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./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

Table 5B
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S , 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	$0.254 \leq t \leq 13$	21	90	30	204	NFA-7	G4, T3
2	$1.27 \leq t \leq 13$	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	$0.15 \leq t \leq 80.00$	21	95	35	204	NFA-1	G4, T4
6	$6.30 \leq t < 12.50$	21	115	70	204	NFA-1	G4, T2, W2
7	$12.50 \leq t \leq 40.00$	21	105	40	204	NFA-1	G4, T2, W2
8	$40.00 < t \leq 80.00$	21	100	40	204	NFA-1	G4, T2, W2
9	$0.254 \leq t \leq 13$	21	95	35	204	NFA-1	G4, T2
10	$0.254 \leq t \leq 13$	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	$t \geq 25$	21	95	35	204	NFA-1	G4, T2
15	...	21	95	35	204	NFA-1	G4, T2, W2
16	$0.152 \leq t \leq 75$	22	150	60	204	NFA-3	G4, T2
17	$6 \leq t \leq 75$	22	160	60	204	NFA-3	G4, T2, W2
18	$1.295 \leq t \leq 75$	22	170	65	204	NFA-8	G4, T2
19	$6 \leq t < 13$	22	195	110	204	NFA-8	G4, T2, W2
20	$13 \leq t \leq 75$	22	170	65	204	NFA-8	G4, T2, W2
21	$1.295 \leq t \leq 38$	25	275	125	66	NFA-11	G4, G6, G14
22	$38 < t \leq 76$	25	270	115	66	NFA-11	G4, G6, G14
23	$76 < t \leq 125$	25	260	110	66	NFA-11	G4, G6, G14
24	$125 \leq t \leq 178$	25	255	105	66	NFA-11	G4, G6, G14
25	$178 < t \leq 204$	25	250	95	66	NFA-11	G4, G6, G14
26	$6 \leq t \leq 38$	25	275	125	66	NFA-11	G4, G6, G14, W2
27	$38 < t \leq 76$	25	270	115	66	NFA-11	G4, G6, G14, W2
28	$t \leq 125$	25	275	165	66	NFA-11	G2, G4, G6, G14, W2
29	...	25	275	165	66	NFA-11	G4, G6, G14, W2
30	$1.295 \leq t \leq 50$	25	240	95	66	NFA-9	G4, G6, G14
31	$1.6002 \leq t < 13$	25	250	125	66	NFA-9	G4, G6, G14, W2
32	$13 \leq t < 25$	25	240	110	66	NFA-9	G4, G6, G14, W2
33	$25 < t \leq 50$	25	240	95	66	NFA-9	G4, G6, G14, W2
34	$50 < t \leq 76$	25	235	95	66	NFA-9	G4, G6, G14, W2
35	$1.295 \leq t \leq 75$	22	215	85	204	NFA-6	G4, T1
36	$6 \leq t \leq 13$	22	220	125	204	NFA-6	G4, T2, W2
37	$13 \leq t \leq 75$	22	215	85	204	NFA-6	G4, T1, W2
38	$t \leq 125$	22	215	85	204	NFA-6	G2, G4, T1
39	$t \leq 125$	22	215	85	204	NFA-6	G2, G4, T1, W2
40	$t \leq 125$	22	215	85	204	NFA-6	G4, T1
41	$t \leq 125$	22	215	85	204	NFA-6	G4, T1, W2
42	$1.295 \leq t \leq 6$	23	205	110	204	NFA-13	G4, G8, T4, W3
43	$6 \leq t \leq 75$	23	205	110	204	NFA-13	G4, G8, T4, W3
44	$1.295 \leq t \leq 6$	23	290	240	204	NFA-12	G4, G8, T2, W3
45	$6 \leq t \leq 100$	23	290	240	204	NFA-12,13	G4, G8, T2, W3, W4

Table 5B
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S , for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	23.0	22.3	21.3	20.3	19.2	17.9	16.7	8.88	...	...	...	...	...	...	...	...	...	...
6	46.0	44.4	42.7	40.7	18.2	13.6	10.9	8.88	...	...	...	...	...	...	...	...	...	...
7	27.6	26.6	25.6	24.4	18.2	13.6	10.9	8.88	...	...	...	...	...	...	...	...	...	...
8	27.6	26.5	25.7	24.6	18.2	13.6	10.9	8.88	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...

Table 5B
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S , for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/Temper
1	...	Plate, sheet	SB-209	...	A96061	T651
2	...	Plate, sheet	SB-209	...	A96061	T6 wld.
3	...	Drawn smls. tube	SB-210	...	A96061	T4
4	...	Drawn smls. tube	SB-210	...	A96061	T6
5	...	Drawn smls. tube	SB-210	...	A96061	T6 wld.
6	...	Bar, rod, shapes	SB-221	...	A96061	T4
7	...	Bar, rod, shapes	SB-221	...	A96061	T6
8	...	Bar, rod, shapes	SB-221	...	A96061	T6 wld.
9	...	Smls. extr. tube/pipe	SB-241	...	A96061	T4
10	...	Smls. extr. tube/pipe	SB-241	...	A96061	T6
11	...	Smls. drawn pipe	SB-241	...	A96061	T6
12	...	Smls. drawn pipe	SB-241	...	A96061	T6
13	...	Smls. extr. tube/pipe	SB-241	...	A96061	T6 wld.
14	...	Smls. drawn pipe	SB-241	...	A96061	T6 wld.
15	...	Shapes	SB-308	...	A96061	T6
16	...	Shapes	SB-308	...	A96061	T6 wld.
(25) 17	...	Die forgings	SB-247	...	A96061	T6
(25) 18	...	Hand forgings	SB-247	...	A96061	T6
(25) 19	...	Hand forgings	SB-247	...	A96061	T6
(25) 20	...	Die & hand forgings	SB-247	...	A96061	T6 wld.
21	...	Drawn smls. tube	SB-210	...	A96063	T6
22	...	Bar, rod, shapes	SB-221	...	A96063	T5
23	...	Bar, rod, shapes	SB-221	...	A96063	T5
24	...	Bar, rod, shapes	SB-221	...	A96063	T6
25	...	Smls. extr. tube	SB-241	...	A96063	T5
26	...	Smls. extr. tube	SB-241	...	A96063	T5
27	...	Smls. extr. tube	SB-241	...	A96063	T6
28	...	Bar, rod	SB-187	...	C10200	O60
29	...	Bar, rod	SB-187	...	C11000	O60
30	...	Smls. tube	SB-111	...	C28000	O61
31	...	Smls. tube	SB-111	...	C44300	O61
32	...	Smls. tube	SB-111	...	C44400	O61
33	...	Smls. tube	SB-111	...	C44500	O61
(25) 34	...	Plate	SB-171	...	C46400	M10, M20, O20, O25
(25) 35	...	Plate, sheet	SB-171	...	C46400	M10, M20, O20, O25
(25) 36	...	Smls. tube	SB-111	...	C60800	O61
(25) 37	...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25) 38	...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25) 39	...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25) 40	...	Bar, rod	SB-98	...	C65100	O60
41	...	Bar, rod	SB-98	...	C65100	H02
(25) 42	...	Plate, sheet, strip, bar	SB-96	...	C65500	O61
(25) 43	...	Bar, rod	SB-98	...	C65500	O60
44	...	Bar, rod	SB-98	...	C65500	H02
(25) 45	...	Bar, rod	SB-98	...	C66100	O60

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	$100 < t \leq 150$	23	275	240	204	NFA-12,13	G4, G8, T2, W3, W4
2	...	23	165	...	204	NFA-12	G4, G8, T4
3	$0.635 \leq t \leq 13$	23	205	110	204	NFA-13	G4, T4, W3
4	$0.635 \leq t \leq 13$	23	290	240	204	NFA-12,13	G4, T2, W3, W4
5	...	23	165	...	204	NFA-12,13	G4, T2
6	...	23	180	110	204	NFA-13	G2, G4, G8, T4, W3
7	...	23	260	240	204	NFA-12,13	G2, G4, G8, T3, W3, W4
8	...	23	165	...	204	NFA-12,13	G2, G4, G8, T4, W4
9	...	23	180	110	204	NFA-13	G4, G8, T4, W3
10	...	23	260	240	204	NFA-12,13	G4, G8, T3, W3, W4
11	DN < 25	23	290	240	204	NFA-12,13	G4, T2, W3, W4
12	DN ≥ 25	23	260	240	204	NFA-12,13	G4, T3, W3, W4
13	...	23	165	...	204	NFA-12,13	G4, T4, W4
14	...	23	165	...	204	NFA-12,13	G4, T4, W4
15	...	23	260	240	204	NFA-12,13	G2, G4, T3, W3, W4
16	...	23	165	...	204	NFA-12,13	G2, G4, T4, W4
17	≤101.60	23	260	240	149	NFA-12,13	G4, W4
18	≤101.60	23	255	230	149	NFA-12,13	G4, W4
19	101.61–203.20	23	240	220	149	NFA-12,13	G4, W4
20	≤203.20	23	165	...	149	NFA-12,13	G4, W4
21	$0.635 \leq t \leq 13$	23	225	195	204	NFA-1	G4, T1, W3
22	$t \leq 13$	23	150	110	204	NFA-1	G2, G4, T1, W3
23	$13 < t \leq 25$	23	145	105	204	NFA-1	G2, G4, T1, W3
24	$t \leq 25$	23	205	170	204	NFA-1	G2, G4, T1, W3
25	$t \leq 13$	23	150	110	204	NFA-1	G4, T1, W3
26	$13 < t \leq 25$	23	145	105	204	NFA-1	G4, T1, W3
27	$t \leq 25$	23	205	170	204	NFA-1	G4, T1, W3
28	All	31	195	55	204	NFC-1	G1, G3, T3
29	All	31	195	55	204	NFC-1	G1, G3, T3
30	...	32	345	140	204	NFC-3	G3, G5, T4
31	...	32	310	105	204	NFC-2	G3, G5, T4
32	...	32	310	105	204	NFC-2	G3, G5, T4
33	...	32	310	105	204	NFC-2	G3, G5, T4
34	$80 < t \leq 140$	32	345	125	204	NFC-2	G3, T3
35	$t \leq 80$	32	345	140	204	NFC-2	G3, T3
36	...	35	345	130	260	NFC-2	G1, G3, G5, T3
37	$50 < t \leq 150$	35	450	195	260	NFC-8	G3
38	$12 < t \leq 50$	35	485	205	260	NFC-8	G3
39	$t \leq 12$	35	495	220	260	NFC-8	G3
40	All	33	275	85	177	NFC-1	G1, G3, G9, T4
41	≤50	33	380	140	177	NFC-2	G3, G9, W2
42	≤50	33	345	125	177	NFC-2	G1, G3, G9, T3
43	All	33	360	105	177	NFC-2	G1, G3, G9, T4
44	≤50	33	485	260	177	NFC-2	G1, G3, G9, W2
45	All	33	360	105	177	NFC-2	G1, G3, G9, T4

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S , for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	115	115	115	115	113	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
2	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
3	73.5	72.1	71.1	70.0	70.0	70.0	40.2	21.1	...	...	...	...	...	...	...	...	...	...
4	121	121	121	121	113	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
5	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
6	73.5	72.9	70.8	70.8	70.8	70.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
7	109	109	109	109	109	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
8	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
9	73.5	72.9	70.8	70.8	70.8	70.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
10	109	109	109	109	109	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
11	121	121	121	121	113	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
12	109	109	109	109	109	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
13	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
14	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
15	109	109	109	109	109	75.6	40.2	21.1	...	...	...	...	...	...	...	...	...	...
16	68.8	68.8	68.8	68.8	68.8	68.8	40.2	21.1	...	...	...	...	...	...	...	...	...	...
17	109	109	109	109	109	...	...	...	...	...	...	...	...	...	...	...	...	...
18	106	106	106	106	106	...	...	...	...	...	...	...	...	...	...	...	...	...
19	101	101	101	101	101	...	...	...	...	...	...	...	...	...	...	...	...	...
20	68.8	68.8	68.8	68.8	68.8	...	...	...	...	...	...	...	...	...	...	...	...	...
21	94.8	94.8	94.8	64.0	49.2	27.5	15.3	8.53	...	...	...	...	...	...	...	...	...	...
22	63.2	63.2	63.2	59.4	31.6	24.0	15.3	8.53	...	...	...	...	...	...	...	...	...	...
23	60.3	60.3	60.3	59.4	31.6	24.0	15.3	8.53	...	...	...	...	...	...	...	...	...	...
24	86.2	86.2	86.2	64.0	49.2	27.5	15.3	8.53	...	...	...	...	...	...	...	...	...	...
25	63.2	63.2	63.2	59.4	31.6	24.0	15.3	8.53	...	...	...	...	...	...	...	...	...	...
26	60.3	60.3	60.3	59.4	31.6	24.0	15.3	8.53	...	...	...	...	...	...	...	...	...	...
27	86.2	86.2	86.2	64.0	49.2	27.5	15.3	8.53	...	...	...	...	...	...	...	...	...	...
28	36.8	36.8	36.8	36.8	36.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
29	36.8	36.8	36.8	36.8	36.8	31.1	21.9	14.8	...	...	...	...	...	...	...	...	...	...
30	91.9	91.9	91.9	91.9	91.9	91.9	41.0	19.1	...	...	...	...	...	...	...	...	...	...
31	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	...	...	...	...	...	...	...	...	...	...
32	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	...	...	...	...	...	...	...	...	...	...
33	68.9	68.9	68.9	68.9	68.9	68.9	41.5	18.3	...	...	...	...	...	...	...	...	...	...
34	82.7	82.7	82.7	82.7	82.7	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
35	91.9	91.9	91.9	91.9	91.9	46.1	21.6	8.70	...	...	...	...	...	...	...	...	...	...
36	87.3	87.3	87.3	87.3	87.3	70.4	44.9	30.6	17.7	9.48	...	...	...	...	...	...	...	...
37	129	128	127	127	126	125	124	123	122	121	...	...	...	...	...	...	...	...
38	138	137	136	136	135	134	133	131	130	129	...	...	...	...	...	...	...	...
39	147	147	145	144	144	143	142	140	139	137	...	...	...	...	...	...	...	...
40	55.2	55.2	55.2	55.2	55.2	55.2	50.8	...	...	...	...	...	...	...	...	...	...	...
41	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...	...	...	...	...	...	...	...
42	82.7	82.7	82.7	82.7	82.7	75.4	50.8	...	...	...	...	...	...	...	...	...	...	...
43	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	...	...
44	175	175	175	175	175	175	175	...	...	...	...	...	...	...	...	...	...	...
45	68.9	68.9	68.9	68.9	68.9	68.9	50.8	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Design./UNS No.	Class/Condition/Temper
1	...	Bar, rod	SB-98	...	C66100	H02
2	...	Plate	SB-171	...	C70600	M10, M20, O20, O25
3	...	Condenser tubes	SB-111	...	C70600	O61
4	...	Smls. U-bend tube	SB-395	...	C70600	O61
5	...	Plate	SB-171	...	C70620	M10, M20, O20, O25
6	...	Condenser tubes	SB-111	...	C70620	O61
7	...	Smls. U-bend tube	SB-395	...	C70620	O61
8	...	Plate	SB-171	...	C71500	M10, M20, O20, O25
9	...	Plate	SB-171	...	C71500	M10, M20, O20, O25
10	...	Condenser tubes	SB-111	...	C71500	O61
11	...	Smls. U-bend tube	SB-395	...	C71500	O61
12	...	Plate	SB-171	...	C71520	M10, M20, O20, O25
13	...	Plate	SB-171	...	C71520	M10, M20, O20, O25
14	...	Condenser tubes	SB-111	...	C71520	O61
15	...	Smls. U-bend tube	SB-395	...	C71520	O61
16	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed
17	99Ni	Bar, rod	SB-160	...	N02200	Annealed
18	99Ni	Smls. pipe & tube	SB-161	...	N02200	Annealed
19	99Ni	Plate, sheet, strip	SB-162	...	N02200	Annealed
20	99Ni	Smls. tube	SB-163	...	N02200	Annealed
21	99Ni	Plate, sheet, strip	SB-162	...	N02200	As rolled
22	99Ni-Low C	Bar, rod	SB-160	...	N02201	Annealed
23	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
24	99Ni-Low C	Bar, rod	SB-160	...	N02201	Hot fin.
25	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
26	99Ni-Low C	Plate, sheet, strip	SB-162	...	N02201	Annealed
27	99Ni-Low C	Smls. tube	SB-163	...	N02201	Annealed
28	67Ni-30Cu	Bar, rod	SB-164	...	N04400	Annealed
29	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
30	67Ni-30Cu	Forgings	SB-564	...	N04400	Annealed
31	67Ni-30Cu	Plate	SB-127	...	N04400	Annealed
32	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Annealed
33	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
34	67Ni-30Cu	Plate	SB-127	...	N04400	As rolled
35	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Stress rel.
36	67Ni-30Cu-S	Bar, rod	SB-164	...	N04405	Annealed
37	47Ni-22Cr-9Mo-18Fe	Plate	SB-435	...	N06002	Annealed
38	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...	N06002	Annealed
39	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...	N06002	Solution ann.
40	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.
41	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...	N06002	Solution ann.
42	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.
43	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
44	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
45	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	≤50	33	485	260	177	NFC-2	G1, G3, G9, W2
2	$t \leq 140$	34	275	105	316	NFC-3	G1, G3, T15
3	...	34	275	105	316	NFC-3	G1, G3, T15
4	...	34	275	105	316	NFC-3	G1, G3, T15
5	$t \leq 140$	34	275	105	316	NFC-3	G1, G3, T15
6	...	34	275	105	316	NFC-3	G1, G3, T15
7	...	34	275	105	316	NFC-3	G1, G3, T15
8	$60 < t \leq 140$	34	310	125	371	NFC-4	G1, G3
9	$t \leq 60$	34	345	140	371	NFC-4	G1, G3
10	...	34	360	125	371	NFC-4	G1, G3
11	...	34	360	125	371	NFC-4	G1, G3
12	$60 < t \leq 140$	34	310	125	371	NFC-4	G1, G3
13	$t \leq 60$	34	345	140	371	NFC-4	G1, G3
14	...	34	360	125	371	NFC-4	G1, G3
15	...	34	360	125	371	NFC-4	G1, G3
16	O.D. > 125	41	380	80	316	NFN-2	G3
17	...	41	380	105	316	NFN-2	G2, G3
18	O.D. ≤ 125	41	380	105	316	NFN-2	G3
19	...	41	380	100	316	NFN-2	G3
20	...	41	380	100	316	NFN-2	G3
21	...	41	380	135	316	NFN-2	G3
22	...	41	345	70	316	NFN-1	G2, G3
23	O.D. > 125	41	345	70	649	NFN-1	G3, T10
24	...	41	345	70	316	NFN-1	G2, G3
25	O.D. ≤ 125	41	345	80	649	NFN-1	G3, T9
26	...	41	345	80	316	NFN-1	G3
27	...	41	345	80	649	NFN-1	G3, T9
28	...	42	480	170	482	NFN-3	G1, G2, G3, T9
29	O.D. > 125	42	480	170	482	NFN-3	G1, G3, T9
30	...	42	480	170	482	NFN-3	G1, G2, G3, T9
31	...	42	485	195	482	NFN-3	G1, G3, T9
32	...	42	485	195	482	NFN-3	G1, G3, T9
33	O.D. ≤ 125	42	480	195	482	NFN-3	G1, G3, T9
34	...	42	515	275	482	NFN-3	G1, G3, T8
35	...	42	585	380	427	NFN-3	G1, G3, T8, W1
36	...	42	480	170	482	NFN-3	G1, G2, G3, T9
37	$5 < t \leq 64$	43	655	240	482	NFN-15	G1, G3, G13
38	$1.5 < t \leq 5$	43	655	240	482	NFN-15	G1, G3, G13
39	$t > 5$	43	660	240	482	NFN-15	G1, G2, G3, G13
40	...	43	690	275	899	NFN-15	G1, G3, G7, G13, T11
41	...	43	690	275	899	NFN-15	G1, G3, G13, T11
42	...	43	690	275	899	NFN-15	G1, G3, G7, G13, T11
43	$t > 19$	45	585	205	538	NFN-11	G1, G2, G3
44	$t > 19$	45	585	205	538	NFN-11	G1, G3
45	$8 < t \leq 19$	45	620	240	538	NFN-11	G1, G2, G3, T11

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	175	175	175	175	175	175	175	...	...	...	...	...	...	...	...	...	...	...
2	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
3	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
4	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
5	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
6	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
7	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	60.4	51.7	45.2	39.0	...	...	...	...	...	...
8	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
10	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
11	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
12	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
13	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...
14	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
15	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	...	...	...	...
16	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
17	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
18	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
19	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
20	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...	...
21	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	...	...	...	...	...	...
22	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	...	...	...	...	...	...
23	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
24	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	...	...	...	...	...	...
25	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
26	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	...	...	...	...	...	...
27	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
28	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	105	79.7	59.9
29	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	105	79.7	59.9
30	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	105	79.7	59.9
31	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	105	79.7	59.9
32	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	105	79.7	59.9
33	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	105	79.7	59.9
34	184	184	184	184	184	184	184	184	184	184	184	184	184	184	144	102	63.8	33.5
35	244	244	244	244	244	244	244	244	244	244	244	244	244	244	122	89.4	65.3	...
36	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	105	79.7	59.9
37	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
38	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
39	161	161	161	161	161	161	161	161	156	152	148	145	142	140	138	137	136	135
40	156	156	156	156	156	156	156	156	151	147	144	141	138	136	134	133	132	131
41	184	184	184	184	184	184	184	184	178	173	169	165	162	160	158	157	155	154
42	156	156	156	156	156	156	156	156	151	147	144	141	138	136	134	133	132	131
43	138	138	138	138	138	138	138	138	138	138	135	134	132	131	130	129	128	128
44	138	138	138	138	138	138	138	138	138	138	135	134	132	131	130	129	128	128
45	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	151	150	149

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	27.4	22.8	18.7	15.6	12.9	10.0	8.20	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	27.4	22.8	18.7	15.6	12.9	10.0	8.20	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	27.4	22.8	18.7	15.6	12.9	10.0	8.20	...	...	...	...	...	...	...	...	...	...
28	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	17.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	40.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	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
41	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
42	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
43	127	127	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	127	127	126	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	136	132	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
1	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
2	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...	N06007	Solution ann.
3	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...	N06007	Solution ann.
4	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...	N06007	Solution ann.
5	55Ni-21Cr-13.5Mo	Smls. & wld. fittings	SB-366	...	N06022	Solution ann.
6	55Ni-21Cr-13.5Mo	Forgings	SB-462	...	N06022	Solution ann.
7	55Ni-21Cr-13.5Mo	Forgings	SB-564	...	N06022	Solution ann.
8	55Ni-21Cr-13.5Mo	Rod	SB-574	...	N06022	Solution ann.
9	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...	N06022	Solution ann.
10	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...	N06022	Solution ann.
11	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...	N06022	Solution ann.
12	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...	N06022	Solution ann.
13	59Ni-23Cr-16Mo	Wld. fittings	SB-366	...	N06059	Solution ann.
14	59Ni-23Cr-16Mo	Smls. fittings	SB-366	...	N06059	Solution ann.
15	59Ni-23Cr-16Mo	Forged fittings	SB-462	...	N06059	Solution ann.
16	59Ni-23Cr-16Mo	Forgings	SB-564	...	N06059	Solution ann.
17	59Ni-23Cr-16Mo	Bar, rod	SB-574	...	N06059	Solution ann.
18	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...	N06059	Solution ann.
19	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.
20	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...	N06059	Solution ann.
21	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.
22	61Ni-16Mo-16Cr	Rod	SB-574	...	N06455	Solution ann.
23	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...	N06455	Solution ann.
24	61Ni-16Mo-16Cr	Wld. pipe	SB-619	...	N06455	Solution ann.
25	61Ni-16Mo-16Cr	Smls. pipe & tube	SB-622	...	N06455	Solution ann.
26	61Ni-16Mo-16Cr	Wld. tube	SB-626	...	N06455	Solution ann.
27	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold worked/ann.
28	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed
29	72Ni-15Cr-8Fe	Bar, rod	SB-166	...	N06600	Annealed
30	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold worked/ann.
31	72Ni-15Cr-8Fe	Plate	SB-168	...	N06600	Annealed
32	72Ni-15Cr-8Fe	Forgings	SB-564	...	N06600	Annealed
33	72Ni-15Cr-8Fe	Wld. tube	SB-516	...	N06600	Cold drawn/ann.
34	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...	N06600	Cold drawn/ann.
35	35Ni-19Cr-1 1/4Si	Bar	SB-511	...	N08330	Annealed
36	35Ni-19Cr-1 1/4Si	Smls. & wld. pipe	SB-535	...	N08330	Annealed
37	35Ni-19Cr-1 1/4Si	Plate, sheet, strip	SB-536	...	N08330	Annealed
38	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08800	Annealed
39	42Fe-33Ni-21Cr	Smls. pipe & tube	SB-407	...	N08800	Annealed
40	42Fe-33Ni-21Cr	Plate	SB-409	...	N08800	Annealed
41	42Fe-33Ni-21Cr	Wld. pipe	SB-514	...	N08800	Annealed
42	42Fe-33Ni-21Cr	Wld. tube	SB-515	...	N08800	Annealed
43	42Fe-33Ni-21Cr	Forgings	SB-564	...	N08800	Annealed
44	42Fe-33Ni-21Cr	Bar, rod	SB-408	...	N08800	Hot fin.
45	42Fe-33Ni-21Cr	Smls. tube	SB-163	...	N08810	Annealed

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	5 < t ≤ 19	45	620	240	538	NFN-11	G1, G3, T11
2	...	45	620	240	538	NFN-11	G1, G3, G7, T11
3	...	45	620	240	538	NFN-11	G1, G3, T11
4	...	45	620	240	538	NFN-11	G1, G3, G7, T11
5	...	43	690	310	677	NFN-10	G1, G12, T14
6	...	43	690	310	677	NFN-10	G1, G12, T14
7	...	43	690	310	677	NFN-10	G1, G12, T14
8	...	43	690	310	677	NFN-10	G1, G12, T14
9	...	43	690	310	677	NFN-10	G1, G12, T14
10	...	43	690	310	677	NFN-10	G1, G7, G12, T14
11	...	43	690	310	677	NFN-10	G1, G12, T14
12	...	43	690	310	677	NFN-10	G1, G7, G12, T14
13	...	43	690	310	760	NFN-14	G1, G3, G7, G11, T14
14	...	43	690	310	760	NFN-14	G1, G3, G11, T14
15	...	43	690	310	760	NFN-14	G1, G3, G11, T14
16	...	43	690	310	760	NFN-14	G1, G3, G11, T14
17	...	43	690	310	760	NFN-14	G1, G3, G11, T14
18	...	43	690	310	760	NFN-14	G1, G3, G11, T14
19	...	43	690	310	760	NFN-14	G1, G3, G7, G11, T14
20	...	43	690	310	760	NFN-14	G1, G3, G11, T14
21	...	43	690	310	760	NFN-14	G1, G3, G7, G11, T14
22	...	43	690	275	427	NFN-14	G1, G2, G3
23	...	43	690	275	427	NFN-14	G1, G3
24	...	43	690	275	427	NFN-14	G1, G3, G7
25	...	43	690	275	427	NFN-14	G1, G3
26	...	43	690	275	427	NFN-14	G1, G3, G7
27	O.D. > 125	43	550	205	649	NFN-4	G1, G3, T11
28	...	43	550	240	649	NFN-4	G1, G3, T11
29	...	43	550	240	649	NFN-4	G1, G2, G3, T11
30	O.D. ≤ 125	43	550	240	649	NFN-4	G1, G3, T11
31	...	43	550	240	649	NFN-4	G1, G3, T11
32	...	43	550	240	649	NFN-4	G1, G2, G3, T11
33	O.D. ≤ 114	43	550	240	649	NFN-4	G1, G3, G7, T11
34	O.D. ≤ 114	43	550	240	649	NFN-4	G1, G3, G7, T11
35	...	46	485	205	899	NFN-13	G1, G2, G3, G13, H1, T12
36	...	46	485	205	899	NFN-13	G1, G3, G7, G10, H2, T12
37	...	46	485	205	899	NFN-13	G1, G3, G10, H2, T12
38	...	45	520	205	816	NFN-8	G1, G3, T13
39	...	45	520	205	816	NFN-8	G1, G3, T13
40	...	45	520	205	816	NFN-8	G1, G3, T13
41	...	45	520	205	816	NFN-8	G1, G3, G7, T13
42	...	45	520	205	816	NFN-8	G1, G3, G7, T13
43	...	45	520	205	816	NFN-8	G1, G2, G3, T13
44	...	45	520	205	816	NFN-8	G1, G2, G3, T13
45	...	45	450	170	899	NFN-9	G1, G3, G13, T14

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	161	161	160	158	156	154	153	152	151	150	149
2	137	137	137	137	137	137	137	137	137	136	134	132	131	130	129	128	127	127
3	161	161	161	161	161	161	161	161	161	160	158	156	154	153	152	151	150	149
4	137	137	137	137	137	137	137	137	137	136	134	132	131	130	129	128	127	127
5	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
6	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
7	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
8	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
9	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
10	176	176	176	176	176	176	176	176	172	168	164	160	157	155	153	151	149	148
11	207	207	207	207	207	207	207	207	202	197	193	189	185	182	180	177	175	174
12	176	176	176	176	176	176	176	176	172	168	164	160	157	155	153	151	149	148
13	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144
14	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
15	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
16	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
17	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
18	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
19	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144
20	207	207	207	207	207	207	207	207	206	202	197	192	188	184	180	176	173	170
21	176	176	176	176	176	176	176	176	175	171	167	164	160	156	153	150	147	144
22	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
23	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
24	156	156	156	156	156	156	156	156	156	156	156	156	156	155	153	151	150	...
25	184	184	184	184	184	184	184	184	184	184	184	184	184	182	180	178	176	...
26	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	154	...
27	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
28	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
29	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
30	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
31	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
32	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
33	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
34	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
35	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
36	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
37	138	138	138	138	138	138	138	138	138	135	132	129	127	124	122	120	118	116
38	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
39	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
40	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
41	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
42	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
43	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
44	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
45	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	132	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	115	112	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	136	132	129	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	115	112	109	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
6	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
7	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
8	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
9	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
10	146	145	145	127	95.0	71.6	55.7	45.2	35.0	...	...	...	...	...	...	...	...
11	172	171	170	149	112	84.2	65.6	53.1	41.2	...	...	...	...	...	...	...	...
12	146	145	145	127	95.0	71.6	55.7	45.2	35.0	...	...	...	...	...	...	...	...
13	142	141	140	130	104	82.9	67.4	55.8	45.1	36.7	30.3	25.2	...	...	...	...	...
14	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
15	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
16	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
17	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
18	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
19	142	141	140	130	104	82.9	67.4	55.8	45.1	36.7	30.3	25.2	...	...	...	...	...
20	167	166	165	153	122	97.5	79.3	65.6	53.0	43.1	35.6	29.6	...	...	...	...	...
21	142	141	140	130	104	82.9	67.4	55.8	45.1	36.7	30.3	25.2	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
28	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
29	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
30	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
31	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
32	84.8	58.4	39.7	27.0	19.2	15.0	13.7	...	...	...	...	...	...	...	...	...	...
33	72.0	49.6	33.8	23.0	16.3	12.7	11.7	...	...	...	...	...	...	...	...	...	...
34	72.0	49.6	33.8	23.0	16.3	12.7	11.7	...	...	...	...	...	...	...	...	...	...
35	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
36	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
37	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
38	138	138	116	91.3	71.4	54.2	37.9	25.5	13.2	10.2	7.48	6.14	5.31	...	...	...	...
39	138	138	116	91.3	71.4	54.2	37.9	25.5	13.2	10.2	7.48	6.14	5.31	...	...	...	...
40	138	138	116	91.3	71.4	54.2	37.9	25.5	13.2	10.2	7.48	6.14	5.31	...	...	...	...
41	117	117	98.7	77.6	60.7	46.0	32.2	21.7	11.2	8.63	6.36	5.22	4.52	...	...	...	...
42	117	117	98.7	77.6	60.7	46.0	32.2	21.7	11.2	8.63	6.36	5.22	4.52	...	...	...	...
43	138	138	116	91.3	71.4	54.2	37.9	25.5	13.2	10.2	7.48	6.14	5.31	...	...	...	...
44	138	138	116	91.3	71.4	54.2	37.9	25.5	13.2	10.2	7.48	6.14	5.31	...	...	...	...
45	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

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/Temper
1	42Fe-33Ni-21Cr	Smls. pipe & tube	SB-407	...	N08810	Annealed
2	42Fe-33Ni-21Cr	Bar, rod	SB-408	...	N08810	Annealed
3	42Fe-33Ni-21Cr	Plate	SB-409	...	N08810	Annealed
4	42Fe-33Ni-21Cr	Wld. pipe	SB-514	...	N08810	Annealed
5	42Fe-33Ni-21Cr	Wld. tube	SB-515	...	N08810	Annealed
6	42Fe-33Ni-21Cr	Forgings	SB-564	...	N08810	Annealed
7	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...	N08825	Annealed
8	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...	N08825	Annealed
9	42Ni-21.5Cr-3Mo-2.3Cu	Plate, sheet, strip	SB-424	...	N08825	Annealed
10	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...	N08825	Annealed
11	42Ni-21.5Cr-3Mo-2.3Cu	Forgings	SB-564	...	N08825	Annealed
12	62Ni-28Mo-5Fe	Plate	SB-333	...	N10001	Solution ann.
13	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...	N10001	Solution ann.
14	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...	N10001	Solution ann.
15	62Ni-28Mo-5Fe	Wld. tube	SB-626	...	N10001	Solution ann.
16	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Solution ann.
17	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Solution ann.
18	62Ni-28Mo-5Fe	Sheet, strip	SB-333	...	N10001	Solution ann.
19	70Ni-16Mo-7Cr-5Fe	Plate, sheet, strip	SB-434	...	N10003	Annealed
20	70Ni-16Mo-7Cr-5Fe	Rod	SB-573	...	N10003	Solution ann.
21	54Ni-16Mo-15Cr	Smls. fittings	SB-366	...	N10276	Solution ann.
22	54Ni-16Mo-15Cr	Wld. fittings	SB-366	...	N10276	Solution ann.
23	54Ni-16Mo-15Cr	Forgings	SB-462	...	N10276	Solution ann.
24	54Ni-16Mo-15Cr	Rod	SB-574	...	N10276	Solution ann.
25	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...	N10276	Solution ann.
26	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	Solution ann.
27	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...	N10276	Solution ann.
28	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
29	65Ni-28Mo-2Fe	Plate, sheet, strip	SB-333	...	N10665	Solution ann.
30	65Ni-28Mo-2Fe	Rod	SB-335	...	N10665	Solution ann.
31	65Ni-28Mo-2Fe	Smls. fittings	SB-366	...	N10665	Solution ann.
32	65Ni-28Mo-2Fe	Wld. fittings	SB-366	...	N10665	Solution ann.
33	65Ni-28Mo-2Fe	Forgings	SB-462	...	N10665	Solution ann.
34	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Solution ann.
35	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...	N10665	Solution ann.
36	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Solution ann.
37	Ti	Plate, sheet, strip	SB-265	1	R50250	Annealed
38	Ti	Bar, billet	SB-348	1	R50250	Annealed
39	Ti	Forgings	SB-381	1	R50250	Annealed
40	Ti	Smls. tube	SB-338	1	R50250	Smls. ann.
41	Ti	Smls. pipe	SB-861	1	R50250	Smls. ann.
42	Ti	Wld. tube	SB-338	1	R50250	Wld. ann.
43	Ti	Wld. pipe	SB-862	1	R50250	Wld. ann.
44	Ti	Plate, sheet, strip	SB-265	2	R50400	Annealed
45	Ti	Bar, billet	SB-348	2	R50400	Annealed

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S , 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	...	45	450	170	899	NFN-9	G1, G3, G13, T14
2	...	45	450	170	899	NFN-9	G1, G2, G3, G13, T14
3	...	45	450	170	899	NFN-9	G1, G3, G13, T14
4	...	45	450	170	899	NFN-9	G1, G3, G7, G13, T14
5	...	45	450	170	899	NFN-9	G1, G3, G7, G13, T14
6	...	45	448	172	899	NFN-9	G1, G2, G3, G13, T14
7	...	45	585	240	538	NFN-7	G1, G3
8	...	45	585	240	538	NFN-7	G1, G3
9	...	45	585	240	538	NFN-7	G1, G3
10	...	45	585	240	538	NFN-7	G1, G2, G3
11	...	45	585	240	538	NFN-7	G1, G3
12	$5 \leq t \leq 64$	44	690	310	427	NFN-5	G1, G3
13	...	44	690	310	427	NFN-5	G1, G3, G7
14	...	44	690	310	427	NFN-5	G1, G3
15	...	44	690	310	427	NFN-5	G1, G3, G7
16	$38 < t \leq 89$	44	690	315	427	NFN-5	G1, G2, G3
17	$8 \leq t \leq 38$	44	795	315	427	NFN-5	G1, G2, G3
18	$t < 5$	44	795	345	427	NFN-5	G1, G3
19	$t < 64$	44	690	280	427	NFN-6	G3
20	...	44	690	280	427	NFN-6	G1, G2, G3
21	...	43	690	285	427	NFN-10	G1, G3
22	...	43	690	285	427	NFN-10	G1, G3, G7
23	...	43	690	285	427	NFN-10	G1, G3
24	...	43	690	285	677	NFN-10	G1, G2, G3, T13
25	...	43	690	285	677	NFN-10	G1, G3, T13
26	...	43	690	285	677	NFN-10	G1, G3, G7, T13
27	...	43	690	285	677	NFN-10	G1, G3, T13
28	...	43	690	285	677	NFN-10	G1, G3, G7, T13
29	...	44	760	350	427	NFN-16	G1, G3
30	...	44	760	350	427	NFN-16	G1, G2, G3
31	...	44	760	350	427	NFN-16	G1, G3
32	...	44	760	350	427	NFN-16	G1, G3, G7
33	...	44	760	350	427	NFN-16	G1, G3
34	...	44	760	350	427	NFN-16	G1, G3, G7
35	...	44	760	350	427	NFN-16	G1, G3
36	...	44	760	350	427	NFN-16	G1, G3, G7
37	...	51	240	170	316	NFT-3	...
38	...	51	240	170	316	NFT-3	...
39	...	51	240	170	316	NFT-3	...
40	...	51	240	170	316	NFT-3	...
41	...	51	240	170	316	NFT-3	...
42	...	51	240	170	316	NFT-3	G7
43	...	51	240	170	316	NFT-3	G7
44	...	51	345	275	316	NFT-2	...
45	...	51	345	275	316	NFT-2	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	40	65	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475
1	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
2	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
3	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
4	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
5	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
6	115	115	115	115	115	115	115	115	115	115	115	113	110	108	106	104	102	100
7	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
8	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
9	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
10	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
11	161	161	161	161	161	161	161	161	161	161	161	161	161	161	160	159	158	157
12	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206	205	...
13	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	174	...
14	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	206	205	...
15	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	175	174	...
16	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	205	...
17	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	211	205	...
18	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	229	228	...
19	184	184	184	184	184	184	184	184	184	184	181	179	177	176	174	172	169	...
20	184	184	184	184	184	184	184	184	184	184	181	179	177	176	174	172	169	...
21	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	...
22	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	...
23	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	...
24	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
25	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
26	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	133
27	188	188	188	188	188	188	188	188	187	182	177	172	168	165	162	159	157	156
28	160	160	160	160	160	160	160	160	159	155	150	147	143	140	138	136	134	133
29	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
30	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
31	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
32	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
33	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
34	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
35	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	...
36	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	...
37	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
38	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
39	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
40	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
41	101	92.5	78.1	69.3	61.5	54.4	48.1	42.5	37.7	34.0	31.5	30.1	...	...	...	...	...	...
42	85.5	78.6	66.3	58.9	52.3	46.3	40.9	36.1	32.1	28.9	26.7	25.6	...	...	...	...	...	...
43	85.5	78.6	66.3	58.9	52.3	46.3	40.9	36.1	32.1	28.9	26.7	25.6	...	...	...	...	...	...
44	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
45	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	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
2	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
3	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
4	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
5	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
6	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
7	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	156	155	152	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	155	154	143	119	98.4	81.6	67.0	54.5	44.4	...	...	...	...	...	...	...	...
25	155	154	143	119	98.4	81.6	67.0	54.5	44.4	...	...	...	...	...	...	...	...
26	132	131	122	101	83.7	69.3	56.9	46.3	37.7	...	...	...	...	...	...	...	...
27	155	154	143	119	98.4	81.6	67.0	54.5	44.4	...	...	...	...	...	...	...	...
28	132	131	122	101	83.7	69.3	56.9	46.3	37.7	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/Temper
1	Ti	Forgings	SB-381	2	R50400	Annealed
2	Ti	Smls. tube	SB-338	2	R50400	Smls. ann.
3	Ti	Smls. pipe	SB-861	2	R50400	Smls. ann.
4	Ti	Wld. tube	SB-338	2	R50400	Wld. ann.
5	Ti	Wld. pipe	SB-862	2	R50400	Wld. ann.
6	Ti	Plate, sheet, strip	SB-265	3	R50550	Annealed
7	Ti	Bar, billet	SB-348	3	R50550	Annealed
8	Ti	Forgings	SB-381	3	R50550	Annealed
9	Ti	Smls. tube	SB-338	3	R50550	Smls. ann.
10	Ti	Smls. pipe	SB-861	3	R50550	Smls. ann.
11	Ti	Wld. tube	SB-338	3	R50550	Wld. ann.
12	Ti	Wld. pipe	SB-862	3	R50550	Wld. ann.
13	Ti-Pd	Plate, sheet, strip	SB-265	7	R52400	Annealed
14	Ti-Pd	Bar, billet	SB-348	7	R52400	Annealed
15	Ti-Pd	Forgings	SB-381	F-7	R52400	Annealed
16	Ti-Pd	Smls. tube	SB-338	7	R52400	Smls. ann.
17	Ti-Pd	Smls. pipe	SB-861	7	R52400	Smls. ann.
18	Ti-Pd	Wld. tube	SB-338	7	R52400	Wld. ann.
19	Ti-Pd	Wld. pipe	SB-862	7	R52400	Wld. ann.
20	Ti-Pd	Plate, sheet, strip	SB-265	16	R52402	Annealed
21	Ti-Pd	Smls. tube	SB-338	16	R52402	Annealed
22	Ti-Pd	Wld. tube	SB-338	16	R52402	Annealed
23	Ti-Pd	Bar, billet	SB-348	16	R52402	Annealed
24	Ti-Pd	Forgings	SB-381	F-16	R52402	Annealed
25	Ti-0.3Mo-0.8Ni	Plate, sheet, strip	SB-265	12	R53400	Annealed
26	Ti-0.3Mo-0.8Ni	Bar, billet	SB-348	12	R53400	Annealed
27	Ti-0.3Mo-0.8Ni	Forgings	SB-381	F-12	R53400	Annealed
28	Ti-0.3Mo-0.8Ni	Smls. tube	SB-338	12	R53400	Smls. ann.
29	Ti-0.3Mo-0.8Ni	Smls. pipe	SB-861	12	R53400	Smls. ann.
30	Ti-0.3Mo-0.8Ni	Wld. tube	SB-338	12	R53400	Wld. ann.
31	Ti-0.3Mo-0.8Ni	Wld. pipe	SB-862	12	R53400	Wld. ann.

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, 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	G7
5	...	51	345	275	316	NFT-2	G7
6	...	52	450	380	316	NFT-1	...
7	...	52	450	380	316	NFT-1	...
8	...	52	450	380	316	NFT-1	...
9	...	52	450	380	316	NFT-1	...
10	...	52	450	380	316	NFT-1	...
11	...	52	450	380	316	NFT-1	G7
12	...	52	450	380	316	NFT-1	G7
13	...	51	345	275	316	NFT-2	...
14	...	51	345	275	316	NFT-2	...
15	...	51	345	275	316	NFT-2	...
16	...	51	345	275	316	NFT-2	...
17	...	51	345	275	316	NFT-2	...
18	...	51	345	275	316	NFT-2	G7
19	...	51	345	275	316	NFT-2	G7
20	...	51	345	275	316	NFT-2	...
21	...	51	345	275	316	NFT-2	...
22	...	51	345	275	316	NFT-2	...
23	...	51	345	275	316	NFT-2	...
24	...	51	345	275	316	NFT-2	...
25	...	52	483	345	316	NFT-5	...
26	...	52	483	345	316	NFT-5	...
27	...	52	483	345	316	NFT-5	...
28	...	52	483	345	316	NFT-5	...
29	...	52	483	345	316	NFT-5	...
30	...	52	483	345	316	NFT-5	G7
31	...	52	483	345	316	NFT-5	G7

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding																		
Line No.	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	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
4	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
5	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
6	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
7	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
8	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
9	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
10	187	187	187	180	164	148	134	121	108	96.7	85.4	74.0	...	...	...	...	...	...
11	159	159	159	153	139	126	114	103	92.1	82.2	72.6	62.9	...	...	...	...	...	...
12	159	159	159	153	139	126	114	103	92.1	82.2	72.6	62.9	...	...	...	...	...	...
13	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
14	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
15	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
16	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
17	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
18	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
19	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
20	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
21	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
22	122	122	120	110	100	88.9	78.5	68.9	60.6	53.9	49.1	45.8	...	...	...	...	...	...
23	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
24	144	144	142	129	117	105	92.4	81.1	71.2	63.4	57.7	53.9	...	...	...	...	...	...
25	201	201	188	172	159	148	138	130	122	116	111	111	...	...	...	...	...	...
26	201	201	188	172	159	148	138	130	122	116	111	111	...	...	...	...	...	...
27	201	201	188	172	159	148	138	130	122	116	111	111	...	...	...	...	...	...
28	201	201	188	172	159	148	138	130	122	116	111	111	...	...	...	...	...	...
29	201	201	188	172	159	148	138	130	122	116	111	111	...	...	...	...	...	...
30	171	171	159	146	135	126	118	110	104	98.0	95.0	95.0	...	...	...	...	...	...
31	171	171	159	146	135	126	118	110	104	98.0	95.0	95.0	...	...	...	...	...	...

Table 5B (Cont'd)
Section VIII, Division 2, Class 2
Maximum Allowable Stress Values, S, for Nonferrous Materials

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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTES TO TABLE 5B**GENERAL NOTES**

- (a) The following abbreviations are used: ann., annealed; 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 T15).
- (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.
- (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.
- G14 The allowable stress value at 65°C shall be used at 66°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.

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 – TIME-DEPENDENT PROPERTIES (CONT'D)

T15 Allowable stresses for temperatures of 250°C and above are values obtained from time-dependent properties.

NOTES – WELDING REQUIREMENTS

W1 Welding except for seal welds is not permitted.

W2 For welded construction, stress values for material at 0 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 6A
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.	Group No.
1	Carbon steel	Bar, stay	SA-675	45	...	...	...	1	1
2	Carbon steel	Plate	SA-285	A	K01700	...	...	1	1
3	Carbon steel	Sheet	SA-414	A	K01501	...	...	1	1
4	Carbon steel	Wld. pipe & tube	SA-178	A	K01200	...	...	1	1
5	Carbon steel	Smls. pipe & tube	SA-192	...	K01201	...	...	1	1
6	Carbon steel	Smls. pipe & tube	SA-53	A	K02504	...	...	1	1
7	Carbon steel	Wld. pipe & tube	SA-53	A	K02504	...	...	1	1
8	Carbon steel	Butt-wld. pipe	SA-53	F	...	...	...	1	1
9	Carbon steel	Smls. pipe & tube	SA-106	A	K02501	...	...	1	1
10	Carbon steel	Wld. pipe & tube	SA-135	A	...	...	...	1	1
11	Carbon steel	Bar, stay	SA-675	50	...	...	...	1	1
12	Carbon steel	Plate	SA-285	B	K02200	...	...	1	1
13	Carbon steel	Sheet	SA-414	B	K02201	...	...	1	1
14	Carbon steel	Plate	SA/EN 10025-2	S235JR	...	...	$t \leq 100$	1	1
15	Carbon steel	Wld. pipe & tube	SA/EN 10217-1	P235TR2	...	...	$t \leq 40$	1	1
16	Carbon steel	Bar, stay	SA-675	55	...	...	...	1	1
17	Carbon steel	Plate	SA-285	C	K02801	...	...	1	1
18	Carbon steel	Plate	SA-516	55	K01800	...	...	1	1
19	Carbon steel	Sheet	SA-414	C	K02503	...	...	1	1
20	Carbon steel	Plate	SA-36	...	K02600	...	...	1	1
21	Carbon steel	Bar, stay	SA-36	...	K02600	...	...	1	1
22	Carbon steel	Forgings	SA-181	...	K03502	60	...	1	1
23	Carbon steel	Castings	SA-216	WCA	J02502	...	...	1	1
24	Carbon steel	Forgings	SA-266	1	K03506	...	...	1	1
25	Carbon steel	Bar, stay	SA-675	60	...	...	...	1	1
26	Carbon steel	Plate	SA-515	60	K02401	...	...	1	1
27	Carbon steel	Plate	SA-516	60	K02100	...	...	1	1
28	Carbon steel	Smls. pipe & tube	SA-53	B	K03005	...	...	1	1
29	Carbon steel	Wld. pipe & tube	SA-53	B	K03005	...	...	1	1
30	Carbon steel	Smls. pipe & tube	SA-106	B	K03006	...	...	1	1
31	Carbon steel	Wld. pipe & tube	SA-135	B	...	...	...	1	1
(25) 32	Carbon steel	Smls. & wld. fittings	SA-234	WPB	K03006	...	...	1	1
33	Carbon steel	Sheet	SA-414	D	K02505	...	...	1	1
34	Carbon steel	Wld. pipe & tube	SA-178	C	K03503	...	...	1	1
35	Carbon steel	Smls. pipe & tube	SA-210	A-1	K02707	...	...	1	1
36	Carbon steel	Bolting	SA-307	B	...	...	...	...	...
37	Carbon steel	Bar, stay	SA-675	65	...	...	...	1	1
38	Carbon steel	Plate	SA-515	65	K02800	...	...	1	1
39	Carbon steel	Plate	SA-516	65	K02403	...	...	1	1
40	Carbon steel	Sheet	SA-414	E	K02704	...	...	1	1
41	Carbon steel	Plate	SA/CSA-G40.21	44W	...	...	...	1	1
42	Carbon steel	Plate	SA/CSA-G40.21	50W	...	...	...	1	1
43	Carbon steel	Bolting	SA-311	1018	...	A	...	...	...
44	Carbon steel	Plate	SA-455	...	K03300	...	$15 < t \leq 19$	1	2
45	Carbon steel	Bar, stay	SA-675	70	...	...	...	1	2

Table 6A
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	310	155	...	...	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
2	310	165	CS-1	...	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
3	310	170	CS-1	...	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
4	325	180	CS-1	G3, G4	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1
5	325	180	CS-1	G3	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
6	330	205	CS-2	G4	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2
7	330	205	CS-2	...	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3
8	330	205	...	G5	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
9	330	205	CS-2	...	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2
10	330	205	CS-2	G4	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3
11	345	170	...	...	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
12	345	185	CS-1	...	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
13	345	205	CS-2	...	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
14	360	215	CS-2	...	72.0	...	72.0	...	72.0	...	72.0	...	72.0	72.0
15	360	225	CS-2	G4	61.2	...	61.2	...	61.2	...	61.2	...	61.2	61.2
16	380	390	...	...	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
17	380	205	CS-2	...	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
18	380	205	CS-2	...	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
19	380	230	CS-2	...	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
20	400	250	CS-2	G1, G2	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
21	400	250	...	G1	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
22	415	205	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
23	415	205	CS-2	G6	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2
24	415	205	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
25	415	205	...	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
26	415	220	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
27	415	220	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
28	415	240	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
29	415	240	CS-2	G4	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
30	415	240	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
31	415	240	CS-2	G4	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
32	415	240	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
33	415	240	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
34	415	255	CS-2	...	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
35	415	255	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
36	415	...	...	G7	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	...	...
37	450	225	...	...	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
38	450	240	CS-2	...	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
39	450	240	CS-2	...	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
40	450	260	CS-2	...	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
41	450	305	CS-2	...	89.6	...	89.6	...	89.6	...	89.6	...	89.6	89.6
42	450	345	CS-2	...	89.6	...	89.6	...	89.6	...	89.6	...	89.6	89.6
43	450	380	...	G8, W1, W3	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
44	485	240	CS-2	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
45	485	240	...	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.	Group No.
1	Carbon steel	Forgings	SA-105	...	K03504	...	...	1	2
2	Carbon steel	Forgings	SA-181	...	K03502	70	...	1	2
3	Carbon steel	Castings	SA-216	WCB	J03002	...	...	1	2
4	Carbon steel	Forgings	SA-266	2	K03506	...	...	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	Smls. pipe & tube	SA-106	C	K03501	...	...	1	2
8	Carbon steel	Sheet	SA-414	F	K03102	...	...	1	2
9	Carbon steel	Bolting	SA-311	1018	...	A	...	...	...
10	Carbon steel	Plate	SA-455	...	K03300	...	10 < t ≤ 15	1	2
11	Carbon steel	Forgings	SA-266	3	K05001	...	...	1	2
12	Carbon steel	Plate	SA-455	...	K03300	...	t ≤ 10	1	2
13	Carbon steel	Sheet	SA-414	G	K03103	...	...	1	2
14	Carbon steel	Bolting	SA-311	1035	...	A	...	...	...
15	Carbon steel	Bolting	SA-311	1035	...	A	...	...	...
16	Carbon steel	Bolting	SA-311	1045	...	A	...	...	...
17	Carbon steel	Bolting	SA-311	1045	...	A	...	...	...
18	Carbon steel	Bolting	SA-311	1050	...	A	...	...	...
19	Carbon steel	Bolting	SA-311	1050	...	A	...	...	...
(25) 20	Carbon steel	Bolting	SA-325	1	...	...	25 < t ≤ 38	...	...
21	Carbon steel	Bolting	SA-311	1045	...	B	...	...	...
(25) 22	Carbon steel	Bolting	SA-325	1	...	...	13 ≤ t ≤ 25	...	...
23	Carbon steel	Bolting	SA-354	BC	...	...	...	...	...
24	Carbon steel	Bolting	SA-354	BD	...	...	...	...	...
(25) 25	...	...	...	...	...	...	...	...	...
26	1Cr-0.2Mo	Bolting	SA-193	B7	G41400	...	...	...	...
27	1Cr-0.2Mo	Bolting	SA-320	L7	...	...	...	...	...
28	5Cr- ¹ / ₂ Mo	Bolting	SA-193	B5	K50100	...	...	...	...
29	18Cr-2Mo	Plate	SA-240	...	S44400	...	t ≤ 10	7	2
30	18Cr-2Mo	Tube	SA-268	...	S44400	...	t ≤ 10	7	2
31	18Cr-2Mo	Bar	SA-479	...	S44400	...	t ≤ 10	7	2
(25) 32	18Cr-Ti	Plate	SA-240	439	S43035	...	t ≤ 10	7	2
(25) 33	18Cr-Ti	Plate	SA-240	...	S43932	...	t ≤ 10	7	2
(25) 34	18Cr-Ti	Tube	SA-268	TP439	S43035	...	t ≤ 10	7	2
(25) 35	18Cr-Ti	Bar	SA-479	439	S43035	...	t ≤ 10	7	2
36	29Cr-4Mo	Smls. tube	SA-268	...	S44700	...	...	10J	1
37	29Cr-4Mo	Wld. tube	SA-268	...	S44700	...	...	10J	1
38	1 ³ / ₄ Ni- ³ / ₄ Cr- ¹ / ₄ Mo	Bolting	SA-320	L43	G43400	...	t ≤ 100	...	...
39	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...	...	8	1
40	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	...	...	8	1
41	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	...	...	8	1
42	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...	...	8	1
43	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316L	S31603	...	...	8	1
44	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	...	...	8	1
45	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	...	...	8	1

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	485	250	...	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
2	485	250	CS-2	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
3	485	250	CS-2	G6	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
4	485	250	CS-2	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
5	485	260	CS-2	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
6	485	260	CS-2	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
7	485	275	CS-3	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
8	485	290	CS-3	...	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
9	485	415	...	G8, W1, W2	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
10	505	255	CS-2	...	101	101	101	101	101	101	101	101	101	101
11	515	260	CS-2	...	103	103	103	103	103	103	103	103	103	103
12	515	260	CS-2	...	103	103	103	103	103	103	103	103	103	103
13	515	310	CS-3	...	103	103	103	103	103	103	103	103	103	103
14	550	485	...	G8, W1, W3	110	110	110	110	110	110	110	110	110	110
15	590	520	...	G8, W1, W2	117	117	117	117	117	117	117	117	117	117
16	620	550	...	G8, W1, W3	124	124	124	124	124	124	124	124	124	124
17	655	585	...	G8, W1, W2	131	131	131	131	131	131	131	131	131	131
18	655	585	...	G8, W1, W3	131	131	131	131	131	131	131	131	131	131
19	690	620	...	G8, W1, W2	138	138	138	138	138	138	138	138	138	138
20	725	560	...	G7	139	139	139	139	139	139	139	139	139	139
21	795	690	...	G8, W1, W2	159	159	159	159	159	159	159	159	159	159
22	825	635	...	G7	165	165	165	165	165	165	165	165	165	165
23	860	750	...	G7	172	172	172	172	172	172	172	172	172	172
24	1035	900	...	G7	207	207	207	207	207	207	207	207	207	207
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	690	515	...	G7	129	129	129	129	129	129	129	129	129	129
27	860	725	...	G7	172	172	172	172	172	172	172	172	172	172
28	690	550	...	G7	138	138	138	138	138	138	138	138	138	138
29	415	275	CS-2	...	82.7	82.7	82.7	81.3	80.2	79.3	78.5	77.7	76.9	76.0
30	415	275	CS-2	...	82.7	82.7	82.7	81.3	80.0	79.3	78.5	77.7	76.9	76.0
31	415	310	...	...	82.7	82.7	82.7	81.3	80.2	79.3	78.5	77.7	76.9	76.0
32	415	205	...	...	82.7	82.7	82.7	81.1	79.8	78.8	77.9	77.1	76.4	75.6
33	415	205	CS-2	...	82.8	82.7	82.6	81.2	79.8	78.8	77.8	77.1	76.4	75.6
34	415	205	CS-2	...	82.7	82.7	82.7	81.1	78.8	78.8	77.9	77.1	76.4	75.6
35	485	275	CS-2	...	96.5	96.5	96.5	94.7	93.2	91.9	90.9	90.0	89.1	88.2
36	550	415	HA-6	G12	103	103	103	101	99.8	99.3	99.2	99.2	99.2	99.2
37	550	415	HA-6	G4, G12	87.9	87.9	87.2	85.7	84.8	84.4	84.4	84.4	84.4	84.4
38	860	725	...	G7	172	172	172	172	172	172	172	172	172	172
39	485	170	HA-4	G9, G11	96.5	96.5	93.0	90.2	87.3	83.8	80.8	78.3	76.1	74.3
40	485	170	HA-4	G9, G10, G11	96.5	96.5	93.0	90.2	87.3	83.8	80.8	78.3	76.1	74.3
41	485	170	HA-4	G9	96.5	96.5	93.0	90.2	87.3	83.3	80.8	78.3	76.1	74.3
42	485	170	HA-4	G4, G9, G10, G11	82.0	82.0	79.0	76.7	74.2	71.2	68.7	66.6	64.7	63.1
43	485	170	HA-4	G9, G11	96.5	96.5	93.0	90.2	87.3	83.8	80.8	78.3	76.1	74.3
44	485	170	HA-4	G4, G9, G11	82.0	82.0	79.0	76.7	74.2	71.2	68.7	66.6	64.7	63.1
45	485	170	HA-4	G9, G10	96.5	96.5	93.0	90.2	87.3	83.8	80.8	78.3	76.1	74.3

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.	Group No.
1	16Cr-12Ni-2Mo	Castings	SA-351	CF3M	J92800	...	$t \geq 2.6$	8	1
2	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...	...	8	1
3	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...	...	8	1
4	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...	...	8	1
5	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...	...	8	1
6	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316	S31600	...	...	8	1
7	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	...	...	8	1
8	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	...	...	8	1
9	16Cr-12Ni-2Mo-Ti	Smls. tube	SA-213	TP316Ti	S31635	...	...	8	1
10	16Cr-12Ni-2Mo-Ti	Plate	SA-240	316Ti	S31635	...	...	8	1
11	16Cr-12Ni-2Mo-Ti	Smls. pipe	SA-312	TP316Ti	S31635	...	...	8	1
12	16Cr-12Ni-2Mo-Ti	Wld. pipe	SA-312	TP316Ti	S31635	...	...	8	1
(25) 13	16Cr-12Ni-2Mo-Ti	Plate	SA/EN 10088-2	X6CrNiMoTi17-12-2	...	...	$t \leq 8$	8	1
14	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...	$t \leq 127$	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. pipe	SA-312	TP304L	S30403	...	...	8	1
19	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	...	...	8	1
20	18Cr-8Ni	Bar	SA-479	304L	S30403	...	...	8	1
21	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	$t \leq 127$	8	1
22	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...	...	8	1
23	18Cr-8Ni	Plate	SA-240	304	S30400	...	...	8	1
24	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...	...	8	1
25	18Cr-8Ni	Smls. pipe	SA-312	TP304	S30400	...	...	8	1
26	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	...	...	8	1
27	18Cr-8Ni	Bar	SA-479	304	S30400	...	...	8	1
28	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...	$t \geq 2.6$	8	1
(25) 29	...	...	...	...	...	...	...	...	...
30	20Cr-10Ni	Bar	SA-479	ER308	S30880	...	...	...	...
31	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...	S32101	...	$t > 5$	10H	1
32	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	...	$t > 5$	10H	1
33	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	...	$t > 5$	10H	1
34	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	...	$t > 5$	10H	1
35	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	...	$t > 5$	10H	1
36	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...	S32101	...	$t \leq 5$	10H	1
37	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	...	$t \leq 5$	10H	1
38	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	...	$t \leq 5$	10H	1
39	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	...	$t \leq 5$	10H	1
40	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	...	$t \leq 5$	10H	1
41	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...	...	10H	1
42	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S31803	...	...	10H	1
43	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S31803	...	...	10H	1
44	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S31803	...	...	10H	1
45	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S31803	...	...	10H	1

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	485	205	...	G6, G9	77.2	77.2	77.2	75.9	75.0	74.4	74.1	74.1	74.1	74.1
2	515	205	HA-2	G9, G11	103	103	103	102	100	99.6	99.1	95.8	92.8	90.3
3	515	205	HA-2	G9, G10, G11	103	103	103	102	100	99.6	99.1	95.8	92.8	90.3
4	515	205	HA-2	G9	103	103	103	102	100	99.6	99.1	95.8	92.8	90.3
5	515	205	HA-2	G4, G9, G10, G11	87.9	87.9	87.9	86.4	85.3	84.7	84.3	81.4	78.9	76.6
6	515	205	HA-2	G9, G11	103	103	103	102	100	99.6	99.1	95.8	92.8	90.3
7	515	205	HA-2	G4, G9, G11	87.9	87.9	87.9	86.4	85.4	84.7	84.3	81.4	78.9	76.7
8	515	205	HA-2	G7, G9, G13	103	103	103	102	100	99.6	99.1	95.8	92.8	90.3
9	515	205	HA-2	G9	103	102	95.0	91.0	87.8	85.3	83.4	82.1	81.3	80.8
10	515	205	HA-2	G9	103	102	95.0	91.0	87.8	85.3	83.4	82.1	81.3	80.8
11	515	205	HA-2	G9	103	102	95.0	91.0	87.8	85.3	83.4	82.1	81.3	80.8
12	515	205	HA-2	G4, G9	87.9	86.8	80.7	77.3	74.6	72.5	70.9	69.8	69.1	68.7
13	540	240	HA-2	G9, G14	103	102	95.0	91.0	87.8	85.3	83.4	82.1	81.3	80.8
14	485	170	HA-3	G9, G11	96.5	96.2	90.1	86.8	84.4	82.5	81.2	78.4	76.0	74.0
15	485	170	HA-3	G9, G10, G11	96.5	96.5	90.1	86.8	84.4	82.5	81.1	78.4	76.0	74.0
16	485	170	HA-3	G9	96.5	96.2	90.2	86.8	84.8	82.5	81.2	78.4	76.0	74.0
17	485	170	HA-3	G4, G9, G10, G11	82.0	82.0	76.6	73.8	71.7	70.1	69.0	66.6	64.6	62.9
18	485	170	HA-3	G9, G11	96.5	96.2	90.1	86.8	84.4	82.5	81.2	78.4	76.0	74.0
19	485	170	HA-3	G4, G9, G11	82.0	81.8	77.1	73.8	71.1	70.1	69.0	66.6	64.6	62.9
20	485	170	HA-3	G9, G10	96.5	96.2	90.1	86.8	84.4	82.2	81.2	78.4	76.0	74.0
21	515	205	HA-1	G9, G11	103	103	96.9	93.6	91.2	89.5	88.4	87.7	87.5	87.4
22	515	205	HA-1	G9, G10, G11	103	103	96.8	93.6	91.2	89.5	88.4	87.7	87.5	87.4
23	515	205	HA-1	G9	103	103	96.9	93.9	91.9	89.5	88.4	87.7	87.5	87.4
24	515	205	HA-1	G4, G9, G10, G11	87.9	87.9	82.4	79.6	77.5	76.1	75.1	74.6	74.3	74.3
25	515	205	HA-1	G9, G11	103	103	96.9	93.6	91.2	89.5	88.4	87.7	87.5	87.4
26	515	205	HA-1	G4, G9, G11	87.9	87.7	82.4	79.6	77.5	76.1	75.1	74.6	74.3	74.3
27	515	205	HA-1	G7, G9, G13	103	103	96.9	93.6	91.2	89.5	88.4	87.7	87.5	87.4
28	485	205	...	G6, G9	77.2	77.2	72.9	70.1	67.8	65.8	64.3	63.0	62.1	61.2
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	515	205	HA-2	G7, G9, G13	103	103	96.9	93.6	91.2	89.5	88.4	87.7	87.5	87.4
31	650	450	HA-5	...	130	130	130	127	124	121	119	119	119	119
32	650	450	HA-5	...	130	130	130	127	124	121	119	119	119	119
33	650	450	HA-5	...	110	110	110	108	105	103	102	101	101	101
34	650	450	HA-5	...	130	130	130	127	124	121	119	119	119	119
35	650	450	HA-5	...	110	110	110	108	105	103	102	101	101	101
36	695	530	HA-5	...	139	139	139	136	133	130	128	127	127	127
37	695	530	HA-5	...	139	139	139	136	133	130	128	127	127	127
38	695	530	HA-5	...	118	118	118	116	113	111	109	108	108	108
39	695	530	HA-5	...	139	139	139	136	133	130	128	127	127	127
40	695	530	HA-5	...	118	118	118	116	113	111	109	108	108	108
41	620	450	HA-5	...	124	124	124	122	120	117	116	114	113	112
42	620	450	HA-5	...	124	124	124	122	120	117	116	114	113	112
43	620	450	HA-5	...	106	106	106	104	102	99.8	98.2	96.9	96.0	95.3
44	620	450	HA-5	...	124	124	124	122	120	117	116	114	113	112
45	620	450	HA-5	...	106	106	106	104	102	99.8	98.2	96.9	96.0	95.3

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line	No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy	Class/	Size/	P-No.	Group
						Desig./	Cond./	Thickness,		
						UNS	Temper	mm		No.
(25)	1	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S32205	...	...	10H	1
(25)	2	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S32205	...	...	10H	1
(25)	3	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S32205	...	...	10H	1
(25)	4	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S32205	...	...	10H	1
(25)	5	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S32205	...	...	10H	1
	6	23Cr-12Ni	Bar	SA-479	309S	S30908	...	...	8	2
	7	23Cr-12Ni	Bar	SA-479	309H	S30909	...	...	8	2
	8	25Cr-20Ni	Bar	SA-479	310S	S31008	...	...	8	2
	9	44Fe-25Ni-21Cr-Mo	Plate	SA-240	904L	N08904	...	...	45	...
(25)	10	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...	...	45	...

Table 6A (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Ferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	655	450	HA-5	...	131	131	131	129	126	124	122	121	119	118
2	655	450	HA-5	...	131	131	131	129	126	124	122	121	119	118
3	655	450	HA-5	G4	111	111	111	109	107	105	104	103	101	101
4	655	480	HA-5	...	131	131	131	129	126	124	122	121	119	118
5	655	480	HA-5	G4	111	111	111	109	107	105	104	103	101	101
6	515	205	HA-2	G7, G9, G13	103	103	103	103	103	102	101	100	99.1	98.3
7	515	205	HA-2	G7, G9, G13	103	103	103	103	103	102	101	100	99.1	98.3
8	515	205	HA-2	G7, G9, G13	103	103	103	103	103	102	101	100	99.1	98.3
9	490	220	NFN-9	...	98.0	98.0	97.8	95.3	93.4	91.8	90.4	89.1	88.1	85.8
10	450	170	NFN-9	G9	89.6	89.6	89.6	89.6	89.6	89.6	89.2	88.7	88.3	...

NOTES TO TABLE 6A

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) 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.
- (c) The following abbreviations are used: Smls., Seamless; and Wld., Welded.
- (d) The maximum allowable use temperature is 260°C. The values for 275°C are provided for interpolation only.

NOTES – GENERAL REQUIREMENTS

- G1 These allowable stress values apply also to structural shapes.
- G2 SA/CSA-G40.21 as specified in ASME BPVC, Section II, Part A, grade 38W may be used in lieu of SA-36 for plates and bars not exceeding 19 mm.
- G3 Tensile value is expected minimum.
- G4 The stress value includes a joint factor of 0.85.
- G5 The stress value includes a joint factor of 0.60.
- G6 The stress value includes a casting quality factor of 0.80. Increased casting quality factors as a result of material examination beyond the requirements of the material specifications shall not be permitted.
- G7 The stress value is 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.
- G8 For tie-rods and draw bolts on cast-iron sectional boilers subject to system pressure.
- G9 The water temperature shall not exceed 99°C.
- G10 Tubing material shall be fully annealed.
- G11 The limitations of ASME BPVC, Section IV, HF-204.2 and HF-204.3 apply.
- G12 Heat treatment after forming or fabrication is neither required nor prohibited.
- G13 For arc or resistance welded studs only.
- G14 For cold-rolled strips only.

NOTES – WELDING REQUIREMENTS

- W1 Welding or brazing is not permitted.
- W2 For tie-rods and draw bolts up to 22 mm diameter subject to system pressure, welding is not permitted.
- W3 For tie-rods and draw bolts over 22 mm diameter and up to 32 mm diameter subject to system pressure, welding is not permitted.

INTENTIONALLY LEFT BLANK

Table 6B
Section IV Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.
1	...	Castings	SB-26	...	A13560	T6	...	...
2	...	Smls. extr. tube	SB-241	...	A91100	O	...	21
3	...	Drawn smls. tube	SB-210	...	A93003	O	...	21
(25) 4	...	Plate, sheet	SB-209	...	A95052	H32 wld.	...	22
(25) 5	...	Drawn smls. tube	SB-210	...	A95052	O	...	22
6	...	Drawn smls. tube	SB-210	...	A95052	H32 wld.	...	22
7	...	Smls. extr. tube	SB-241	...	A95052	H32 wld.	...	22
8	...	Plate, sheet	SB-209	...	A96061	T6 wld.	...	23
9	...	Plate, sheet	SB-209	...	A96061	T651 wld.	...	23
10	...	Drawn smls. tube	SB-210	...	A96061	T6	...	23
11	...	Drawn smls. tube	SB-210	...	A96061	T6 wld.	...	23
12	...	Bar, rod, wire	SB-211	...	A96061	T6 wld.	...	23
13	...	Bar, rod, wire	SB-211	...	A96061	T651 wld.	...	23
14	...	Bar, rod, shapes	SB-221	...	A96061	T6 wld.	...	23
15	...	Smls. extr. tube	SB-241	...	A96061	T6 wld.	...	23
16	...	Smls. extr. tube	SB-241	...	A96063	O	...	23
(25) 17	...	Smls. extr. tube	SB-241	...	A96063	T1	12.71-25.40	23
(25) 18	...	Smls. extr. tube	SB-241	...	A96063	T1	≤12.70	23
19	...	Bar, rod, shapes	SB-221	...	A96063	T5	t > 12.7	23
20	...	Bar, rod, shapes	SB-221	...	A96063	T5	t ≤ 12.7	23
21	...	Bar, rod, shapes	SB-221	...	A96063	T6	...	23
22	...	Castings	SB/EN 1706	...	AC-42000	F	...	...
23	...	Castings	SB/EN 1706	...	AC-43000	F	...	...
24	...	Castings	SB/EN 1706	...	AC-44300	F	...	...
(25) 25	...	Smls. tube	SB-75	...	C10200	O50	All	31
(25) 26	...	Smls. tube	SB-75	...	C10200	O60	All	31
(25) 27	...	Smls. pipe	SB-42	...	C10200	O61	All	31
(25) 28	...	Plate, sheet, strip, bar	SB-152	...	C10200	O25	...	31
(25) 29	...	Smls. pipe	SB-42	...	C10200	H55	50 < DN ≤ 300	31
(25) 30	...	Smls. tube	SB-75	...	C10200	H55	All	31
(25) 31	...	Smls. cond. tube	SB-111	...	C10200	H55	...	31
(25) 32	...	Smls. U-bend tube	SB-395	...	C10200	H55	...	31
(25) 33	...	Smls. pipe	SB-42	...	C10200	H80	6 < DN ≤ 50	31
(25) 34	...	Smls. tube	SB-75	...	C10200	H80	t < 100	31
(25) 35	...	Smls. cond. tube	SB-111	...	C10200	H80	...	31
(25) 36	...	Plate, sheet, strip, bar	SB-152	...	C10400	O25	...	31
(25) 37	...	Plate, sheet, strip, bar	SB-152	...	C10500	O25	...	31
(25) 38	...	Plate, sheet, strip, bar	SB-152	...	C10700	O25	...	31
(25) 39	...	Plate, sheet, strip, bar	SB-152	...	C11000	O25	...	31
(25) 40	...	Smls. tube	SB-75	...	C12000	O50	All	31
(25) 41	...	Smls. tube	SB-75	...	C12000	O60	All	31
(25) 42	...	Smls. pipe	SB-42	...	C12000	O61	All	31
(25) 43	...	Smls. pipe	SB-42	...	C12000	H55	50 < DN ≤ 300	31
(25) 44	...	Smls. tube	SB-75	...	C12000	H55	All	31
(25) 45	...	Smls. cond. tube	SB-111	...	C12000	H55	...	31

Table 6B
Section IV Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	235	165	...	G6, W1	37.5	37.5	37.5	37.0	...	...	...	...	...	...
2	75	20	NFA-7	...	13.8	13.8	13.8	12.6	11.2	...	...	...	...	...
3	97	34	NFA-1	...	19.3	19.1	17.4	15.9	14.4	...	...	...	...	...
4	172	66	NFA-8	...	34.5	34.5	34.5	34.5	32.8	...	...	...	...	...
5	172	69	NFA-8	...	34.5	34.5	34.5	34.5	32.8	...	...	...	...	...
6	172	69	NFA-12	...	34.5	34.5	34.5	34.5	32.8	...	...	...	...	...
7	172	69	NFA-8	...	34.5	34.5	34.5	34.5	32.8	...	...	...	...	...
8	165	75	NFA-12	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
9	165	75	NFA-12,13	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
10	290	241	NFA-12,13	W1	57.9	57.9	57.9	55.5	47.9	...	...	...	...	...
11	165	75	NFA-12,13	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
12	165	75	NFA-12	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
13	165	75	NFA-12,13	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
14	165	75	NFA-12,13	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
15	165	75	NFA-12,13	...	33.1	33.1	33.1	32.6	31.2	...	...	...	...	...
16	110	35	NFA-1	...	22.1	22.1	21.6	20.3	19.2	...	...	...	...	...
17	110	55	NFA-1	W1	22.0	22.0	22.0	22.0	22.0	...	...	...	...	...
18	115	60	NFA-1	W1	23.4	23.4	23.4	23.4	23.4	...	...	...	...	...
19	144	105	NFA-1	W1	29.0	29.0	28.1	26.6	23.8	...	...	...	...	...
20	151	110	NFA-1	W1	30.3	30.3	29.2	27.8	24.8	...	...	...	...	...
21	207	172	NFA-1	...	41.4	41.4	40.4	35.3	27.7	...	...	...	...	...
22	140	80	...	G9	11.2	11.0	10.8	10.7	10.5	...	...	...	...	...
23	150	80	...	G6	24.0	24.0	24.0	24.0	24.0	...	...	...	...	...
24	240	130	...	G8, W1	24.0	24.0	20.7	20.7	20.7	...	...	...	...	...
25	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
26	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
27	205	60	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
28	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
29	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
30	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
31	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
32	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
33	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
34	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
35	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
36	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
37	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
38	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
39	205	70	NFC-1	G1	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
40	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
41	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
42	205	60	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
43	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
44	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
45	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...

Table 6B (Cont'd)
Section IV Maximum Allowable Stress Values, *S*, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.
(25) 1	...	Smls. U-bend tube	SB-395	...	C12000	H55	...	31
(25) 2	...	Smls. pipe	SB-42	...	C12000	H80	6 < DN ≤ 50	31
(25) 3	...	Smls. tube	SB-75	...	C12000	H80	<i>t</i> < 100	31
(25) 4	...	Smls. cond. tube	SB-111	...	C12000	H80	...	31
(25) 5	...	Finned tube	SB-359	...	C12200	O62	...	31
(25) 6	...	Smls. tube	SB-75	...	C12200	O50	All	31
(25) 7	...	Smls. tube	SB-75	...	C12200	O60	All	31
(25) 8	...	Smls. pipe	SB-42	...	C12200	O61	All	31
(25) 9	...	Finned tube	SB-359	...	C12200	O61	...	31
(25) 10	...	Plate, sheet, strip, bar	SB-152	...	C12200	O25	...	31
(25) 11	...	Smls. pipe	SB-42	...	C12200	H55	50 < DN ≤ 300	31
(25) 12	...	Smls. tube	SB-75	...	C12200	H55	All	31
(25) 13	...	Smls. cond. tube	SB-111	...	C12200	H55	...	31
(25) 14	...	Finned tube	SB-359	...	C12200	H55	...	31
(25) 15	...	Smls. U-bend tube	SB-395	...	C12200	H55	...	31
(25) 16	...	Smls. pipe	SB-42	...	C12200	H80	6 < DN ≤ 50	31
(25) 17	...	Smls. tube	SB-75	...	C12200	H80	<i>t</i> < 100	31
(25) 18	...	Smls. cond. tube	SB-111	...	C12200	H80	...	31
(25) 19	...	Finned tube	SB-359	...	C12200	H80	...	31
(25) 20	...	Plate, sheet, strip, bar	SB-152	...	C12300	O25	...	31
(25) 21	...	Plate, sheet, strip, bar	SB-152	...	C14200	O25	...	31
(25) 22	...	Smls. cond. tube	SB-111	...	C14200	H55	...	31
(25) 23	...	Smls. U-bend tube	SB-395	...	C14200	H55	...	31
(25) 24	...	Smls. cond. tube	SB-111	...	C14200	H80	...	31
25	...	Smls. tube	SB-43	...	C23000	O61	...	32
26	...	Smls. cond. tube	SB-111	...	C23000	O61	...	32
27	...	Smls. U-bend tube	SB-395	...	C23000	O61	...	32
(25) 28	...	Forgings	SB-283	...	C37700	M10	<i>t</i> > 38	...
(25) 29	...	Forgings	SB-283	...	C37700	M10	≤ 38	...
(25) 30	...	Plate, sheet	SB-171	...	C44300	M20, O25	<i>t</i> ≤ 100	32
31	...	Finned tube	SB-359	...	C44300	O61	...	32
32	...	Smls. U-bend tube	SB-395	...	C44300	...	...	32
(25) 33	...	Plate, sheet	SB-171	...	C44400	M20, O25	<i>t</i> ≤ 100	32
34	...	Finned tube	SB-359	...	C44400	O61	...	32
35	...	Smls. U-bend tube	SB-395	...	C44400	...	...	32
(25) 36	...	Plate, sheet	SB-171	...	C44500	M20, O25	<i>t</i> ≤ 100	32
37	...	Finned tube	SB-359	...	C44500	O61	...	32
38	...	Smls. U-bend tube	SB-395	...	C44500	...	...	32
(25) 39	...	Plate, sheet	SB-171	...	C46400	M20, O25	<i>t</i> ≤ 75	32
40	...	Smls. cond. tube	SB-111	...	C60800	O61	...	35
41	...	Bar, rod	SB-98	...	C65100	O60	All	33
42	...	Bar, rod	SB-98	...	C65100	H02	<i>t</i> < 50	33
43	...	Smls. pipe & tube	SB-315	...	C65500	O61	...	33
(25) 44	...	Plate, sheet, strip, bar	SB-96	...	C65500	O61	<i>t</i> ≤ 50	33
45	...	Bar, rod	SB-98	...	C65500	O60	All	33

Table 6B (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
2	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
3	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
4	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
5	205	45	NFC-1	...	29.9	26.4	26.4	26.4	26.3	...	...	...	...	...
6	205	62	NFC-7	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
7	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
8	205	60	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
9	205	62	NFC-1	...	41.4	40.7	36.4	36.4	36.2	...	...	...	...	...
10	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
11	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
12	250	205	NFC-3	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
13	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
14	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
15	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
16	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
17	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
18	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
19	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
20	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
21	205	70	NFC-1	...	41.4	40.7	40.0	38.7	37.5	...	...	...	...	...
22	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
23	250	205	NFC-6	G2, G11	49.6	49.6	49.6	49.6	48.1	46.9	45.7	43.6	...	...
24	310	275	NFC-4	G2	62.1	62.1	62.1	62.1	60.3	57.1	...	...	...	...
25	275	85	NFC-2	...	55.2	55.1	55.1	55.1	55.1	...	...	...	...	...
26	275	85	NFC-2	...	55.2	55.1	55.1	55.1	55.1	...	...	...	...	...
27	275	85	NFC-2	...	55.2	55.1	55.1	55.1	55.1	...	...	...	...	...
28	317	103	...	G3, W1	63.4	57.4	57.4	...	...	...	...	...	...	...
29	345	124	...	G3, W1	68.9	68.9	67.4	...	...	...	...	...	...	...
30	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
31	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
32	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
33	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
34	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
35	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
36	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
37	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
38	310	105	NFC-2	...	62.0	62.0	62.0	61.2	60.4	59.3	...	...	...	...
39	345	140	NFC-2	...	68.9	68.9	68.9	68.9	68.9	...	...	...	...	...
40	345	130	NFC-2	...	68.9	68.9	68.9	68.9	68.9	68.4	65.8	...	...	...
41	275	85	...	G4	55.0	54.8	54.3	54.0	53.6	53.1	...	...	...	...
42	380	140	...	G2, G4	75.8	75.8	75.8	75.8	75.8	75.8	...	...	...	...
43	345	103	NFC-2	G4	68.9	68.8	68.6	68.4	68.1	67.8	...	...	...	...
44	345	125	NFC-2	G4	68.9	68.9	68.9	68.9	68.9	67.9	...	...	...	...
45	360	105	...	G4	71.7	71.7	71.7	71.7	71.7	70.6	...	...	...	...

Table 6B (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.
(25)	1 ...	Bar, rod	SB-98	...	C65500	H01	...	33
	2 ...	Smls. pipe & tube	SB-466	...	C70600	O60	...	34
	3 ...	Plate	SB-171	...	C70600	M20, O25	$t \leq 140$	34
	4 ...	Smls. cond. tube	SB-111	...	C70600	O61	...	34
	5 ...	Finned tube	SB-359	...	C70600	O61	...	34
	6 ...	Smls. U-bend tube	SB-395	...	C70600	O61	...	34
	7 ...	Wld. tube	SB-543	...	C70600	WO61	...	34
	8 ...	Smls. pipe & tube	SB-466	...	C70620	O60	...	34
	9 ...	Plate	SB-171	...	C70620	M20, O25	$t \leq 140$	34
	10 ...	Smls. cond. tube	SB-111	...	C70620	O61	...	34
	11 ...	Finned tube	SB-395	...	C70620	O61	...	34
	12 ...	Smls. U-bend tube	SB-395	...	C70620	O61	...	34
	13 ...	Wld. tube	SB-543	...	C70620	WO61	...	34
	14 ...	Smls. tube	SB-466	...	C71000	O60	...	34
	15 ...	Smls. cond. tube	SB-111	...	C71000	O61	...	34
	16 ...	Smls. U-bend tube	SB-395	...	C71000	O61	...	34
	17 ...	Plate	SB-171	...	C71500	M20, O25	$t \leq 60$	34
	18 ...	Smls. pipe & tube	SB-466	...	C71500	O60	...	34
	19 ...	Smls. cond. tube	SB-111	...	C71500	O61	...	34
	20 ...	Smls. U-bend tube	SB-395	...	C71500	O61	...	34
	21 ...	Plate	SB-171	...	C71520	M20, O25	$t \leq 60$	34
	22 ...	Smls. pipe & tube	SB-466	...	C71520	O60	...	34
	23 ...	Smls. cond. tube	SB-111	...	C71520	O61	...	34
	24 ...	Smls. U-bend tube	SB-395	...	C71520	O61	...	34
(25)	25 ...	Castings	SB-62	...	C83600	M01	...	...
(25)	26 ...	Castings	SB-584	...	C84400	M01	...	...
(25)	27 ...	Castings	SB-584	...	C90300	M01	...	...
(25)	28 ...	Castings	SB-61	...	C92200	M01	...	...
	29 67Ni-30Cu	Bar	SB-164	...	N04400	Annealed	...	42
	30 67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed	>125 O.D.	42
	31 67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed	≤ 125 O.D.	42
	32 67Ni-30Cu	Rod	SB-164	...	N04400	Hot worked	...	42
	33 67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Stress rel.	...	42
	34 57Ni-22Cr-14W-2Mo-La	Smls. & wld. fittings	SB-366	...	N06230	Solution ann.	...	43
	35 57Ni-22Cr-14W-2Mo-La	Plate, sheet, strip	SB-435	...	N06230	Solution ann.	...	43
	36 57Ni-22Cr-14W-2Mo-La	Forgings	SB-564	...	N06230	Solution ann.	...	43
	37 57Ni-22Cr-14W-2Mo-La	Bar	SB-572	...	N06230	Solution ann.	...	43
	38 57Ni-22Cr-14W-2Mo-La	Wld. pipe	SB-619	...	N06230	Solution ann.	...	43
	39 57Ni-22Cr-14W-2Mo-La	Smls. pipe & tube	SB-622	...	N06230	Solution ann.	...	43
	40 57Ni-22Cr-14W-2Mo-La	Wld. tube	SB-626	...	N06230	Solution ann.	...	43
	41 33Ni-42Fe-21Cr	Plate	SB-409	...	N08800	Annealed	...	45
	42 33Ni-42Fe-21Cr	Plate	SB-409	...	N08810	Annealed	...	45

Table 6B (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Nonferrous Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	380	165	...	G2, G4	75.8	75.8	75.8	75.8	75.8	75.8	...	...	...	...
2	260	90	NFC-3	G10	52.4	52.4	52.4	52.4	52.4	51.5	49.9	48.6	47.6	46.9
3	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
4	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
5	275	105	NFC-3	G10	55.2	54.8	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
6	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
7	275	105	NFC-3	G10	46.9	46.9	46.9	46.9	46.9	46.1	44.7	43.5	42.6	42.0
8	260	90	NFC-3	G10	52.4	52.4	52.4	52.4	52.4	51.5	49.9	48.6	47.6	46.9
9	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
10	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
11	275	105	NFC-3	G10	55.2	54.8	55.2	55.2	55.2	55.2	52.6	51.2	50.1	49.4
12	275	105	NFC-3	G10	55.2	55.2	55.2	55.2	55.2	54.2	52.6	51.2	50.1	49.4
13	275	105	NFC-3	G10	46.9	46.9	46.9	46.9	46.9	46.1	44.7	43.5	42.6	42.0
14	310	110	NFC-3	G10	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
15	310	110	NFC-3	G10	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
16	310	110	NFC-3	G10	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
17	345	140	NFC-4	G10	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
18	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
19	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
20	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
21	345	140	NFC-4	G10	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
22	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
23	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
24	360	125	NFC-4	G10	71.7	71.7	71.7	71.7	71.7	71.7	71.4	70.1	68.9	67.8
25	205	95	NFC-1	G6, G12	33.1	33.1	33.1	33.1	33.1	33.1	31.5	31.1	29.4	...
26	200	90	...	G6	32.0	32.0	31.9	30.6	29.3	28.3	27.2	...	...	...
27	276	124	...	G6	44.1	44.1	44.1	44.1	44.1	44.1	44.1	...	...	...
28	235	110	NFC-1	G6	37.5	37.5	37.5	37.5	37.5	37.5	33.4	...	...	...
29	485	170	NFN-3	G5, G10	96.5	96.5	96.5	96.2	93.6	91.9	90.9	90.4	90.4	90.4
30	485	170	NFN-3	G5, G10	96.5	96.5	96.5	96.2	93.6	91.9	90.9	90.4	90.4	90.4
31	485	195	NFN-3	G5, G10	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
32	550	275	NFN-3	G5, G10	110	110	110	110	110	110	110	110	110	110
33	585	380	NFN-3	G5, G10	117	117	117	117	117	117	117	117	117	117
34	758	310	NFN-24	...	152	152	152	152	152	151	149	147	145	...
35	758	310	NFN-24	...	152	152	152	152	152	151	149	147	145	...
36	758	310	NFN-24	...	152	152	152	152	152	151	149	147	145	...
37	758	310	NFN-24	...	152	152	152	152	152	151	149	147	145	...
38	758	310	NFN-24	...	129	129	129	129	129	128	127	125	123	...
39	758	310	NFN-24	...	152	152	152	152	152	151	149	147	145	...
40	758	310	NFN-24	...	129	129	129	129	129	128	127	125	123	...
41	515	205	NFN-8	G7	103	103	103	103	103	103	103	103	103	103
42	450	170	NFN-9	G7	89.6	89.6	89.6	89.6	89.6	89.6	89.2	88.7	88.3	...

NOTES TO TABLE 6B**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) 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.
- (c) The following abbreviations are used: cond., condenser; Smls., Seamless; and Wld., Welded.

NOTES – GENERAL REQUIREMENTS

- G1 When material is to be welded, the phosphorous deoxidized types should be specified.
- G2 When nonferrous materials conforming to Section II specifications are used in welded or brazed construction, the maximum allowable working stresses shall not exceed the values given herein for the material in the annealed condition.
- G3 For use in ASME BPVC, Section IV, eq. HG-307.2(b)(2), the maximum allowable stress at room temperature (40°C max.) shall be 68.9 MPa (through 38 mm thickness) and 63.4 MPa over 38 mm thickness.
- G4 Copper-silicon alloys are not always suitable when exposed to certain median and high temperatures, particularly steam above 100°C. Therefore, this material is limited to the construction of hot water boilers to be operated at a temperature not to exceed 93°C.
- G5 To be used for HLW connections only.
- G6 The stress value includes a casting quality factor of 0.8. Increased casting quality factors as a result of material examination beyond the requirement of the material specification shall not be permitted. This is not intended to apply to valves and fittings made to recognized standards.
- G7 The maximum water temperature shall not exceed 96°C.
- G8 The castings shall not be repaired.
- G9 When proof testing is required to establish design pressure, that testing shall comply with ASME BPVC, Section IV, HG-501 and HG-502.3, except that in the equation in HG-502.3, the design factor shall be 10 in lieu of 5.
- G10 The maximum allowable use temperature is 260°C. The values for 275°C are provided for interpolation only.
- G11 The maximum allowable use temperature is 204°C. The values for 225°C are provided for interpolation only.
- G12 The maximum allowable use temperature is 232°C. The values for 250°C are provided for interpolation only.

NOTES – WELDING REQUIREMENTS

- W1 Welding or brazing is not permitted.

INTENTIONALLY LEFT BLANK

Table 6C
Section IV Maximum Allowable Stress Values, S, for Lined Water Heater Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.	Group No.
1	Carbon steel	Castings	SA-278	20	...	...	...	...	...
2	Carbon steel	Castings	SA-278	25	...	...	...	...	...
3	Carbon steel	Castings	SA-278	30	...	...	...	...	...
4	Carbon steel	Castings	SA-278	35	...	...	...	...	...
5	Carbon steel	Castings	SA-278	40	...	...	...	...	...
6	Carbon steel	Wld. tube	SA-513	1008	...	...	...	1	1
7	Carbon steel	Bar	SA-675	45	...	...	...	1	1
8	Carbon steel	Plate	SA-285	A	K01700	...	...	1	1
9	Carbon steel	Plate	SA-285 AISI C-1012	...	...	...	...	1	1
10	Carbon steel	Sheet	SA-414	A	K01501	...	...	1	1
11	Carbon steel	Sheet	SA-414 AISI C-1012	...	...	...	...	1	1
12	Carbon steel	Wld. tube	SA-513	1010	...	...	...	1	1
13	Carbon steel	Wld. tube	SA-178	E/A	K01200	...	...	1	1
14	Carbon steel	Smls. pipe	SA-53	A	K02504	...	...	1	1
15	Carbon steel	Wld. pipe	SA-53	E/A	K02504	...	...	1	1
16	Carbon steel	Smls. pipe	SA-106	A	K02501	...	...	1	1
17	Carbon steel	Wld. pipe	SA-135	E/A	...	...	...	1	1
18	Carbon steel	Wld. tube	SA-513	1015	...	...	...	1	1
19	Carbon steel	Bar	SA-675	50	...	...	...	1	1
20	Carbon steel	Plate	SA-285	B	K02200	...	...	1	1
21	Carbon steel	Plate	SA-285 AISI C-1015d	...	...	...	...	1	1
22	Carbon steel	Sheet	SA-414	B	K02201	...	...	1	1
23	Carbon steel	Sheet	SA-414 AISI C-1015d	...	...	...	...	1	1
24	Carbon steel	Bar	SA-675	55	...	...	...	1	1
25	Carbon steel	Plate	SA-285	C	K02801	...	...	1	1
26	Carbon steel	Plate	SA-516	55	K01800	...	...	1	1
27	Carbon steel	Plate	SA-285 AISI C-1023	...	...	...	...	1	1
28	Carbon steel	Sheet	SA-414	C	K02503	...	...	1	1
29	Carbon steel	Sheet	SA-414 AISI C-1023	...	...	...	...	1	1
30	Carbon steel	Plate	SA-36	...	K02600	...	...	1	1
31	Carbon steel	Bar, shapes	SA-36	...	K02600	...	...	1	1
32	Carbon steel	Forgings	SA-181	...	K03502	60	...	1	1
33	Carbon steel	Bar	SA-675	60	...	...	...	1	1
34	Carbon steel	Plate	SA-515	60	K02401	...	...	1	1
35	Carbon steel	Plate	SA-516	60	K02100	...	...	1	1
36	Carbon steel	Smls. pipe	SA-53	B	K03005	...	...	1	1
37	Carbon steel	Wld. pipe	SA-53	E/B	K03005	...	...	1	1
38	Carbon steel	Smls. pipe	SA-106	B	K03006	...	...	1	1
39	Carbon steel	Wld. pipe	SA-135	E/B	...	...	...	1	1
40	Carbon steel	Sheet	SA-414	D	K02505	...	...	1	1
41	Carbon steel	Wld. tube	SA-178	E/C	K03503	...	...	1	1
42	Carbon steel	Bar	SA-675	65	...	...	...	1	1
43	Carbon steel	Plate	SA-515	65	K02800	...	...	1	1
44	Carbon steel	Plate	SA-516	65	K02403	...	...	1	1
45	Carbon steel	Sheet	SA-414	E	K02704	...	...	1	1

Table 6C
Section IV Maximum Allowable Stress Values, S, for Lined Water Heater Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	138	124	CI-1	W1	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
2	173	154	CI-1	W1	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
3	207	186	CI-1	W1	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8
4	241	217	CI-1	W1	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3	60.3
5	276	248	CI-1	W1	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
6	290	207	...	G1, G2	61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6
7	310	155	CS-6	...	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6
8	310	165	CS-1	...	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6
9	310	170	...	...	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5
10	310	170	CS-1	...	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6
11	310	170	...	...	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5
12	310	221	...	G1, G2	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9
13	325	180	...	G1, G2	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9
14	330	205	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
15	330	205	CS-2	G1	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
16	330	205	CS-2	...	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7
17	330	205	CS-2	G1	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
18	330	241	...	G1, G2	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
19	345	170	CS-1	...	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2
20	345	185	CS-1	...	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2
21	345	205	...	...	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3
22	345	205	CS-2	...	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2
23	345	205	...	...	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3
24	380	190	CS-1	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
25	380	205	CS-2	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
26	380	205	CS-2	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
27	380	230	...	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
28	380	230	CS-2	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
29	380	230	...	...	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
30	400	250	CS-2	...	100	100	100	100	100	100	100	100	100	100
31	400	250	...	...	100	100	100	100	100	100	100	100	100	100
32	415	205	CS-2	...	103	103	103	103	103	103	103	103	103	103
33	415	205	CS-2	...	103	103	103	103	103	103	103	103	103	103
34	415	220	CS-2	...	103	103	103	103	103	103	103	103	103	103
35	415	220	CS-2	...	103	103	103	103	103	103	103	103	103	103
36	415	240	CS-2	...	103	103	103	103	103	103	103	103	103	103
37	415	240	CS-2	G1	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
38	415	240	CS-2	...	103	103	103	103	103	103	103	103	103	103
39	415	240	CS-2	G1	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
40	415	240	CS-2	...	103	103	103	103	103	103	103	103	103	103
41	415	255	...	G1	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
42	450	225	CS-2	...	112	112	112	112	112	112	112	112	112	112
43	450	240	CS-2	...	112	112	112	112	112	112	112	112	112	112
44	450	240	CS-2	...	112	112	112	112	112	112	112	112	112	112
45	450	260	CS-2	...	112	112	112	112	112	112	112	112	112	112

Table 6C (Cont'd)
Section IV Maximum Allowable Stress Values, S , for Lined Water Heater Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Class/ Cond./ Temper	Size/ Thickness, mm	P-No.	Group No.
1	Carbon steel	Plate	SA/CSA-G40.21	44W	...	...	$t \leq 200$	1	1
2	Carbon steel	Plate	SA/CSA-G40.21	50W	...	...	$t \leq 150$	1	1
3	Carbon steel	Plate	SA-455	...	K03300	...	$15 < t \leq 20$	1	2
4	Carbon steel	Bars	SA-675	70	...	...	...	1	2
5	Carbon steel	Forgings	SA-105	...	K03504	...	...	1	2
6	Carbon steel	Forgings	SA-181	...	K03502	70	...	1	2
7	Carbon steel	Plate	SA-515	70	K03101	...	...	1	2
8	Carbon steel	Plate	SA-516	70	K02700	...	...	1	2
9	Carbon steel	Smls. pipe	SA-106	C	K03501	...	...	1	2
10	Carbon steel	Sheet	SA-414	F	K03102	...	...	1	2
11	Carbon steel	Plate	SA-455	...	K03300	...	$9.5 < t \leq 15$	1	2
12	Carbon steel	Plate	SA-455	...	K03300	...	$t \leq 9.5$	1	2
13	Carbon steel	Sheet	SA-414	G	K03103	...	...	1	2

Table 6C (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Lined Water Heater Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	450	305	CS-2	...	112	112	112	112	112	112	112	112	112	112
2	450	345	CS-2	...	112	112	112	112	112	112	112	112	112	112
3	485	240	CS-2	...	121	121	121	121	121	121	121	121	121	121
4	485	240	CS-2	...	121	121	121	121	121	121	121	121	121	121
5	485	250	CS-2	...	121	121	121	121	121	121	121	121	121	121
6	485	250	CS-2	...	121	121	121	121	121	121	121	121	121	121
7	485	260	CS-2	...	121	121	121	121	121	121	121	121	121	121
8	485	260	CS-2	...	121	121	121	121	121	121	121	121	121	121
9	485	275	CS-2	...	121	121	121	121	121	121	121	121	121	121
10	485	290	CS-2	...	121	121	121	121	121	121	121	121	121	121
11	505	255	CS-2	...	126	126	126	126	126	126	126	126	126	126
12	515	260	CS-2	...	129	129	129	129	129	129	129	129	129	129
13	515	310	CS-3	...	129	129	129	129	129	129	129	129	129	129

NOTES TO TABLE 6C

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) 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 The stress value includes a joint factor of 0.85.

G2 Tensile value is expected minimum.

NOTES – WELDING REQUIREMENTS

W1 Welding or brazing is not permitted.

INTENTIONALLY LEFT BLANK

Table 6D
Section IV Maximum Allowable Stress Values, S , for Unlined Water Heater Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Size/ Thickness, mm	P-No.	Group No.
1	18Cr-2Mo	Plate	SA-240	...	S44400	$t \leq 10$	7	2
2	18Cr-2Mo	Smls. tube	SA-268	...	S44400	$t \leq 10$	7	2
3	18Cr-2Mo	Wld. tube	SA-268	...	S44400	$t \leq 10$	7	2
4	18Cr-2Mo	Bar	SA-479	...	S44400	$t \leq 10$	7	2
5	18Cr-Ti	Plate	SA-240	439	S43035	$t \leq 10$	7	2
6	18Cr-Ti	Smls. tube	SA-268	TP439	S43035	$t \leq 10$	7	2
7	18Cr-Ti	Bar	SA-479	439	S43035	$t \leq 10$	7	2
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	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	$t \leq 13$	8	1
11	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	$t \leq 13$	8	1
12	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	$t \leq 13$	8	1
13	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	$t \leq 13$	8	1
14	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	$t \leq 13$	8	1
15	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	$t \leq 13$	8	1
16	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	$t \leq 13$	8	1
17	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	$t \leq 13$	8	1
18	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316L	S31603	$t \leq 13$	8	1
19	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316L	S31603	$t \leq 13$	8	1
20	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	$t \leq 13$	8	1
21	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316L	S31603	$t \leq 13$	8	1
22	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	$t \leq 13$	8	1
23	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	$t \leq 13$	8	1
24	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	$t \leq 13$	8	1
25	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	$t \leq 13$	8	1
26	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	$t \leq 13$	8	1
27	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	$t \leq 13$	8	1
28	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	$t \leq 13$	8	1
29	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	$t \leq 13$	8	1
30	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	$t \leq 13$	8	1
31	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	$t \leq 13$	8	1
32	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316	S31600	$t \leq 13$	8	1
33	16Cr-12Ni-2Mo	Smls. pipe	SA-312	TP316	S31600	$t \leq 13$	8	1
34	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	$t \leq 13$	8	1
35	16Cr-12Ni-2Mo	Wld. pipe	SA-312	TP316	S31600	$t \leq 13$	8	1
36	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	$t \leq 13$	8	1
37	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	$t \leq 13$	8	1
38	18Cr-8Ni	Forgings	SA-182	F304L	S30403	$t \leq 13$	8	1
39	18Cr-8Ni	Forgings	SA-182	F304L	S30403	$t \leq 13$	8	1
40	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	$t \leq 13$	8	1
41	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	$t \leq 13$	8	1
42	18Cr-8Ni	Plate	SA-240	304L	S30403	$t \leq 13$	8	1
43	18Cr-8Ni	Plate	SA-240	304L	S30403	$t \leq 13$	8	1
44	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	$t \leq 13$	8	1
45	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	$t \leq 13$	8	1

Table 6D
Section IV Maximum Allowable Stress Values, S, for Unlined Water Heater Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	415	275	CS-2	...	104	103	103	102	100	99.1	98.0	97.0	96.0	94.9
2	415	275	CS-2	...	104	103	103	102	100	99.1	98.0	97.0	96.0	94.9
3	415	275	CS-2	G1	88.0	87.9	87.8	86.5	85.2	84.3	83.3	82.5	81.6	80.6
4	415	...	CS-2	...	104	103	103	102	100	99.1	98.0	97.0	96.0	94.9
5	415	205	CS-2	...	104	103	103	102	99.8	98.5	97.3	96.4	95.5	94.5
6	415	205	CS-2	...	104	103	103	102	99.8	98.5	97.3	96.4	95.5	94.5
7	485	225	CS-2	...	121	121	117	114	112	109	108	106	104	94.5
8	550	415	HA-6	G2	138	138	137	135	133	133	133	133	133	133
9	550	415	HA-6	G1, G2	117	117	116	115	113	113	113	113	113	113
10	485	170	HA-4	...	115	105	96.7	91.3	87.3	83.3	80.7	78.7	76.0	74.0
11	485	170	HA-4	G3	121	119	117	114	110	109	107	106	103	99.9
12	485	170	HA-4	...	115	105	96.7	91.3	87.3	83.3	80.7	78.7	76.0	74.0
13	485	170	HA-4	G3	121	119	117	114	110	109	107	106	103	99.9
14	485	170	HA-4	...	115	105	96.7	91.3	87.3	83.3	80.7	78.7	76.0	74.0
15	485	170	HA-4	G3	121	119	117	114	110	109	107	106	103	99.9
16	485	170	HA-4	G1	97.5	89.0	82.2	77.6	74.2	70.8	68.6	66.9	64.6	62.9
17	485	170	HA-4	G1, G3	103	101	99.2	96.5	93.7	92.4	91.2	90.3	87.2	84.9
18	485	170	HA-4	...	115	105	96.7	91.3	87.3	83.3	80.7	78.7	76.0	74.0
19	485	170	HA-4	G3	121	119	117	114	110	109	107	106	103	99.9
20	485	170	HA-4	G1	97.5	89.0	82.2	77.6	74.2	70.8	68.6	66.9	64.6	62.9
21	485	170	HA-4	G1, G3	103	101	99.2	96.5	93.7	92.4	91.2	90.3	87.2	84.9
22	485	170	HA-4	...	115	105	96.7	91.3	87.3	83.3	80.7	78.7	76.0	74.0
23	485	170	HA-4	G3	121	119	117	114	110	109	107	106	103	99.9
24	515	205	HA-2	...	129	126	117	112	107	103	98.7	96.0	92.7	90.7
25	515	205	HA-2	G3	129	129	129	127	126	125	124	124	124	122
26	515	205	HA-2	...	129	126	117	112	107	103	98.7	96.0	92.7	90.7
27	515	205	HA-2	G3	129	129	129	127	126	125	124	124	124	122
28	515	205	HA-2	...	129	126	117	112	107	103	98.7	96.0	92.7	90.7
29	515	205	HA-2	G3	129	129	129	127	126	125	124	124	124	122
30	515	205	HA-2	G1	110	107	99.7	95.2	91.2	87.3	83.9	81.6	78.8	77.1
31	515	205	HA-2	G1, G3	110	110	110	108	107	106	105	105	105	104
32	515	205	HA-2	...	129	126	117	112	107	103	98.7	96.0	92.7	90.7
33	515	205	HA-2	G3	129	129	129	127	126	125	124	124	124	122
34	515	205	HA-2	G1	110	107	99.7	95.2	91.2	87.3	83.9	81.6	78.8	77.1
35	515	205	HA-2	G1, G3	110	110	110	108	107	106	105	105	105	104
36	515	205	HA-2	...	129	126	117	112	107	103	98.7	96.0	92.7	90.7
37	515	205	HA-2	G3	129	129	129	127	126	125	124	124	124	122
38	485	170	HA-3	...	115	105	97.3	92.0	88.0	84.0	80.7	78.0	76.0	74.0
39	485	170	HA-3	G3	121	117	113	109	105	103	102	101	99.5	98.9
40	485	170	HA-3	...	115	105	97.3	92.0	88.0	84.0	80.7	78.0	76.0	74.0
41	485	170	HA-3	G3	121	117	113	109	105	103	102	101	99.5	98.9
42	485	170	HA-3	...	115	105	97.3	92.0	88.0	84.0	80.7	78.0	76.0	74.0
43	485	170	HA-3	G3	121	117	113	109	105	103	102	101	99.5	98.9
44	485	170	HA-3	G1	97.5	89.0	82.7	78.2	74.8	71.4	68.6	66.3	64.6	62.9
45	485	170	HA-3	G1, G3	103	99.3	96.1	92.8	89.5	87.9	86.3	85.4	84.6	84.0

Table 6D (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Unlined Water Heater Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/ Grade	Alloy Desig./ UNS No.	Size/ Thickness, mm	P-No.	Group No.
1	18Cr-8Ni	Smls. pipe	SA-312	TP304L	S30403	$t \leq 13$	8	1
2	18Cr-8Ni	Smls. pipe	SA-312	TP304L	S30403	$t \leq 13$	8	1
3	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	$t \leq 13$	8	1
4	18Cr-8Ni	Wld. pipe	SA-312	TP304L	S30403	$t \leq 13$	8	1
5	18Cr-8Ni	Bar	SA-479	304L	S30403	$t \leq 13$	8	1
6	18Cr-8Ni	Bar	SA-479	304L	S30403	$t \leq 13$	8	1
7	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	8	1
8	18Cr-8Ni	Forgings	SA-182	F304	S30400	...	8	1
9	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	$t \leq 13$	8	1
10	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	$t \leq 13$	8	1
11	18Cr-8Ni	Plate	SA-240	304	S30400	$t \leq 13$	8	1
12	18Cr-8Ni	Plate	SA-240	304	S30400	$t \leq 13$	8	1
13	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	$t \leq 13$	8	1
14	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	$t \leq 13$	8	1
15	18Cr-8Ni	Smls. pipe	SA-312	TP304	S30400	$t \leq 13$	8	1
16	18Cr-8Ni	Smls. pipe	SA-312	TP304	S30400	$t \leq 13$	8	1
17	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	$t \leq 13$	8	1
18	18Cr-8Ni	Wld. pipe	SA-312	TP304	S30400	$t \leq 13$	8	1
19	18Cr-8Ni	Bar	SA-479	304	S30400	$t \leq 13$	8	1
20	18Cr-8Ni	Bar	SA-479	304	S30400	$t \leq 13$	8	1
(25) 21	20Cr-3Ni-1.5Mo-N	Plate	SA-240	...	S32003	$t > 5$	10H	1
(25) 22	20Cr-3Ni-1.5Mo-N	Smls. tube	SA-789	...	S32003	$t > 5$	10H	1
(25) 23	20Cr-3Ni-1.5Mo-N	Wld. tube	SA-789	...	S32003	$t > 5$	10H	1
(25) 24	20Cr-3Ni-1.5Mo-N	Smls. pipe	SA-790	...	S32003	$t > 5$	10H	1
(25) 25	20Cr-3Ni-1.5Mo-N	Wld. pipe	SA-790	...	S32003	$t > 5$	10H	1
(25) 26	20Cr-3Ni-1.5Mo-N	Sheet, strip	SA-240	...	S32003	$t \leq 5$	10H	1
(25) 27	20Cr-3Ni-1.5Mo-N	Smls. tube	SA-789	...	S32003	$t \leq 5$	10H	1
(25) 28	20Cr-3Ni-1.5Mo-N	Wld. tube	SA-789	...	S32003	$t \leq 5$	10H	1
(25) 29	20Cr-3Ni-1.5Mo-N	Smls. pipe	SA-790	...	S32003	$t \leq 5$	10H	1
(25) 30	20Cr-3Ni-1.5Mo-N	Wld. pipe	SA-790	...	S32003	$t \leq 5$	10H	1
(25) 31	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...	S32101	$t > 5$	10H	1
(25) 32	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	$t > 5$	10H	1
(25) 33	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	$t > 5$	10H	1
(25) 34	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	$t > 5$	10H	1
(25) 35	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	$t > 5$	10H	1
(25) 36	21Cr-5Mn-1.5Ni-Cu-N	Sheet, strip	SA-240	...	S32101	$t \leq 5$	10H	1
(25) 37	21Cr-5Mn-1.5Ni-Cu-N	Smls. tube	SA-789	...	S32101	$t \leq 5$	10H	1
(25) 38	21Cr-5Mn-1.5Ni-Cu-N	Wld. tube	SA-789	...	S32101	$t \leq 5$	10H	1
(25) 39	21Cr-5Mn-1.5Ni-Cu-N	Smls. pipe	SA-790	...	S32101	$t \leq 5$	10H	1
(25) 40	21Cr-5Mn-1.5Ni-Cu-N	Wld. pipe	SA-790	...	S32101	$t \leq 5$	10H	1
41	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...	10H	1
42	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S31803	...	10H	1
43	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S31803	...	10H	1
44	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S31803	...	10H	1
45	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S31803	...	10H	1

Table 6D (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Unlined Water Heater Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	485	170	HA-3	...	115	105	97.3	92.0	88.0	84.0	80.7	78.0	76.0	74.0
2	485	170	HA-3	G3	121	117	113	109	105	103	102	101	99.5	98.9
3	485	170	HA-3	G1	97.5	89.0	82.7	78.2	74.8	71.4	68.6	66.3	64.6	62.9
4	485	170	HA-3	G1, G3	103	99.3	96.1	92.8	89.5	87.9	86.3	85.4	84.6	84.0
5	485	170	HA-3	...	115	105	97.3	92.0	88.0	84.0	80.7	78.0	76.0	74.0
6	485	170	HA-3	G3	121	117	113	109	105	103	102	101	99.5	98.9
7	515	205	HA-1	...	129	123	113	107	103	98.7	96.0	92.7	90.0	88.0
8	515	205	HA-1	G3	129	125	121	118	114	112	111	110	109	109
9	515	205	HA-1	...	129	123	113	107	103	98.7	96.0	92.7	90.0	88.0
10	515	205	HA-1	G3	129	125	121	118	114	112	111	110	109	109
11	515	205	HA-1	...	129	123	113	107	103	98.7	96.0	92.7	90.0	88.0
12	515	205	HA-1	G3	129	125	121	118	114	112	111	110	109	109
13	515	205	HA-1	G1	110	104	96.3	91.2	87.3	83.9	81.6	78.8	76.5	74.8
14	515	205	HA-1	G1, G3	110	106	103	100	96.9	95.4	93.9	93.4	92.9	92.9
15	515	205	HA-1	...	129	123	113	107	103	98.7	96.0	92.7	90.0	88.0
16	515	205	HA-1	G3	129	125	121	118	114	112	111	110	109	109
17	515	205	HA-1	G1	110	104	96.3	91.2	87.3	83.9	81.6	78.8	76.5	74.8
18	515	205	HA-1	G1, G3	110	106	103	100	96.9	95.4	93.9	93.4	92.9	92.9
19	515	205	HA-1	...	129	123	113	107	103	98.7	96.0	92.7	90.0	88.0
20	515	205	HA-1	G3	129	125	121	118	114	112	111	110	109	109
21	655	450	HA-5	...	164	155	143	139	136	135	134	134	134	134
22	655	450	HA-5	...	164	155	143	139	136	135	134	134	134	134
23	655	450	HA-5	G1	139	132	122	118	115	115	114	114	114	114
24	655	450	HA-5	...	164	155	143	139	136	135	134	134	134	134
25	655	450	HA-5	G1	139	132	122	118	115	115	114	114	114	114
26	690	485	HA-5	...	172	163	151	147	143	142	141	141	141	141
27	690	485	HA-5	...	172	163	151	147	143	142	141	141	141	141
28	690	485	HA-5	G1	146	139	128	125	121	121	120	120	120	120
29	690	485	HA-5	...	172	163	151	147	143	142	141	141	141	141
30	690	485	HA-5	G1	146	139	128	125	121	121	120	120	120	120
31	650	450	HA-5	...	163	163	163	159	155	152	150	149	149	149
32	650	450	HA-5	...	163	163	163	159	155	152	150	149	149	149
33	650	450	HA-5	G1	138	138	138	135	131	129	127	127	127	127
34	650	450	HA-5	...	163	163	163	159	155	152	150	149	149	149
35	650	450	HA-5	G1	138	138	138	135	131	129	127	127	127	127
36	700	530	HA-5	...	175	175	175	171	167	164	161	161	161	161
37	700	530	HA-5	...	175	175	175	171	167	164	161	161	161	161
38	700	530	HA-5	G1	149	149	149	145	142	139	137	137	136	136
39	700	530	HA-5	...	175	175	175	171	167	164	161	161	161	161
40	700	530	HA-5	G1	149	149	149	145	142	139	137	137	136	136
41	620	450	HA-5	...	155	155	155	152	150	147	144	143	141	140
42	620	450	HA-5	...	155	155	155	152	150	147	144	143	141	140
43	620	450	HA-5	G1	132	132	132	129	128	125	122	122	120	119
44	620	450	HA-5	...	155	155	155	152	150	147	144	143	141	140
45	620	450	HA-5	G1	132	132	132	129	128	125	122	122	120	119

Table 6D (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Unlined Water Heater Materials

	Line					Alloy	Size/		
	No.	Nominal Composition	Product Form	Spec.	Type/	Desig./	Thickness,	P-No.	Group
				No.	Grade	UNS	mm		No.
(25)	1	22Cr-5Ni-3Mo-N	Plate, sheet, strip	SA-240	...	S32205	...	10H	1
(25)	2	22Cr-5Ni-3Mo-N	Smls. pipe	SA-790	...	S32205	...	10H	1
(25)	3	22Cr-5Ni-3Mo-N	Wld. pipe	SA-790	...	S32205	...	10H	1
(25)	4	22Cr-5Ni-3Mo-N	Smls. tube	SA-789	...	S32205	...	10H	1
(25)	5	22Cr-5Ni-3Mo-N	Wld. tube	SA-789	...	S32205	...	10H	1

Table 6D (Cont'd)
Section IV Maximum Allowable Stress Values, S, for Unlined Water Heater Materials

Line No.	Min. Tensile Strength, MPa	Min. Yield Strength, MPa	External Pressure Chart No.	Notes	Maximum Allowable Stress, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding									
					40	65	100	125	150	175	200	225	250	275
1	655	450	HA-5	...	164	164	164	161	158	155	153	151	149	148
2	655	450	HA-5	...	164	164	164	161	158	155	153	151	149	148
3	655	450	HA-5	G1	139	139	139	137	134	132	130	128	127	126
4	655	480	HA-5	...	164	164	164	161	158	155	153	151	149	148
5	655	480	HA-5	G1	139	139	139	137	134	132	130	128	127	126

NOTES TO TABLE 6D**GENERAL NOTES**

- (a) The following abbreviations are used: 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) 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.
- (d) 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 The stress value includes a joint factor of 0.85.
- G2 Heat treatment after forming or fabrication is neither required nor prohibited.
- G3 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.

INTENTIONALLY LEFT BLANK

Table U
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials			
(25) 1	Carbon steel	Castings	SA-278	20
(25) 2	Carbon steel	Castings	SA-278	25
(25) 3	Carbon steel	Castings	SA-278	30
(25) 4	Carbon steel	Castings	SA-278	35
(25) 5	Carbon steel	Castings	SA-278	40
	Carbon steel	Sheet	SA-1008	CS-A
	Carbon steel	Sheet	SA-1008	CS-B
(25) 8	Carbon steel	Wld. tube	SA-513	1/1008
	Carbon steel	Bar	SA-675	45
	Carbon steel	Wld. pipe	SA-134	A283A
	Carbon steel	Plate	SA-285	A
	Carbon steel	Wld. pipe	SA-672	A45
	Carbon steel	Sheet	SA-414	A
(25) 14	Carbon steel	Wld. tube	SA-513	1/1010
	Carbon steel	Wld. tube	SA-178	A
	Carbon steel	Smls. tube	SA-179	...
	Carbon steel	Smls. tube	SA-192	...
	Carbon steel	Wld. tube	SA-214	...
	Carbon steel	Smls. tube	SA-556	A2
(25) 20	...	...	...	...
	Carbon steel	Wld. pipe	SA-53	E/A
(25) 22	Carbon steel	Butt-wld. pipe	SA-53	F/A
	Carbon steel	Smls. pipe	SA-53	S/A
	Carbon steel	Smls. pipe	SA-106	A
	Carbon steel	Wld. pipe	SA-135	A
	Carbon steel	Forged pipe	SA-369	FPA
	Carbon steel	Wld. pipe	SA-587	...
(25) 28	Carbon steel	Wld. tube	SA-513	1/1015
	Carbon steel	Bar	SA-675	50
	Carbon steel	Wld. pipe	SA-134	A283B
	Carbon steel	Plate	SA-285	B
	Carbon steel	Wld. pipe	SA-672	A50
	Carbon steel	Sheet	SA-414	B
	Carbon steel	Plate	SA/EN 10028-3	P275NH
(25) 35	Carbon steel	Plate	SA/EN 10025-2	S235JR
	Carbon steel	Plate	SA/EN 10028-2	P235GH
	Carbon steel	Plate	SA/EN 10028-3	P275NH
	Carbon steel	Smls. tube	SA/EN 10216-2	P235GH
(25) 39	Carbon steel	Wld. pipe & tube	SA/EN 10217-1	P235TR2
	Carbon steel	Sheet, strip	SA-1011	36
	Carbon steel	Plate	SA/EN 10028-3	P275NH
	Carbon steel	Bar	SA-675	55
	Carbon steel	Wld. pipe	SA-134	A283C
	Carbon steel	Plate	SA-283	C
	Carbon steel	Plate	SA-285	C

Table U
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials				
1	...	...	...	138
2	...	...	...	173
3	...	...	...	207
4	...	...	...	241
5	...	...	...	276
6	...	...	...	275
7	...	...	...	275
8	...	...	...	290
9	...	...	...	310
10	...	...	...	310
11	K01700	...	...	310
12	K01700	...	...	310
13	K01501	...	...	310
14	...	...	...	310
15	K01200	...	...	325
16	K01200	...	...	325
17	K01201	...	...	325
18	K01807	...	...	325
19	K01807	...	...	325
20	...	...	...	...
21	K02504	...	...	330
22	...	...	...	330
23	K02504	...	...	330
24	K02501	...	...	330
25	...	...	...	330
26	K02501	...	...	330
27	K11500	...	...	330
28	...	...	...	330
29	...	...	...	345
30	...	...	...	345
31	K02200	...	...	345
32	K02200	...	...	345
33	K02201	...	...	345
34	...	...	$150 < t \leq 250$	350
35	...	...	$t \leq 100$	360
36	...	...	≤ 60	360
37	...	...	$100 < t \leq 150$	360
38	...	...	$t \leq 60$	360
39	...	...	$t \leq 40$	360
40	SS	Type 1	$t \leq 6$	365
41	...	...	$60 < t \leq 100$	370
42	...	...	...	380
43	K02401	...	...	380
44	K02401	...	...	380
45	K02801	...	...	380

Table U
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials														
1	138	138	138	138	138	...	...	...	...	...	...	...	...	...	...
2	172	172	172	172	172	...	...	...	...	...	...	...	...	...	...
3	207	207	207	207	207	...	...	...	...	...	...	...	...	...	...
4	241	241	241	241	241	...	...	...	...	...	...	...	...	...	...
5	276	276	276	276	276	276	276	276	...	...	...	...	...	...	...
6	276	276	276	276	276	276	276	276	276	272	255	235	213	189	169
7	276	276	276	276	276	276	276	276	276	272	255	235	213	189	169
8	290	290	290	290	290	290	290	290	290	285	267	246	223	199	177
9	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
10	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
11	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
12	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
13	310	310	310	310	310	310	310	310	310	306	286	264	239	213	190
14	310	310	310	310	310	310	310	310	310	306	286	263	239	214	190
15	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
16	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
17	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
18	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
19	324	324	324	324	324	324	324	324	324	319	299	275	250	223	198
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
22	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
23	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
24	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
25	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
26	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
27	331	331	331	331	331	331	331	331	331	326	306	282	255	227	203
28	331	331	331	331	331	331	331	331	331	326	305	281	255	228	202
29	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
30	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
31	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
32	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
33	345	345	345	345	345	345	345	345	345	340	318	293	265	237	211
34	350	350	350	350	350	350	350	350	350	345	323	298	270	241	214
35	359	359	359	359	359	359	359	359	359	354	331	305	276	247	219
36	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
37	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
38	360	360	360	360	360	360	360	360	360	355	332	306	277	248	220
39	359	359	359	359	359	359	359	359	359	353	331	305	276	247	219
40	366	366	364	362	362	362	362	362	...	...	...	...	...	...	...
41	369	369	369	369	369	369	369	369	369	365	343	316	286	255	225
42	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
43	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
44	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
45	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232

Table U
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

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

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	Carbon steel	Smls. & wld. pipe	SA-333	1
2	Carbon steel	Smls. & wld. tube	SA-334	1
3	Carbon steel	Plate	SA-516	55
4	Carbon steel	Smls. pipe	SA-524	II
5	Carbon steel	Wld. pipe	SA-671	CA55
6	Carbon steel	Wld. pipe	SA-671	CE55
7	Carbon steel	Wld. pipe	SA-672	A55
8	Carbon steel	Wld. pipe	SA-672	B55
9	Carbon steel	Wld. pipe	SA-672	C55
10	Carbon steel	Wld. pipe	SA-672	E55
11	Carbon steel	Sheet	SA-414	C
12	Carbon steel	Sheet, strip	SA-1011	40
13	Carbon steel	Sheet, strip	SA-1011	45
14	Carbon steel	Plate	SA/EN 10028-3	P275NH
15	Carbon steel	Plate, sheet, bar	SA-36	...
16	Carbon steel	Plate, sheet	SA-662	A
17	Carbon steel	Sheet, strip	SA-1011	36
18	Carbon steel	Plate	SA/EN 10028-2	P265GH
19	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH
20	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A
21	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR
22	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0
23	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C
24	Carbon steel	Forgings	SA-181	...
25	Carbon steel	Castings	SA-216	WCA
26	Carbon steel	Forgings	SA-266	1
27	Carbon steel	Bolting	SA-307	A
28	Carbon steel	Bolting	SA-307	B
29	Carbon steel	Forgings	SA-350	LF1
30	Carbon steel	Castings	SA-352	LCA
31	Carbon steel	Cast pipe	SA-660	WCA
32	Carbon steel	Bar	SA-675	60
33	Carbon steel	Forgings	SA-765	I
34	Carbon steel	Plate	SA-515	60
35	Carbon steel	Plate	SA-516	60
36	Carbon steel	Wld. pipe	SA-671	CB60
37	Carbon steel	Wld. pipe	SA-671	CC60
38	Carbon steel	Wld. pipe	SA-671	CE60
39	Carbon steel	Wld. pipe	SA-672	B60
40	Carbon steel	Wld. pipe	SA-672	C60
41	Carbon steel	Wld. pipe	SA-672	E60
42	Carbon steel	Wld. pipe	SA-134	A283D
43	Carbon steel	Plate	SA-283	D
44	Carbon steel	Wld. pipe	SA-53	E/B
45	Carbon steel	Smls. pipe	SA-53	S/B

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K03008	...	...	380
2	K03008	...	...	380
3	K01800	...	...	380
4	K02104	...	...	380
5	K02801	...	...	380
6	K02202	...	...	380
7	K02801	...	...	380
8	K02001	...	...	380
9	K01800	...	...	380
10	K02202	...	...	380
11	K02503	...	...	380
12	SS	...	$t \leq 6$	380
13	HSLAS	2	...	380
14	...	...	≤ 60	390
15	K02600	...	...	400
16	K01701	...	...	400
17	SS	Type 2	$t \leq 6$	400
18	...	...	≤ 60	410
19	...	...	$t \leq 60$	410
20	...	...	...	410
21	...	...	...	410
22	...	...	...	410
23	...	...	...	410
24	K03502	60	...	415
25	J02502	...	...	415
26	K03506	...	...	415
27	...	...	$6 \leq t \leq 100$	415
28	...	...	...	415
29	K03009	1	...	415
30	J02504	...	...	415
31	J02504	...	...	415
32	...	...	...	415
33	K03046	...	...	415
34	K02401	...	...	415
35	K02100	...	...	415
36	K02401	...	...	415
37	K02100	...	...	415
38	K02402	...	...	415
39	K02401	...	...	415
40	K02100	...	...	415
41	K02402	...	...	415
42	K02702	...	...	415
43	K02702	...	...	415
44	K03005	...	...	415
45	K03005	...	...	415

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
7	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
8	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
9	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
10	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
11	379	379	379	379	379	379	379	379	379	374	350	322	292	261	232
12	379	379	379	379	379	379	379	379	...	...	...	...	...	...	...
13	379	379	379	379	379	379	379	379	...	...	...	...	...	...	...
14	390	390	390	390	390	390	390	390	390	385	361	333	302	269	238
15	400	400	400	400	400	400	400	400	400	394	369	340	308	275	245
16	400	400	400	400	400	400	400	400	400	394	369	340	308	275	245
17	402	400	400	400	400	400	...	...	...	...	...	...	...	...	...
18	410	410	410	410	410	410	410	410	410	404	379	349	316	282	250
19	410	410	410	410	410	410	410	410	410	404	379	349	316	282	250
20	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
21	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
22	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
23	410	410	410	410	410	410	410	410	...	...	...	...	...	...	...
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
44	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
45	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

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	Carbon steel	Smls. pipe	SA-106	B
2	Carbon steel	Wld. pipe	SA-135	B
3	Carbon steel	Smls. & wld. ftgs.	SA-234	WPB
4	Carbon steel	Smls. & wld. pipe	SA-333	6
5	Carbon steel	Smls. & wld. tube	SA-334	6
6	Carbon steel	Forged pipe	SA-369	FPB
7	Carbon steel	Forgings	SA-372	A
8	Carbon steel	Sheet	SA-414	D
9	Carbon steel	Smls. & wld. ftgs.	SA-420	WPL6
10	Carbon steel	Smls. pipe	SA-524	I
11	Carbon steel	Bar	SA-696	B
12	Carbon steel	Forgings	SA-727	...
13	Carbon steel	Wld. tube	SA-178	C
14	Carbon steel	Smls. tube	SA-210	A-1
15	Carbon steel	Smls. tube	SA-556	B2
(25) 16	...	...	...	...
17	Carbon steel	Plate, bar	SA/CSA-G40.21	38W
18	Carbon steel	Plate, sheet, bar	SA-572	42
19	Carbon steel	Sheet, strip	SA-1011	45
20	Carbon steel	Sheet, strip	SA-1011	45
21	Carbon steel	Sheet, strip	SA-1011	50
22	Carbon steel	Plate	SA/AS 1548	PT430
23	Carbon steel	Plate	SA/EN 10028-2	P295GH
24	Carbon steel	Plate	SA/EN 10028-2	P295GH
25	Carbon steel	Bar	SA-675	65
26	Carbon steel	Castings	SA-352	LCB
27	Carbon steel	Plate	SA-515	65
28	Carbon steel	Plate	SA-516	65
29	Carbon steel	Wld. pipe	SA-671	CB65
30	Carbon steel	Wld. pipe	SA-671	CC65
31	Carbon steel	Wld. pipe	SA-672	B65
32	Carbon steel	Wld. pipe	SA-672	C65
33	Carbon steel	Sheet	SA-414	E
34	Carbon steel	Plate	SA-662	B
35	Carbon steel	Plate	SA-537	...
36	Carbon steel	Wld. pipe	SA-691	CMSH-70
37	Carbon steel	Plate, bar	SA/CSA-G40.21	44W
38	Carbon steel	Plate, bar	SA/CSA-G40.21	50W
39	Carbon steel	Plate, sheet, bar	SA-572	50
40	Carbon steel	Round bar	SA-572	50
41	Carbon steel	Sheet, strip	SA-1011	50
42	Carbon steel	Sheet, strip	SA-1011	50
(25) 43	Carbon steel	Bolting	SA-311	1018
44	Carbon steel	Sheet, strip	SA-1011	55
45	Carbon steel	Plate	SA/AS 1548	PT460

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K03006	...	...	415
2	...	...	...	415
3	K03006	...	...	415
4	K03006	...	...	415
5	K03006	...	...	415
6	K03006	...	...	415
7	K03002	...	...	415
8	K02505	...	...	415
9	...	...	...	415
10	K02104	...	...	415
11	K03200	...	...	415
12	K02506	...	...	415
13	K03503	...	...	415
14	K02707	...	...	415
15	K02707	...	...	415
16	...	...	...	...
17	...	...	...	415
18	...	...	$t \leq 150$	415
19	HSLAS	1	...	410
20	SS	...	$t \leq 6$	410
21	HSLAS	2	...	410
22	...	...	≤ 150	430
23	...	...	$150 < t \leq 250$	430
24	...	...	$100 < t \leq 150$	440
25	...	...	...	450
26	J03003	...	...	450
27	K02800	...	...	450
28	K02403	...	...	450
29	K02800	...	...	450
30	K02403	...	...	450
31	K02800	...	...	450
32	K02403	...	...	450
33	K02704	...	...	450
34	K02203	...	...	450
35	K12437	1	$65 < t \leq 100$	450
36	K12437	...	$65 < t \leq 100$	450
37	...	...	$t \leq 200$	450
38	...	...	$t \leq 150$	450
39	...	...	$t \leq 100$	450
40	...	...	$t \leq 275$	450
41	SS	...	$t \leq 6$	450
42	HSLAS	1	...	450
43	G10180	A	$20 < t \leq 30$	450
44	HSLAS	2	...	450
45	...	...	≤ 150	460

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
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	414	414	414	414	414	414	414	414	408	382	352	319	285	253
10	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
11	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
12	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
13	414	414	414	414	414	414	414	414	414	408	382	352	319	285	253
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	414	400	400	400	400	400	400	400	399	395	370	340	308	275	245
18	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
19	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
20	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
21	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
22	431	431	431	431	431	431	431	431	431	425	398	366	332	296	264
23	430	430	430	430	430	430	430	430	430	424	397	366	331	296	263
24	441	441	441	441	441	441	441	441	441	435	408	375	338	303	270
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	442	414	381	345	308	274
27	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
28	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
29	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
30	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
31	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
32	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
33	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
34	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
35	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
36	448	448	448	448	448	448	448	448	448	442	414	381	345	308	274
37	448	448	448	448	448	448	448	448	448	441	414	382	346	309	274
38	448	448	448	448	448	448	448	448	448	441	414	382	346	309	274
39	452	448	448	448	448	448	448	448	...	...	...	...	...	...	...
40	452	448	448	448	448	448	448	448	...	...	...	...	...	...	...
41	452	448	448	448	448	448	448	448	...	...	...	...	...	...	...
42	452	448	448	448	448	448	448	448	...	...	...	...	...	...	...
43	448	448	448	448	448	448	448	448	448	442	434	381	345	309	274
44	452	448	448	448	448	448	448	448	...	...	...	...	...	...	...
45	458	458	458	458	458	458	458	458	458	452	424	389	353	315	281

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	Carbon steel	Plate	SA/EN 10028-2	P295GH
2	Carbon steel	Forgings	SA/EN 10222-2	P280GH
3	Carbon steel	Plate	SA/EN 10028-2	P355GH
4	Carbon steel	Plate	SA/GB 713	Q345R
5	Carbon steel	Plate	SA/EN 10025-2	S355J2+N
6	Carbon steel	Plate	SA/EN 10028-2	P355GH
7	Carbon steel	Plate	SA/GB 713	Q345R
8	Carbon steel	Plate	SA-455	...
9	Carbon steel	Bar	SA-675	70
10	Carbon steel	Forgings	SA-105	...
11	Carbon steel	Forgings	SA-181	...
12	Carbon steel	Castings	SA-216	WCB
13	Carbon steel	Forgings	SA-266	2
14	Carbon steel	Forgings	SA-266	4
15	Carbon steel	Forgings	SA-350	LF2
16	Carbon steel	Forgings	SA-508	1
17	Carbon steel	Forgings	SA-508	1A
18	Carbon steel	Forgings	SA-541	1
19	Carbon steel	Forgings	SA-541	1A
20	Carbon steel	Cast pipe	SA-660	WCB
21	Carbon steel	Forgings	SA-765	II
22	Carbon steel	Plate	SA-515	70
23	Carbon steel	Plate	SA-516	70
24	Carbon steel	Wld. pipe	SA-671	CB70
25	Carbon steel	Wld. pipe	SA-671	CC70
26	Carbon steel	Wld. pipe	SA-672	B70
27	Carbon steel	Wld. pipe	SA-672	C70
28	Carbon steel	Smls. pipe	SA-106	C
29	Carbon steel	Wld. tube	SA-178	D
30	Carbon steel	Smls. tube	SA-210	C
31	Carbon steel	Castings	SA-216	WCC
32	Carbon steel	Smls. & wld. fittings	SA-234	WPC
33	Carbon steel	Castings	SA-352	LCC
34	Carbon steel	Castings	SA-487	16
35	Carbon steel	Plate	SA-537	...
36	Carbon steel	Smls. tube	SA-556	C2
(25) 37	...	...	...	...
38	Carbon steel	Cast pipe	SA-660	WCC
39	Carbon steel	Bar	SA-696	C
40	Carbon steel	Sheet	SA-414	F
41	Carbon steel	Plate	SA-662	C
42	Carbon steel	Plate	SA-537	...
43	Carbon steel	Plate	SA-738	C
44	Carbon steel	Plate	SA-537	...
45	Carbon steel	Wld. pipe	SA-671	CD70

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	...	≤ 100	460
2	...	N, NT, or QT	$t \leq 160$	460
3	...	...	$150 < t \leq 250$	470
4	...	...	$150 < t \leq 250$	470
5	...	...	$3 \leq t \leq 80$	470
6	...	...	$100 < t \leq 150$	480
7	...	...	$100 < t \leq 150$	480
8	K03300	...	$15 < t \leq 20$	485
9	...	...	...	485
10	K03504	...	...	485
11	K03502	70	...	485
12	J03002	...	...	485
13	K03506	...	...	485
14	K03017	...	...	485
15	K03011	...	...	485
16	K13502	...	...	485
17	K13502	...	...	485
18	K03506	...	...	485
19	K03020	...	...	485
20	J03003	...	...	485
21	K03047	...	...	485
22	K03101	...	...	485
23	K02700	...	...	485
24	K03101	...	...	485
25	K02700	...	...	485
26	K03101	...	...	485
27	K02700	...	...	485
28	K03501	...	...	485
29	...	...	...	485
30	K03501	...	...	485
31	J02503	...	...	485
32	K03501	...	...	485
33	J02505	...	...	485
34	...	A	...	485
35	K12437	3	$100 < t \leq 150$	485
36	K03006	...	...	485
37	...	...	...	...
38	J02505	...	...	485
39	K03200	...	...	485
40	K03102	...	...	485
41	K02007	...	...	485
42	K12437	2	$100 < t \leq 150$	485
43	K02008	...	$100 < t \leq 150$	485
44	K12437	1	≤ 65	485
45	K12437	...	≤ 65	485

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	458	458	458	458	458	458	458	458	458	452	424	389	353	315	281
2	460	460	460	460	460	460	460	460	460	452	424	391	354	316	279
3	470	470	470	470	470	470	470	470	470	451	430	402	368	327	283
4	470	470	470	470	470	470	470	470	470	463	433	399	361	322	286
5	470	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	480	480	480	480	480	480	480	480	480	461	439	411	376	334	289
7	480	480	480	480	480	480	480	480	480	473	443	407	368	329	293
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	483	483	483	483	483	483	483	483	476	446	411	372	332	296
20	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
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	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
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	483	483	483	483	483	483	483	483	476	446	411	372	332	296
29	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
30	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
31	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
32	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
33	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
34	483	477	452	437	432	432	432	432	431	429	410	390	...	...	...
35	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
36	483	483	483	483	483	483	483	483	483	476	446	411	372	332	296
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	482	476	472	472	472	472	472	471	466	452	437	...	...	...
43	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
44	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
45	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	Carbon steel	Wld. pipe	SA-672	D70
2	Carbon steel	Wld. pipe	SA-691	CMSH-70
3	Carbon steel	Plate	SA-841	A
4	Carbon steel	Plate, sheet, bar	SA-572	55
5	Carbon steel	Round bar	SA-572	55
6	Carbon steel	Sheet, strip	SA-1011	55
(25) 7	Carbon steel	Bolting	SA-311	1018
8	Carbon steel	Sheet, strip	SA-1011	60
(25) 9	Carbon steel	Forgings	SA/EN 10222-2	P305GH
10	Carbon steel	Plate	SA/EN 10028-2	P355GH
11	Carbon steel	Plate	SA/GB 713	Q345R
12	Carbon steel	Plate	SA/GB 713	Q345R
13	Carbon steel	Plate	SA-455	...
(25) 14	Carbon steel	Forgings	SA/EN 10222-2	P305GH
15	Carbon steel	Plate	SA/EN 10028-2	P355GH
16	Carbon steel	Plate	SA/GB 713	Q345R
17	Carbon steel	Plate	SA/EN 10025-2	S355J2+N
18	Carbon steel	Forgings	SA-266	3
19	Carbon steel	Plate	SA-455	...
20	Carbon steel	Plate	SA-299	A
21	Carbon steel	Wld. pipe	SA-671	CK75
22	Carbon steel	Wld. pipe	SA-672	N75
23	Carbon steel	Wld. pipe	SA-691	CMS-75
24	Carbon steel	Plate	SA-299	A
25	Carbon steel	Wld. pipe	SA-691	CMS-75
26	Carbon steel	Forgings	SA-372	B
27	Carbon steel	Sheet	SA-414	G
28	Carbon steel	Plate	SA-738	A
29	Carbon steel	Plate	SA-537	...
30	Carbon steel	Plate	SA-537	...
31	Carbon steel	Wld. pipe	SA-691	CMSH-80
32	Carbon steel	Plate	SA-738	C
33	Carbon steel	Plate, sheet, bar	SA-572	60
34	Carbon steel	Round bar	SA-572	60
35	Carbon steel	Sheet, strip	SA-1011	60
36	Carbon steel	Plate	SA-299	B
37	Carbon steel	Plate	SA-299	B
38	Carbon steel	Forgings	SA-765	IV
39	Carbon steel	Plate	SA-537	...
40	Carbon steel	Plate	SA-537	...
41	Carbon steel	Wld. pipe	SA-671	CD80
42	Carbon steel	Wld. pipe	SA-672	D80
43	Carbon steel	Plate	SA-738	C
44	Carbon steel	Wld. pipe	SA-691	CMSH-80
45	Carbon steel	Plate	SA-841	B

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K12437	...	≤ 65	485
2	K12437	...	≤ 65	485
3	...	1	≤ 65	485
4	...	...	$t \leq 50$	485
5	...	...	$t \leq 90$	485
6	HSLAS	1	...	480
7	G10180	A	$t \leq 20$	485
8	HSLAS	2	...	480
9	...	N, NT, or QT	$70 < t \leq 160$	490
10	...	...	$60 < t \leq 100$	490
11	...	...	$36 < t \leq 100$	490
12	...	...	$16 < t \leq 36$	500
13	K03300	...	$9.5 < t \leq 15$	505
14	...	N, NT, or QT	$t \leq 70$	510
15	...	...	≤ 60	510
16	...	...	$3 \leq t \leq 16$	510
17	...	...	$t < 3$	510
18	K05001	...	...	515
19	K03300	...	≤ 9.5	515
20	K02803	...	> 25	515
21	K02803	...	> 25	515
22	K02803	...	> 25	515
23	K02803	...	> 25	515
24	K02803	...	≤ 25	515
25	K02803	...	≤ 25	515
26	K04001	...	...	515
27	K03103	...	...	515
28	K12447	...	...	515
29	K12437	3	$65 < t \leq 100$	515
30	K12437	2	$65 < t \leq 100$	515
31	K12437	...	$65 < t \leq 100$	515
32	K02008	...	$65 < t \leq 100$	515
33	...	...	$t \leq 32$	520
34	...	...	$t \leq 90$	520
35	HSLAS	1	...	520
36	K02803	...	> 25	550
37	K02803	...	≤ 25	550
38	K02009	...	...	550
39	K12437	3	≤ 65	550
40	K12437	2	≤ 65	550
41	K12437	...	≤ 65	550
42	K12437	...	≤ 65	550
43	K02008	...	≤ 65	550
44	K12437	...	≤ 65	550
45	...	2	≤ 65	550

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
2	483	482	476	472	472	472	472	472	471	466	452	437	...	...	...
3	483	483	483	483	483	483	480	468	448	421	...	...	...	...	...
4	487	483	483	483	483	483	483	483	...	...	...	...	...	...	...
5	487	483	483	483	483	483	483	483	...	...	...	...	...	...	...
6	482	483	483	483	483	483	483	483	...	...	...	...	...	...	...
7	483	483	483	483	483	483	483	483	483	476	445	410	372	332	295
8	482	483	483	483	483	483	483	483	...	...	...	...	...	...	...
9	490	490	490	490	490	490	490	490	490	482	452	416	377	336	298
10	490	490	490	490	490	490	490	490	490	470	449	419	383	341	295
11	490	490	490	490	490	490	490	490	490	482	452	416	376	336	299
12	500	500	500	500	500	500	500	500	500	492	461	424	384	342	305
13	503	503	503	503	503	503	503	503	503	496	465	428	388	346	308
14	510	510	510	510	510	510	510	510	510	501	470	433	393	350	310
15	510	510	510	510	510	510	510	510	510	490	467	437	399	355	307
16	510	510	510	510	510	510	510	510	510	502	470	433	391	349	311
17	510	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
19	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
20	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
21	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
22	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
23	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
24	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
25	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
26	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
27	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
28	517	517	517	517	517	517	517	517	516	510	478	440	399	356	316
29	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
30	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
31	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
32	517	517	510	506	505	505	505	505	505	499	484	469	...	...	...
33	522	522	518	516	516	516	516	516	...	...	...	...	...	...	...
34	522	522	518	516	516	516	516	516	...	...	...	...	...	...	...
35	522	522	518	516	516	516	516	516	...	...	...	...	...	...	...
36	552	552	552	552	552	552	552	552	552	543	509	469	425	379	337
37	552	552	552	552	552	552	552	552	552	543	509	469	425	379	337
38	552	552	551	546	545	545	545	542	535	...	...	...	...	...	...
39	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
40	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
41	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
42	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
43	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
44	552	551	544	539	538	538	538	538	538	533	517	500	...	...	...
45	552	552	552	552	552	552	548	535	512	482	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
	1 Carbon steel	Plate, sheet, bar	SA-572	65
(25)	2 Carbon steel	Bolting	SA-311	1035
	3 Carbon steel	Plate	SA-612	...
	4 Carbon steel	Plate	SA-841	F
	5 Carbon steel	Plate	SA-612	...
	6 Carbon steel	Plate	SA-738	B
(25)	7 Carbon steel	Bolting	SA-311	1035
	8 Carbon steel	Plate	SA-841	F
	9 Carbon steel	Forgings	SA-372	C
	10 Carbon steel	Bolting	SA-449	...
	11 Carbon steel	Plate	SA-724	A
	12 Carbon steel	Plate	SA-724	C
(25)	13 Carbon steel	Bolting	SA-311	1045
	14 Carbon steel	Plate	SA-724	B
(25)	15 Carbon steel	Bolting	SA-311	1045
(25)	16 Carbon steel	Bolting	SA-311	1050
(25)	17 Carbon steel	Bolting	SA-311	1050
(25)	18 ...	...	...	...
(25)	19 Carbon steel	Bolting	SA-325	1
	20 Carbon steel	Bolting	SA-449	...
	21 Carbon steel	Bolting	SA-354	BC
(25)	22 Carbon steel	Bolting	SA-311	1045
	23 Carbon steel	Bolting	SA-325	1
	24 Carbon steel	Bolting	SA-449	...
	25 Carbon steel	Bolting	SA-354	BC
	26 Carbon steel	Bolting	SA-354	BD
	27 Carbon steel	Bolting	SA-354	BD
(25)	28 Carbon steel	Flat wire	SA-905	...
(25)	29 Carbon steel	Flat wire	SA-905	...
(25)	30 Carbon steel	Flat wire	SA-905	...
(25)	31 Carbon steel	Flat wire	SA-905	...
(25)	32 Carbon steel	Flat wire	SA-905	...
(25)	33 Carbon steel	Flat wire	SA-905	...
(25)	34 Carbon steel	Flat wire	SA-905	...
(25)	35 Carbon steel	Flat wire	SA-905	...
(25)	36 Carbon steel	Flat wire	SA-905	...
(25)	37 Carbon steel	Flat wire	SA-905	...
	38 Ductile cast iron	Castings	SA-874	...
	39 Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT
	40 C-Mn-Si-Cb	Plate	SA-737	B
	41 C-Mn-Si-Cb	Plate	SA/AS 1548	PT490
	42 C-Mn-Si-Cb	Plate	SA/GB 713	Q730R
	43 C-Mn-Si-Cb	Plate	SA/GB 713	Q370R
	44 C-Mn-Si-Cb	Plate	SA/GB 713	Q370R
	45 C-Mn-Si-V	Plate	SA-737	C

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Design./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	...	$t \leq 32$	550
2	G10350	A	$20 < t \leq 30$	550
3	K02900	...	≤ 12.5	560
4	...	6	$t \leq 32$	565
5	K02900	...	≤ 12.5	570
6	K12007	...	...	585
7	G10350	A	$t \leq 20$	590
8	...	7	$t \leq 25$	593
9	K04801	...	...	620
10	K04200	...	$38 < t \leq 75$	620
11	K11831	...	...	620
12	K12037	...	...	620
13	G10450	A	$20 < t \leq 30$	620
14	K12031	...	...	655
15	G10450	A	$t \leq 20$	655
16	G10500	A	$20 < t \leq 30$	655
17	G10500	A	$t \leq 20$	690
18	...	...	...	...
19	K02706	...	$25 < t \leq 38$	725
20	K04200	...	$25 < t \leq 38$	725
21	K04100	...	$64 < t \leq 100$	795
22	G10450	B	$t \leq 75$	795
23	K02706	...	$13 \leq t \leq 25$	825
24	K04200	...	≤ 25	825
25	K04100	...	$6 < t \leq 64$	860
26	K04100	...	$64 < t \leq 100$	965
27	K04100	...	$6 < t \leq 64$	1035
28	...	2	1.5	1695
29	...	2	1.3	1725
30	...	2	1.02	1765
31	...	2	0.76	1805
32	...	2	0.51	1850
33	...	1	1.5	1895
34	...	1	1.3	1930
35	...	1	1.02	1965
36	...	1	0.76	2000
37	...	1	0.51	2040
38	...	...	$300 < t < 530$	300
39	...	...	$300 < t < 530$	300
40	K12001	...	...	485
41	...	...	≤ 150	490
42	...	Normalized	$60 < t \leq 100$	510
43	...	Normalized	$36 < t \leq 60$	520
44	...	Normalized	$10 \leq t \leq 36$	530
45	K12202	...	...	550

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	552	552	548	546	546	546	546	546	...	...	...	...	...	...	...
2	552	552	552	552	552	552	552	552	552	544	509	469	425	380	337
3	558	558	547	547	547	547	547	547	547	...	...	...	...	...	...
4	565	565	565	565	565	565	560	551	...	...	...	...	...	...	...
5	572	571	561	561	561	561	561	561	561	...	...	...	...	...	...
6	586	586	586	586	586	583	578	569	556	539	516	493	...	...	...
7	586	586	586	586	586	586	586	586	586	578	541	498	452	403	358
8	593	593	593	593	593	593	587	578	...	...	...	...	...	...	...
9	621	621	621	621	621	621	621	621	621	612	573	528	478	426	380
10	621	621	621	621	621	621	621	621	621	612	573	528	478	426	380
11	621	620	612	606	606	606	606	606	606	599	581	563	...	...	...
12	621	620	612	606	606	606	606	606	606	599	581	563	...	...	...
13	621	621	621	621	621	621	621	621	621	612	573	528	478	427	379
14	655	654	646	640	640	640	640	640	640	633	614	594	...	...	...
15	655	655	655	655	655	655	655	655	655	646	604	557	505	451	400
16	655	655	655	655	655	655	655	655	655	646	604	557	505	451	400
17	690	690	690	690	690	690	690	690	690	680	636	586	531	475	421
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	724	723	714	708	707	707	707	707	706	699	678	640	577	483	335
20	724	723	714	708	707	707	707	707	706	699	678	640	577	483	335
21	793	793	793	793	793	793	793	791	779	726	667	603	538	479	423
22	793	793	793	793	793	793	793	793	793	781	732	674	611	546	485
23	827	827	816	809	808	808	808	808	808	800	775	732	660	552	384
24	827	827	816	809	808	808	808	808	808	800	775	732	660	552	384
25	862	862	862	862	862	862	862	862	862	850	796	733	664	592	528
26	965	965	965	965	965	965	965	965	965	952	891	820	744	663	591
27	1030	1030	1030	1030	1030	1030	1030	1030	1030	1020	952	875	792	706	627
28	1696	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	1724	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	1765	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	1806	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	1896	1758	...	...	...	...	...	...	...	...	...	...	...	...	...
34	1931	1793	...	...	...	...	...	...	...	...	...	...	...	...	...
35	1965	1828	...	...	...	...	...	...	...	...	...	...	...	...	...
36	1999	1852	...	...	...	...	...	...	...	...	...	...	...	...	...
37	2041	1904	...	...	...	...	...	...	...	...	...	...	...	...	...
38	300	297	285	276	270	267	263	257	...	...	...	...	...	...	...
39	300	297	285	276	270	267	263	257	...	...	...	...	...	...	...
40	483	483	483	483	483	483	483	482	477	459	436	407	373	338	303
41	490	490	490	490	490	490	490	489	484	466	442	413	379	343	308
42	510	510	510	510	510	510	510	510	510	487	460	428	392	356	321
43	520	520	520	520	520	520	520	520	520	497	469	436	400	363	327
44	530	530	530	530	530	530	530	530	530	507	478	444	408	370	334
45	552	552	552	552	552	552	552	552	545	525	498	465	427	387	346

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

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

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	C-Mn-Si-V-Cb	Plate	SA-656	T3
2	C-Mn-Si-V-Cb	Plate	SA-656	T7
3	C-Mn-Si-V-Cb	Plate	SA-656	T3
4	C-Mn-Si-V-Cb	Plate	SA-656	T7
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-Ti	Plate, sheet	SA-562	...
10	C-Si-Ti	Forgings	SA-836	...
(25) 11	C- $\frac{1}{4}$ Mo	Bolting	SA-320	L7A
12	Alloy steel	Bolting	SA/ISO 898-1	9.8
13	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037
14	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042
15	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4140
16	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037
17	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042
18	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3
19	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1b
20	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1b
21	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1
22	C- $\frac{1}{2}$ Mo	Smls. & wld. ftgs.	SA-234	WP1
23	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1
24	C- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P1
25	C- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP1
26	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1a
27	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1a
28	C- $\frac{1}{2}$ Mo	Castings	SA-217	WC1
29	C- $\frac{1}{2}$ Mo	Castings	SA-352	LC1
30	C- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP1
31	C- $\frac{1}{2}$ Mo	Plate	SA-204	A
32	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L65
33	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-65
34	C- $\frac{1}{2}$ Mo	Forgings	SA-182	F1
35	C- $\frac{1}{2}$ Mo	Plate	SA-204	B
36	C- $\frac{1}{2}$ Mo	Forgings	SA-336	F1
37	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L70
38	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-70
39	C- $\frac{1}{2}$ Mo	Plate	SA-204	C
40	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L75
41	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-75
42	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G
43	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H
44	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G
45	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	...	≤50	414
2	...	...	≤50	414
3	...	...	≤40	483
4	...	...	≤40	483
5	...	...	≤25	552
6	...	...	≤25	552
7	...	...	≤20	621
8	...	...	≤20	621
9	K11224	...	...	380
10	...	1	...	380
11	G40370	...	≤65	860
12	...	...	$d \leq 16$	900
13	G40370	...	≥16	1170
14	G40420	...	≥16	1170
15	G41400	...	≥16	1170
16	G40370	...	≤13	1240
17	G40420	...	≤13	1240
18	...	...	$t \leq 60$	450
19	K11422	...	...	365
20	K11422	...	...	365
21	K11522	...	...	380
22	K12821	...	...	380
23	K11522	...	...	380
24	K11522	...	...	380
25	K11522	...	...	380
26	K12023	...	...	415
27	K12023	...	...	415
28	J12524	...	...	450
29	J12522	...	...	450
30	J12521	...	...	450
31	K11820	...	...	450
32	K11820	...	...	450
33	K11820	...	...	450
34	K12822	...	...	485
35	K12020	...	...	485
36	K12520	...	...	485
37	K12020	...	...	485
38	K12020	...	...	485
39	K12320	...	...	515
40	K12320	...	...	515
41	K12320	...	...	515
42	K13049	55	...	585
43	K13547	55	...	585
44	K13049	65	...	725
45	K13547	65	...	725

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...
2	414	414	414	414	414	414	414	414	...	...	...	...	...	...	...
3	483	483	483	483	483	483	483	483	...	...	...	...	...	...	...
4	483	483	483	483	483	483	483	483	...	...	...	...	...	...	...
5	552	552	552	552	552	552	552	552	...	...	...	...	...	...	...
6	552	552	552	552	552	552	552	552	...	...	...	...	...	...	...
7	621	621	621	621	621	621	621	621	...	...	...	...	...	...	...
8	621	621	621	621	621	621	621	621	...	...	...	...	...	...	...
9	379	301	286	273	264	257	253	249	245	240	...	...	...	...	...
10	379	372	349	334	323	314	309	304	299	293	...	...	...	...	...
11	862	862	862	862	862	862	862	862	862	850	796	733	664	592	528
12	900	900	900	...	...	...	...	...	...	...	...	...	...	...	...
13	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
14	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
15	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1170	1150	1110	1050	982
16	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1220	1170	1110	1040
17	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1220	1170	1110	1040
18	450	450	450	450	450	450	450	450	450	450	450	442	424	403	377
19	365	365	365	365	365	365	365	365	365	365	365	359	345	327	306
20	365	365	365	365	365	365	365	365	365	365	365	359	345	327	306
21	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
22	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
23	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
24	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
25	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
26	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
27	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
28	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
29	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
30	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
31	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
32	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
33	448	448	448	448	448	448	448	448	448	448	448	440	422	401	376
34	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
35	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
36	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
37	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
38	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
39	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
40	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
41	517	517	517	517	517	517	517	517	517	517	517	508	487	463	433
42	586	586	586	586	586	586	586	585	563	538	511	481	449	417	386
43	586	586	586	586	586	586	586	585	563	538	511	481	449	417	386
44	724	724	724	724	724	724	724	723	696	665	631	594	555	516	476
45	724	724	724	724	724	724	724	723	696	665	631	594	555	516	476

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	G
2	$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	H
3	$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}-\text{V}$	Plate	SA-517	B
4	$\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{Si}$	Plate	SA-517	A
5	$\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{Si}$	Forgings	SA-592	A
6	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P2
7	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP2
8	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2
9	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$
10	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T2
11	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP2
12	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F2
13	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2
14	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$
15	$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	Wld. tube	SA-423	1
16	$\frac{3}{4}\text{Cr}-\frac{3}{4}\text{Ni}-\text{Cu}-\text{Al}$	Pipe	SA-333	4
(25) 17	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 18	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 19	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 20	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 21	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 22	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 23	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 24	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 25	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 26	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 27	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 28	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 29	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 30	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 31	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 32	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 33	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 34	0.7Cr-1.5Si	Wire	SA-401	9254
(25) 35	0.7Cr-1.5Si	Wire	SA-401	9254
36	1Cr- $\frac{1}{5}\text{Mo}$	Forgings	SA-372	E
37	1Cr- $\frac{1}{5}\text{Mo}$	Forgings	SA-372	F
38	1Cr- $\frac{1}{5}\text{Mo}$	Forgings	SA-372	J
39	1Cr- $\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7
(25) 40	Alloy steel	Bolting	SA/ISO 898-1	8.8
(25) 41	Alloy steel	Bolting	SA/ISO 898-1	8.8
42	1Cr- $\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7M
43	1Cr- $\frac{1}{5}\text{Mo}$	Bolting	SA-320	L7M
44	1Cr- $\frac{1}{5}\text{Mo}$	Forgings	SA-372	F
45	1Cr- $\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K13049	70	...	825
2	K13547	70	...	825
3	K11630	...	≤32	795
4	K11856	...	≤32	795
5	K11856	...	≤65	795
6	K11547	...	...	380
7	K11547	...	...	380
8	K12143	1	...	380
9	K12143	...	...	380
10	K11547	...	...	415
11	J11547	...	...	415
12	K12122	...	...	485
13	K12143	2	...	485
14	K12143	...	...	485
15	K11535	...	...	415
16	K11267	...	...	415
17	G92540	QT	6	1740
18	G92540	QT	5.5	1760
19	G92540	QT	5	1780
20	G92540	QT	4.5	1800
21	G92540	QT	4	1820
22	G92540	QT	3.5	1840
23	G92540	QT	3	1860
24	G92540	QT	2.8	1880
25	G92540	QT	2.5	1900
26	G92540	QT	2.2	1920
27	G92540	QT	2	1940
28	G92540	QT	1.8	1960
29	G92540	QT	1.6	1980
30	G92540	QT	1.4	2000
31	G92540	QT	1.2	2020
32	G92540	QT	1.1	2040
33	G92540	QT	1	2060
34	G92540	QT	0.9	2070
35	G92540	QT	0.8	2080
36	K13047	55	...	585
37	G41350	55	...	585
38	K13548	55	...	585
39	G41400	...	100 < t ≤ 180	690
40	...	...	d ≤ 16	800
41	...	...	d > 16	830
42	G41400	...	≤100	690
43	G41400	...	≤65	690
44	G41350	65	...	725
45	G41400	...	64 < t ≤ 100	795

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
2	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
3	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
4	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
5	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
6	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
7	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
8	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
9	379	379	379	379	379	379	379	379	379	379	379	372	357	339	318
10	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
11	414	414	414	414	414	414	414	414	414	414	414	406	390	370	347
12	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
13	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
14	483	483	483	483	483	483	483	483	483	483	483	474	455	432	404
15	414	414	414	414	414	414	414	414	414	414	414	414	414	...	...
16	414	414	414	414	414	414	414	414	414	414	414	414	414	...	...
17	1739	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	1761	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	1786	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	1793	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	1858	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	1898	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	1908	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	1923	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	1946	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	1967	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	1982	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	1999	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	2013	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	2035	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	2055	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	2057	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	2063	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	2068	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	586	586	586	586	586	586	586	585	563	538	511	481	449	417	386
37	586	586	586	586	586	586	586	585	563	538	511	481	449	417	386
38	586	586	586	586	586	586	586	585	563	538	511	481	449	417	386
39	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
40	800	800	800	...	...	...	...	...	...	...	...	...	...	...	...
41	830	830	830	...	...	...	...	...	...	...	...	...	...	...	...
42	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
43	689	689	689	689	689	689	689	685	655	629	600	567	532	495	454
44	724	724	724	724	724	724	724	723	696	665	631	594	555	516	476
45	793	793	793	793	793	793	792	785	754	723	690	652	612	569	522

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
(25)	Ferrous Materials (Cont'd)			
	1 1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	E
	2 1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	F
	3 1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	J
	4 1Cr- $\frac{1}{5}$ Mo	Bolting	SA-193	B7
	5 1Cr- $\frac{1}{5}$ Mo	Bolting	SA-320	L7
	6 1Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	J
	7 1Cr- $\frac{1}{5}$ Mo-B	Forgings	SA-372	R
	8 1Cr- $\frac{1}{2}$ Mo	Plate	SA-387	12
	9 1Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	1CR
	10 1Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP12
	11 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12
	12 1Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T12
	13 1Cr- $\frac{1}{2}$ Mo	Smls. & wld. ftgs.	SA-234	WP12
	14 1Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P12
	15 1Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP12
	16 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5
	17 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5
	18 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5
	19 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5
	20 1Cr- $\frac{1}{2}$ Mo	Smls. tube	SA/EN 10216-2	13CrMo4-5
	21 1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR
	22 1Cr- $\frac{1}{2}$ Mo	Forgings	SA/EN 10222-2	13CrMo4-5
	23 1Cr- $\frac{1}{2}$ Mo	Plate	SA-387	12
	24 1Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	1CR
	25 1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5
	26 1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR
	27 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12
	28 1Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F12
	29 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16
	30 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16
	31 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	32 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	33 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16
	34 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	35 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	36 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	37 1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21
	38 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
	39 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
	40 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
	41 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
	42 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
	43 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
	44 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
	45 1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K13047	70	...	825
2	G41350	70	...	825
3	K13548	70	...	825
4	G41400	...	≤64	860
5	G41400	...	≤65	860
6	G41370	110	...	930
7	G41371	110	...	930
8	K11757	1	...	380
9	K11757	...	...	380
10	J11562	...	...	415
11	K11562	1	...	415
12	K11562	...	...	415
13	K12062	1	...	415
14	K11562	...	...	415
15	K11562	...	...	415
16	...	NT or QT	$250 < t \leq 500$	420
17	...	...	$150 < t \leq 250$	420
18	...	...	$100 < t \leq 150$	430
19	...	...	$60 < t \leq 100$	440
20	...	...	$t \leq 60$	440
21	...	...	$100 < t \leq 200$	440
22	...	NT or QT	$t \leq 250$	440
23	K11757	2	...	450
24	K11757	...	...	450
25	...	...	$t \leq 60$	450
26	...	...	$6 \leq t \leq 100$	450
27	K11564	2	...	485
28	K11564	...	...	485
29	K14072	...	$100 < t \leq 200$	690
30	K14072	...	$64 < t \leq 100$	760
31	K14073	5	$50 < t \leq 205$	795
32	K14073	5	≤50	825
33	K14072	...	≤64	860
34	K14073	4	≤150	930
35	K14073	3	≤150	1000
36	K14073	2	≤100	1070
37	K14073	1	≤100	1140
38	...	Oil	0.5	2060
39	...	Oil	0.5	2060
40	...	Oil	0.55	2050
41	...	Oil	0.55	2050
42	...	Oil	0.6	2030
43	...	Oil	0.6	2030
44	...	Oil	0.65	2010
45	...	Oil	0.65	2010

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
2	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
3	827	827	827	827	827	827	827	817	790	759	722	681	637	590	544
4	862	862	862	862	862	862	862	852	819	787	750	709	666	618	567
5	862	862	862	862	862	862	862	852	819	787	750	709	666	618	567
6	931	931	931	931	931	931	930	919	889	853	812	766	716	664	612
7	931	931	931	931	931	931	930	919	889	853	812	766	716	664	612
8	379	371	365	365	365	365	365	365	365	365	365	365	358	344	326
9	379	371	365	365	365	365	365	365	365	365	365	365	358	344	326
10	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
11	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
12	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
13	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
14	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
15	414	405	398	398	398	398	398	398	398	398	398	398	391	375	355
16	420	413	403	400	400	400	400	400	400	400	400	399	392	380	360
17	420	411	407	404	404	403	403	403	403	403	403	402	396	383	361
18	430	420	416	414	413	413	413	413	413	413	413	412	405	392	369
19	440	430	426	424	423	423	423	423	423	423	423	422	415	401	378
20	440	440	440	440	440	440	440	440	440	440	440	440	430	395	371
21	440	430	426	424	423	423	423	423	423	423	423	422	415	401	378
22	440	432	423	420	419	419	419	419	419	419	419	418	411	398	377
23	448	439	431	431	431	431	431	431	431	431	431	431	424	407	385
24	448	439	431	431	431	431	431	431	431	431	431	431	424	407	385
25	450	440	436	433	433	432	432	432	432	432	432	431	424	411	386
26	450	440	436	433	433	432	432	432	432	432	432	431	424	411	386
27	483	472	464	464	464	464	464	464	464	464	464	464	456	438	415
28	483	472	464	464	464	464	464	464	464	464	464	464	456	438	415
29	689	689	689	689	689	689	688	676	657	637	614	589	561	532	502
30	758	758	758	758	758	758	756	744	723	701	675	647	617	586	552
31	793	793	793	793	793	793	792	780	754	732	704	676	642	611	580
32	827	827	827	827	827	827	827	813	786	764	735	705	670	638	605
33	862	862	862	862	862	862	862	862	862	862	862	862	726	665	631
34	931	931	931	931	931	931	931	931	926	857	825	793	753	718	681
35	1000	1000	1000	1000	1000	1000	999	983	950	923	888	852	809	771	732
36	1070	1070	1070	1070	1070	1070	1070	1050	1020	986	949	910	865	824	782
37	1140	1140	1140	1140	1140	1140	1140	1120	1080	1050	1010	969	921	878	833
38	2060	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	2060	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	2050	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	2050	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	2030	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	2030	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	2010	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	2010	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
2	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
3	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
4	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
5	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
6	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
7	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
8	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
9	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
10	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
11	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
12	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
13	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
14	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
15	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
16	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
17	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
18	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
19	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
20	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
21	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
22	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
23	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
24	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
25	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
26	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
27	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
28	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
29	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
30	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
31	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
32	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
33	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
34	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
35	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
36	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
37	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
38	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
39	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
40	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
41	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
42	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
43	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
44	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
45	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Design./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	Oil	0.7	2000
2	...	Oil	0.7	2000
3	...	Oil	0.8	1980
4	...	Oil	0.8	1980
5	...	Oil	0.9	1960
6	...	Oil	0.9	1960
7	...	Oil	1	1940
8	...	Oil	1	1940
9	...	Oil	1.1	1920
10	...	Oil	1.1	1920
11	...	Oil	1.2	1900
12	...	Oil	1.2	1900
13	...	Oil	1.4	1860
14	...	Oil	1.4	1860
15	...	Oil	1.6	1820
16	...	Oil	1.6	1820
17	...	Oil	1.8	1800
18	...	Oil	1.8	1800
19	...	Oil	2	1780
20	...	Oil	2	1780
21	...	Oil	2.2	1750
22	...	Oil	2.2	1750
23	...	Oil	2.5	1720
24	...	Oil	2.5	1720
25	...	Oil	2.8	1680
26	...	Oil	2.8	1680
27	...	Oil	3	1660
28	...	Oil	3	1660
29	...	Oil	3.5	1620
30	...	Oil	3.5	1620
31	...	Oil	4	1580
32	...	Oil	4	1580
33	...	Oil	4.5	1560
34	...	Oil	4.5	1560
35	...	Oil	5	1520
36	...	Oil	5	1520
37	...	Oil	5.5	1480
38	...	Oil	5.5	1480
39	...	Oil	6	1460
40	...	Oil	6	1460
41	...	Oil	6.5	1440
42	...	Oil	6.5	1440
43	...	Oil	7	1420
44	...	Oil	7	1420
45	...	Oil	8	1400

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	2000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	2000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	1980	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	1980	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	1960	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	1960	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	1940	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	1940	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	1920	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	1920	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	1900	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	1900	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	1860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	1860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	1820	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	1820	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	1800	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	1800	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	1780	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	1780	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	1750	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	1750	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	1720	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	1720	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	1680	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	1680	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	1660	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	1660	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	1620	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	1620	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	1580	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	1580	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	1560	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	1560	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	1520	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	1520	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	1480	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	1480	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	1460	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	1460	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	1440	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	1440	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	1420	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	1420	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	1400	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
2	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
3	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
4	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
5	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
6	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
7	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
8	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-231	...
9	1Cr- $\frac{1}{4}$ Si-V	Wire	SA-232	...
10	1Cr-V	Smls. tube	SA-213	T17
11	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC6
12	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP11
13	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Bar	SA-739	B11
14	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11
15	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T11
16	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. & wld. ftgs.	SA-234	WP11
17	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P11
18	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11
19	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forged pipe	SA-369	FP11
20	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11
21	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	1 $\frac{1}{4}$ CR
22	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11
23	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11
24	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5
25	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5
26	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5
27	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11
28	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11
29	1 $\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	1 $\frac{1}{4}$ CR
30	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E
31	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E
32	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E
33	1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E
34	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22
35	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA-213	T22
36	2 $\frac{1}{4}$ Cr-1Mo	Smls. & wld. fittings	SA-234	WP22
37	2 $\frac{1}{4}$ Cr-1Mo	Smls. pipe	SA-335	P22
38	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22
39	2 $\frac{1}{4}$ Cr-1Mo	Forged pipe	SA-369	FP22
40	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22
41	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR
42	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10
43	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10
44	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10
45	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	Oil	8	1400
2	...	Oil	9	1380
3	...	Oil	9	1380
4	...	Oil	10	1360
5	...	Oil	10	1360
6	...	Oil	11	1340
7	...	Oil	11	1340
8	...	Oil	12	1320
9	...	Oil	12	1320
10	K12047	...	...	415
11	J12072	...	...	485
12	J12072	...	...	485
13	K11797	...	...	485
14	K11597	1	...	415
15	K11597	...	...	415
16	...	1	...	415
17	K11597	...	...	415
18	K11597	1	...	415
19	K11597	...	...	415
20	K11789	1	...	415
21	K11789	...	...	415
22	K11572	2	...	485
23	K11572	2	...	485
24	...	QT	$100 < t \leq 250$	490
25	...	QT	$60 < t \leq 100$	500
26	...	QT	≤ 60	510
27	K11572	3	...	515
28	K11789	2	...	515
29	K11789	...	...	515
30	K11695	...	$65 < t \leq 100$	725
31	K11695	...	≤ 65	795
32	K21604	...	$65 < t \leq 150$	725
33	K21604	...	≤ 65	795
34	K21590	1	...	415
35	K21590	...	...	415
36	K21590	1	...	415
37	K21590	...	...	415
38	K21590	1	...	415
39	K21590	...	...	415
40	K21590	1	...	415
41	K21590	...	...	415
42	...	...	$150 < t \leq 250$	450
43	...	NT or QT	$200 < t \leq 500$	450
44	...	...	$100 < t \leq 150$	460
45	...	...	$60 < t \leq 100$	470

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	1400	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	1380	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	1380	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	1360	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	1360	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	1340	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	1340	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	1320	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	1320	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
11	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
12	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
13	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
14	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
15	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
16	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
17	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
18	414	414	414	414	414	414	414	414	414	414	414	404	390	371	349
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	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
23	483	483	483	483	483	483	483	483	483	483	483	472	454	433	407
24	490	490	485	485	485	485	485	485	485	485	479	464	447	426	401
25	500	500	495	495	495	495	495	495	495	495	489	474	456	434	410
26	510	510	505	505	505	505	505	505	505	505	499	483	465	443	418
27	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
28	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
29	517	517	517	517	517	517	517	517	517	517	517	505	487	464	436
30	724	724	724	724	724	724	724	724	720	707	693	677	659	639	618
31	793	793	793	793	793	793	793	793	789	775	760	741	722	700	677
32	724	724	724	724	724	724	724	724	720	707	693	677	659	639	618
33	793	793	793	793	793	793	793	793	789	775	760	741	722	700	677
34	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
35	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
36	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
37	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
38	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
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
42	450	449	442	434	432	429	427	424	420	414	406	396	382	366	345
43	450	450	441	435	432	431	429	427	422	416	408	397	383	366	347
44	460	459	452	443	441	439	437	433	429	423	415	404	391	374	353
45	470	469	462	453	451	448	446	443	438	432	424	413	399	382	360

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10
2	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA/EN 10216-2	10CrMo9-10
3	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9
4	2 $\frac{1}{4}$ Cr-1Mo	Cast pipe	SA-426	CP22
5	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22
6	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22
7	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22
8	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR
9	2 $\frac{1}{4}$ Cr-1Mo	Bar	SA-739	B22
(25) 10	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10
11	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-487	8
12	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-508	22
13	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22
14	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-542	B
15	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22
16	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-182	F22V
17	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-336	F22V
18	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-541	22V
19	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-542	D
20	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-832	22V
21	3Cr-1Mo	Smls. tube	SA-213	T21
22	3Cr-1Mo	Smls. pipe	SA-335	P21
23	3Cr-1Mo	Forgings	SA-336	F21
24	3Cr-1Mo	Forged pipe	SA-369	FP21
25	3Cr-1Mo	Plate	SA-387	21
26	3Cr-1Mo	Cast pipe	SA-426	CP21
27	3Cr-1Mo	Forgings	SA-182	F21
28	3Cr-1Mo	Forgings	SA-336	F21
29	3Cr-1Mo	Plate	SA-387	21
30	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-182	F3V
31	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-336	F3V
32	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-508	3V
33	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-541	3V
34	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-542	C
35	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-832	21V
36	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-182	F3VCb
37	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-336	F3VCb
38	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-508	3VCb
39	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-541	3VCb
40	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-542	E
41	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-832	23V
42	5Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T5
43	5Cr- $\frac{1}{2}$ Mo	Smls. & wld. ftgs.	SA-234	WP5
44	5Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P5
45	5Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP5

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	...	$t \leq 60$	480
2	...	...	$t \leq 60$	480
3	J21890	...	...	485
4	J21890	...	...	485
5	K21590	3	...	515
6	K21590	3	...	515
7	K21590	2	...	515
8	K21590	...	...	515
9	K21390	...	...	515
10	...	NT or QT	$t \leq 200$	520
11	J22091	A	...	585
12	K21590	3	...	585
13	K21390	3	...	585
14	K21590	4	...	585
15	K21390	4	...	725
16	K31835	...	...	585
17	K31835	...	...	585
18	K31835	...	...	585
19	K31835	4a	...	585
20	K31835	...	...	585
21	K31545	...	...	415
22	K31545	...	...	415
23	K31545	1	...	415
24	K31545	...	...	415
25	K31545	1	...	415
26	J31545	...	...	415
27	K31545	...	...	515
28	K31545	3	...	515
29	K31545	2	...	515
30	K31830	...	...	585
31	K31830	...	...	585
32	K31830	...	...	585
33	K31830	...	...	585
34	K31830	4a	...	585
35	K31830	...	...	585
36	...	...	...	585
37	...	...	...	585
38	...	...	...	585
39	...	...	...	585
40	...	4a	...	585
41	...	...	...	585
42	K41545	...	...	415
43	K41545	...	...	415
44	K41545	...	...	415
45	K41545	...	...	415

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	480	479	472	463	461	458	456	452	448	441	433	422	408	390	368
2	480	480	473	466	464	462	460	457	451	443	431	416	396	373	345
3	483	482	476	468	466	465	463	460	454	445	433	418	399	375	347
4	483	482	476	468	466	465	463	460	454	445	433	418	399	375	347
5	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
6	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
7	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
8	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
9	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
10	520	520	510	502	500	498	496	493	488	481	471	458	442	423	401
11	586	585	572	567	566	565	562	558	550	540	526	507	483	455	420
12	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
13	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
14	586	586	585	585	578	566	562	557	553	545	529	498	466	...	...
15	724	724	724	724	720	713	708	702	694	685	673	658	641	620	595
16	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
17	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
18	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
19	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
20	586	586	586	586	586	576	567	558	547	535	522	509	494	479	...
21	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
22	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
23	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
24	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
25	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
26	414	412	401	401	401	401	401	401	401	401	401	401	401	400	384
27	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
28	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
29	517	516	503	498	496	494	491	487	482	475	466	455	439	421	396
30	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
31	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
32	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
33	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
34	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
35	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
36	586	585	561	546	536	529	525	521	516	511	503	494	484	474	...
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	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
43	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
44	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
45	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5
2	5Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	5CR
3	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5
4	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5
5	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5
6	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5A
7	5Cr- $\frac{1}{2}$ Mo	Castings	SA-217	C5
8	5Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP5
9	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5a
10	5Cr- $\frac{1}{2}$ Mo	Bolting	SA-193	B5
11	5Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T5b
12	5Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P5b
13	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. tube	SA-213	T5c
14	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. pipe	SA-335	P5c
15	9Cr-1Mo	Smls. tube	SA-213	T9
16	9Cr-1Mo	Fittings	SA-234	WP9
17	9Cr-1Mo	Smls. pipe	SA-335	P9
18	9Cr-1Mo	Forged pipe	SA-369	FP9
19	9Cr-1Mo	Forgings	SA-182	F9
20	9Cr-1Mo	Forgings	SA-336	F9
21	9Cr-1Mo	Castings	SA-217	C12
22	9Cr-1Mo	Cast pipe	SA-426	CP9
23	9Cr-1Mo-V	Smls. tube	SA-213	T91 Types 1 & 2
24	9Cr-1Mo-V	Fittings	SA-234	WP91 Types 1 & 2
25	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Types 1 & 2
26	9Cr-1Mo-V	Forged pipe	SA-369	FP91 Types 1 & 2
27	9Cr-1Mo-V	Plate	SA-387	91 Types 1 & 2
28	9Cr-1Mo-V	Forgings	SA-182	F91 Types 1 & 2
29	9Cr-1Mo-V	Forgings	SA-336	F91 Types 1 & 2
30	11Cr-Ti	Plate	SA-240	...
31	11Cr-Ti	Plate	SA-240	...
32	11Cr-Ti	Plate	SA-240	...
33	11Cr-Ti	Smls. & wld. tube	SA-268	TP409
34	12Cr	Plate	SA-1010	40
35	12Cr	Bar	SA-479	403
36	12Cr	Bar	SA-479	403
37	12Cr	Plate	SA-1010	50
38	12Cr-Al	Bar	SA/JIS G4303	SUS405
39	12Cr-Al	Plate	SA-240	405
40	12Cr-Al	Smls. & wld. tube	SA-268	TP405
41	12Cr-Al	Bar	SA-479	405
42	12Cr-Ti	Smls. & wld. tube	SA-268	...
43	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16
44	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16
45	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K41545	1	...	415
2	K41545	...	...	415
3	K41545	...	...	415
4	K41545	...	...	485
5	K41545	2	...	515
6	K42544	...	...	550
7	J42045	...	...	620
8	J42045	...	...	620
9	K42544	...	...	620
10	K50100	...	≤100	690
11	K51545	...	...	415
12	K51545	...	...	415
13	K41245	...	...	415
14	K41245	...	...	415
15	K90941	...	...	415
16	K90941	...	...	415
17	K90941	...	...	415
18	K90941	...	...	415
19	K90941	...	...	585
20	K90941	...	...	585
21	J82090	...	...	620
22	J82090	...	...	620
23	K90901	...	...	585
24	K90901	...	...	620
25	K90901	...	...	585
26	K90901	...	...	585
27	K90901	2	...	585
28	K90901	...	...	620
29	K90901	...	...	620
30	S40910	...	...	380
31	S40920	...	...	380
32	S40930	...	...	380
33	S40900	...	...	380
34	S41003	...	≤19	455
35	S40300	A	...	485
36	S40300	1	...	485
37	S41003	...	≤19	485
38	...	...	...	410
39	S40500	...	...	415
40	S40500	...	...	415
41	S40500	...	...	415
42	S40800	...	...	380
43	S45500	H1000	...	1415
44	S45500	H1000	$t \geq 13$	1415
45	S45500	H950	...	1515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
2	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
3	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
4	483	481	467	464	463	459	454	447	438	425	411	393	373	351	327
5	517	515	501	497	496	491	486	478	469	456	440	421	400	376	350
6	552	549	534	530	529	524	518	511	500	486	469	449	427	401	373
7	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
8	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
9	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
10	689	685	667	660	659	653	645	636	626	606	589	565	536	507	474
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	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
15	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
16	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
17	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
18	414	412	400	398	397	393	389	383	375	364	352	337	320	301	280
19	586	584	567	563	562	557	551	542	531	516	498	478	454	426	396
20	586	584	567	563	562	557	551	542	531	516	498	478	454	426	396
21	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
22	621	618	601	596	595	589	583	574	563	547	528	506	480	452	420
23	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
24	621	621	621	618	616	611	604	594	581	565	546	523	497	467	434
25	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
26	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
27	586	586	586	584	582	577	570	561	549	534	516	494	469	441	410
28	621	621	621	618	616	611	604	594	581	565	546	523	497	467	434
29	621	621	621	618	616	611	604	594	581	565	546	523	497	467	434
30	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
31	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
32	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
33	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
34	455	455	455	445	431	417	409	401	391	379	364	346	325	299	270
35	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
36	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
37	483	483	483	472	457	442	434	425	415	402	386	367	344	318	286
38	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
39	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
40	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
41	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
42	379	379	371	366	360	354	349	342	334	324	313	298	283	265	246
43	1415	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	1415	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	1515	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16
2	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16
3	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16
4	13Cr	Plate	SA-240	410S
5	13Cr	Smls. & wld. tube	SA-268	TP410
6	13Cr	Plate	SA-240	410
7	13Cr	Forgings	SA-182	F6a
8	13Cr	Bar	SA-479	410
9	13Cr	Bar	SA-479	410
10	13Cr	Bar	SA-479	410
11	13Cr	Forgings	SA-182	F6a
12	13Cr	Castings	SA-217	CA15
13	13Cr	Cast pipe	SA-426	CPCA15
14	13Cr	Bar	SA/EN 10088-3	X12Cr13
15	13Cr	Bolting	SA-193	B6
16	13Cr-4Ni	Castings	SA-487	CA6NM
17	13Cr-4Ni	Forgings	SA-182	F6NM
18	13Cr-4Ni	Bar	SA-479	...
(25) 19	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 20	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 21	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 22	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 23	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 24	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 25	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 26	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 27	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 28	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 29	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 30	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
(25) 31	13Cr-8Ni-2Mo	Bar	SA-564	XM-13
(25) 32	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13
33	15Cr	Smls. & wld. tube	SA-268	TP429
34	15Cr	Plate	SA-240	429
(25) 35	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 36	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 37	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 38	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 39	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 40	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 41	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 42	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 43	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 44	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 45	15Cr-5Ni-3Cu	Bar	SA-564	XM-12

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S45500	H950	$t \geq 13$	1515
2	S45500	H900	...	1620
3	S45500	H900	$t \geq 13$	1620
4	S41008	...	...	415
5	S41000	...	...	415
6	S41000	...	...	450
7	S41000	1	...	485
8	S41000	...	...	485
9	S41000	A	...	485
10	S41000	1	...	485
11	S41000	2	...	585
12	J91150	...	...	620
13	J91150	...	...	620
14	...	QT650	$t \leq 160$	650
15	S41000	...	≤ 100	760
16	J91540	A	...	760
17	S41500	...	...	795
18	S41500	...	...	795
19	S13800	H1150M	...	860
20	S13800	H1150M	...	860
21	S13800	H1150	...	930
22	S13800	H1150	...	930
23	S13800	H1100	...	1035
24	S13800	H1100	...	1035
25	S13800	H1050	...	1205
26	S13800	H1050	...	1205
27	S13800	H1025	...	1275
28	S13800	H1025	...	1275
29	S13800	H1000	...	1415
30	S13800	H1000	...	1415
31	S13800	H950	...	1515
32	S13800	H950	...	1515
33	S42900	...	...	415
34	S42900	...	...	450
35	S15500	H1150M	...	795
36	S15500	H1150M	...	795
37	S15500	H1150	...	930
38	S15500	H1150	...	930
39	S15500	H1100	...	965
40	S15500	H1100	...	965
41	S15500	H1075	...	1000
42	S15500	H1075	...	1000
43	S15500	H1025	...	1070
44	S15500	H1025	...	1070
45	S15500	H925	...	1170

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	1515	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	1620	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	1620	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
5	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
6	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
7	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
8	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
9	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
10	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
11	586	585	574	565	557	547	539	529	516	501	483	461	437	410	380
12	621	620	608	598	590	579	570	560	547	530	511	488	463	434	402
13	621	620	608	598	590	579	570	560	547	530	511	488	463	434	402
14	650	650	636	626	618	606	598	587	573	556	535	512	484	454	422
15	758	758	752	737	724	709	699	687	671	652	628	601	569	533	493
16	758	758	744	727	714	699	691	683	673	661	646	628	605	577	540
17	793	793	793	785	761	733	719	705	689	672	654	634	613	...	...
18	793	793	793	785	761	733	719	705	689	672	654	634	613	...	...
19	862	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	862	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	931	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	931	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	1034	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	1034	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	1207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	1207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	1276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	1276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	1413	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	1413	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	1517	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	1517	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
34	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
35	795	795	792	771	754	740	731	721	714	715	697	674	643	605	556
36	795	795	792	771	754	740	731	721	714	715	697	674	643	605	556
37	930	930	926	902	881	866	855	844	835	836	815	788	752	708	650
38	930	930	926	902	881	866	855	844	835	836	815	788	752	708	650
39	965	965	961	936	915	898	887	876	866	868	846	818	781	734	675
40	965	965	961	936	915	898	887	876	866	868	846	818	781	734	675
41	1000	1000	996	970	948	931	920	907	898	899	877	847	809	761	699
42	1000	1000	996	970	948	931	920	907	898	899	877	847	809	761	699
43	1070	1070	1065	1038	1014	996	984	971	961	962	938	907	866	814	748
44	1070	1070	1065	1038	1014	996	984	971	961	962	938	907	866	814	748
45	1170	1170	1165	1135	1109	1089	1076	1062	1051	1052	1026	992	947	890	818

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
(25) 1	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
(25) 2	15Cr-5Ni-3Cu	Bar	SA-564	XM-12
(25) 3	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12
4	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
5	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
6	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
7	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
8	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
9	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
10	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
11	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
12	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
13	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
14	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
15	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
16	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25
17	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25
18	17Cr	Smls. & wld. tube	SA-268	TP430
19	17Cr	Plate	SA-240	430
20	17Cr	Bar	SA-479	430
(25) 21	17Cr-4Ni-4Cu	Bar	SA-564	630
(25) 22	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 23	17Cr-4Ni-4Cu	Bar	SA-564	630
(25) 24	17Cr-4Ni-4Cu	Plate	SA-693	630
(25) 25	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 26	17Cr-4Ni-4Cu	Bar	SA-564	630
(25) 27	17Cr-4Ni-4Cu	Plate	SA-693	630
(25) 28	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 29	17Cr-4Ni-4Cu	Bar	SA-564	630
(25) 30	17Cr-4Ni-4Cu	Plate	SA-693	630
(25) 31	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 32	17Cr-4Ni-4Cu	Bar	SA-564	630
(25) 33	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 34	17Cr-4Ni-4Cu	Forgings	SA-705	630
(25) 35	17Cr-4Ni-4Cu	Forgings	SA-705	630
36	17Cr-7Ni-1Al	Forgings	SA-705	631
37	17Cr-7Ni-1Al	Forgings	SA-705	631
38	18Cr-2Mo	Plate	SA-240	...
39	18Cr-2Mo	Smls. & wld. tube	SA-268	...
(25) 40	18Cr-2Mo	Bar	SA-479	...
(25) 41	18Cr-Ti	Plate	SA-240	...
(25) 42	18Cr-Ti	Plate	SA-240	439
43	18Cr-Ti	Smls. & wld. tube	SA-268	TP439
44	18Cr-Ti	Wld. tube	SA-803	TP439
(25) 45	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S15500	H925	...	1170
2	S15500	H900	...	1310
3	S15500	H900	...	1310
4	S45000	H1150	...	860
5	S45000	H1150	$t \geq 13$	860
6	S45000	H1100	...	895
7	S45000	H1100	$t \geq 13$	895
8	S45000	H1050	...	1000
9	S45000	H1050	$t \geq 13$	1000
10	S45000	H1025	...	1035
11	S45000	H1025	$t \geq 13$	1035
12	S45000	H1000	...	1105
13	S45000	H1000	$t \geq 13$	1105
14	S45000	H950	...	1170
15	S45000	H950	$t \geq 13$	1170
16	S45000	H900	...	1240
17	S45000	H900	$t \geq 13$	1240
18	S43000	...	...	415
19	S43000	...	...	450
20	S43000	...	...	485
21	S17400	H1150M	...	795
22	S17400	H1150M	...	795
23	S17400	H1150	...	930
24	S17400	H1150	...	930
25	S17400	H1150	...	930
26	S17400	H1100	...	965
27	S17400	H1100	...	965
28	S17400	H1100	...	965
29	S17400	H1075	...	1000
30	S17400	H1075	...	1000
31	S17400	H1075	...	1000
32	S17400	H1025	...	1070
33	S17400	H1025	...	1070
34	S17400	H925	...	1170
35	S17400	H900	...	1310
36	S17700	TH1050	...	1170
37	S17700	RH950	...	1275
38	S44400	...	...	415
39	S44400	...	...	415
40	S44400	...	$t \leq 10$	415
41	S43932	...	...	415
42	S43035	...	...	415
43	S43035	...	...	415
44	S43035	...	...	415
45	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	1170	1170	1165	1135	1109	1089	1076	1062	1051	1052	1026	992	947	890	818
2	1310	1310	1304	1270	1242	1220	1205	1189	1176	1178	1149	1110	1060	997	916
3	1310	1310	1304	1270	1242	1220	1205	1189	1176	1178	1149	1110	1060	997	916
4	860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	895	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	895	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	1000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	1000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	1035	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	1035	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	1105	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	1105	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	1170	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	1170	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	1240	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	1240	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	414	413	405	399	394	386	380	373	365	354	341	326	309	290	268
19	448	448	439	432	426	418	412	405	395	383	369	353	335	314	290
20	483	482	473	465	459	450	444	435	425	412	398	380	360	338	313
21	795	795	792	771	754	740	731	721	714	715	697	674	643	605	556
22	795	795	792	771	754	740	731	721	714	715	697	674	643	605	556
23	931	931	927	903	882	867	856	845	836	837	816	789	753	708	651
24	931	931	927	903	882	867	856	845	836	837	816	789	753	708	651
25	931	931	927	903	882	867	856	845	836	837	816	789	753	708	651
26	965	965	961	936	915	898	887	876	866	868	846	818	781	734	675
27	965	965	961	936	915	898	887	876	866	868	846	818	781	734	675
28	965	965	961	936	915	898	887	876	866	868	846	818	781	734	675
29	1000	1000	996	970	948	931	920	907	898	899	877	847	809	761	699
30	1000	1000	996	970	948	931	920	907	898	899	877	847	809	761	699
31	1000	1000	996	970	948	931	920	907	898	899	877	847	809	761	699
32	1069	1069	1064	1037	1013	995	983	970	960	961	937	906	865	813	748
33	1069	1069	1064	1037	1013	995	983	970	960	961	937	906	865	813	748
34	1172	1172	1167	1137	1111	1091	1078	1064	1052	1054	1028	993	948	892	820
35	1310	1310	1304	1270	1242	1220	1205	1189	1176	1178	1149	1110	1060	997	916
36	1170	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	1275	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	414	413	401	392	384	375	369	363	356	347	338	327	314	298	279
39	414	413	401	392	384	375	369	363	356	347	338	327	314	298	279
40	414	413	401	392	384	375	369	363	356	347	338	327	314	298	279
41	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
42	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
43	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
44	414	413	399	389	382	374	369	364	357	349	340	328	315	299	280
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

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

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	18Cr-Ti	Smls. & wld. tube	SA-268	TP430 Ti
2	18Cr-Ti	Bar	SA-479	439
3	26Cr-3Ni-3Mo	Plate	SA-240	26-3-3
4	26Cr-3Ni-3Mo	Smls. & wld. tube	SA-268	26-3-3
5	26Cr-3Ni-3Mo	Wld. tube	SA-803	26-3-3
6	27Cr	Smls. tube	SA-268	TP446-1
7	27Cr-1Mo	Forgings	SA-182	FXM-27Cb
8	27Cr-1Mo	Plate	SA-240	XM-27
9	27Cr-1Mo	Smls. & wld. tube	SA-268	TPXM-27
10	27Cr-1Mo	Bar	SA-479	XM-27
(25) 11	...	...	...	...
(25) 12	...	...	...	...
13	27Cr-1Mo-Ti	Plate	SA-240	XM-33
14	27Cr-1Mo-Ti	Smls. & wld. tube	SA-268	TPXM-33
15	29Cr-4Mo	Bar	SA-479	...
16	29Cr-4Mo	Plate	SA-240	...
17	29Cr-4Mo	Smls. & wld. tube	SA-268	29-4
18	29Cr-4Mo-2Ni	Bar	SA-479	...
19	29Cr-4Mo-2Ni	Plate	SA-240	...
20	29Cr-4Mo-2Ni	Smls. & wld. tube	SA-268	29-4-2
21	29Cr-4Mo-Ti	Smls. & wld. tube	SA-268	...
22	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D
23	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2
24	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2
25	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	A
26	Mn- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	H75
27	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	B
28	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A
29	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A
30	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A
31	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D
32	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D
33	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D
34	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-302	C
35	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B
36	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	H80
37	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J80
38	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B
39	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J90
40	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B
41	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J100
42	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-302	D
43	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C
44	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E
45	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S43036	...	...	415
2	S43035	...	...	485
3	S44660	...	≤5	585
4	S44660	...	≤5	585
5	S44660	...	≤5	585
6	S44600	...	...	485
7	S44627	...	...	415
8	S44627	...	...	450
9	S44627	...	...	450
10	S44627	...	...	450
11	...	...	...	...
12	...	...	...	...
13	S44626	...	...	470
14	S44626	...	...	470
15	S44700	...	...	485
16	S44700	...	...	550
17	S44700	...	...	550
18	S44800	...	...	485
19	S44800	...	...	550
20	S44800	...	...	550
21	S44735	...	...	515
22	K14508	...	...	725
23	J13005	A	...	585
24	J13005	B	...	620
25	K12021	...	...	515
26	K12021	...	...	515
27	K12022	...	...	550
28	K12521	1	...	550
29	K12521	2	...	620
30	K12521	3	...	690
31	K12529	1	...	550
32	K12529	2	...	620
33	K12529	3	...	690
34	K12039	...	...	550
35	K12539	1	...	550
36	K12039	...	...	550
37	K12539	...	...	550
38	K12539	2	...	620
39	K12539	...	...	620
40	K12539	3	...	690
41	K12539	...	...	690
42	K12054	...	...	550
43	K12554	1	...	550
44	K12554	1	...	550
45	K12554	2	...	620

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	414	414	399	390	382	374	369	364	357	349	340	328	315	299	280
2	483	482	466	454	446	436	431	424	417	407	396	383	367	348	326
3	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
4	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
5	586	586	585	578	574	572	570	567	563	...	...	...	...	...	...
6	483	482	466	454	446	436	431	424	417	407	396	383	367	348	326
7	414	413	400	390	390	390	390	390	...	...	...	...	...	...	...
8	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
9	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
10	448	448	441	438	438	438	438	438	438	438	438	438	438	438	438
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	469	469	466	459	455	448	443	436	426	412	394	376	...	...	...
14	469	469	466	459	455	448	443	436	426	412	394	376	...	...	...
15	483	480	466	463	463	463	463	463	463	463	...	...	...	...	...
16	552	548	532	530	530	530	530	530	530	530	...	...	...	...	...
17	552	548	532	530	530	530	530	530	530	530	...	...	...	...	...
18	483	473	466	463	458	452	449	446	443	438	...	...	...	...	...
19	552	541	533	529	523	516	513	510	506	500	...	...	...	...	...
20	552	541	533	529	523	516	513	510	506	500	...	...	...	...	...
21	517	507	500	496	490	484	481	478	474	469	...	...	...	...	...
22	724	724	724	724	724	724	724	724	723	707	662	611	560	513	484
23	586	586	586	583	583	583	583	583	583	...	...	...	...	...	...
24	621	621	620	617	617	617	617	617	617	...	...	...	...	...	...
25	517	517	517	517	517	517	517	517	517	517	517	503	480	452	418
26	517	517	517	517	517	517	517	517	517	517	517	503	480	452	418
27	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
28	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
29	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
30	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
31	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
32	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
33	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
34	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
35	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
36	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
37	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
38	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
39	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
40	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
41	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
42	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
43	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
44	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
45	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E
2	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C
3	Mn- $\frac{1}{2}$ Ni-V	Plate	SA-225	C
4	Mn-V	Castings	SA-487	1
5	Mn-V	Castings	SA-487	1
6	$1\frac{1}{2}$ Si- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P15
7	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4
8	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4
9	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4
10	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3
11	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3
12	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F
13	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Plate	SA-517	F
14	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F
15	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Smls. & wld. tube	SA-423	2
16	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2
17	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2
18	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2
19	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2
20	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3
21	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3
(25) 22	$\frac{3}{4}$ Ni-1Cu- $\frac{3}{4}$ Cr	Plate	SA-736	A
(25) 23	$\frac{3}{4}$ Ni-1Cu- $\frac{3}{4}$ Cr	Plate	SA-736	A
24	$\frac{3}{4}$ Ni-1Mo- $\frac{3}{4}$ Cr	Castings	SA-217	WC5
25	1Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC4
26	$1\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P
27	$1\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P
28	$1\frac{1}{2}$ Ni	Forgings	SA-350	LF5
29	$1\frac{1}{2}$ Ni	Forgings	SA-350	LF5
(25) 30	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-320	L43
31	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Forgings	SA-372	L
32	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340
33	$1\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340
34	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
35	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
36	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
37	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
(25) 38	Alloy steel	Bolting	SA/ISO 898-1	10.9
(25) 39	Alloy steel	Bolting	SA/ISO 898-1	12.9
40	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
41	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23
42	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24
43	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24
44	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24
45	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K12554	2	...	620
2	K12554	3	...	690
3	K12524	...	...	725
4	J13002	A	...	585
5	J13002	B	...	620
6	K11578	...	...	415
7	J13047	A	...	620
8	J13047	B	...	725
9	J13047	E	...	795
10	K12045	1	...	550
11	K12045	2	...	620
12	K11576	...	$65 < t \leq 100$	725
13	K11576	...	≤ 65	795
14	K11576	...	≤ 65	795
15	K11540	...	...	415
16	K12766	1	...	550
17	K12765	1	...	550
18	K12766	2	...	620
19	K12765	2	...	620
20	K12042	1	...	550
21	K12042	2	...	620
22	...	3	$50 < t \leq 100$	515
23	...	3	≤ 50	585
24	J22000	...	...	485
25	J12082	...	...	485
26	K21650	...	$65 < t \leq 100$	725
27	K21650	...	≤ 65	795
28	K13050	1	...	415
29	K13050	2	...	485
30	G43400	...	≤ 100	860
31	K24055	...	...	1070
32	G43400	...	≥ 16	1170
33	G43400	...	≤ 13	1240
34	H43400	5	$150 < t \leq 240$	795
35	H43400	5	≤ 150	825
36	H43400	4	≤ 240	930
37	H43400	3	≤ 240	1000
38	...	...	...	1040
39	...	...	...	1220
40	H43400	2	≤ 240	1070
41	H43400	1	≤ 200	1140
42	K24064	5	$150 < t \leq 240$	795
43	K24064	5	≤ 150	825
44	K24064	4	≤ 240	930
45	K24064	3	≤ 240	1000

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	689	689	689	689	689	689	689	689	689	689	689	671	640	603	557
3	724	724	724	724	724	724	724	724	723	718	667	616	...	...	...
4	586	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	621	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	414	414	414	414	414	414	414	414	414	414	414	402	384	362	334
7	621	621	621	621	621	621	621	621	621	...	...	...	...	...	...
8	724	724	724	724	724	724	724	724	724	...	...	...	...	...	...
9	793	793	793	793	793	793	793	793	793	...	...	...	...	...	...
10	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
11	621	621	621	621	621	621	621	621	620	611	596	576	550	518	479
12	724	724	724	724	724	724	723	721	706	689	669	645	617	585	550
13	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
14	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
15	414	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
17	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
18	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
19	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
20	552	552	552	552	552	552	552	552	552	552	552	537	512	482	446
21	621	621	621	621	621	621	621	621	621	621	621	604	576	543	501
22	517	517	517	517	517	517	517	517	...	...	...	...	...	...	...
23	586	586	586	586	586	586	586	586	...	...	...	...	...	...	...
24	483	483	483	483	483	483	483	483	483	483	483	470	448	422	390
25	483	483	483	483	483	483	483	483	483	483	483	470	448	422	390
26	724	724	724	724	724	724	723	721	706	689	669	645	617	585	550
27	793	793	793	793	793	793	792	790	774	755	732	706	675	641	602
28	414	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	483	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	862	862	862	862	862	862	862	847	825	803	781	751	725	703	693
31	1069	1069	1069	1069	1069	1069	1069	1069	1069	1069	1058	1021	986	958	942
32	1170	1170	1170	1170	1170	1170	1170	1150	1120	1090	1060	1020	984	954	941
33	1240	1240	1240	1240	1240	1240	1240	1220	1190	1150	1120	1080	1040	1010	996
34	793	793	793	793	793	793	790	776	759	737	714	689	665	646	636
35	827	827	827	827	827	827	825	811	792	770	745	719	695	674	664
36	931	931	931	931	931	931	928	911	891	866	838	809	781	758	747
37	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	839	814	803
38	1040	1040	1040	...	...	...	...	...	...	...	...	...	...	...	...
39	1220	1220	1220	...	...	...	...	...	...	...	...	...	...	...	...
40	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	897	870	858
41	1140	1140	1140	1140	1140	1140	1140	1130	1090	1060	1020	989	955	927	913
42	793	793	793	793	793	793	790	776	759	737	714	689	665	646	636
43	827	827	827	827	827	827	825	811	792	770	745	719	695	674	664
44	931	931	931	931	931	931	928	911	891	866	838	809	781	758	747
45	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	839	814	803

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24
2	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24
3	2Ni-1Cu	Forgings	SA-182	FR
4	2Ni-1Cu	Fittings	SA-234	WPR
5	2Ni-1Cu	Smls. & wld. pipe	SA-333	9
6	2Ni-1Cu	Tube	SA-334	9
7	2Ni-1Cu	Forgings	SA-350	LF9
8	2Ni-1Cu	Smls. & wld. ftgs.	SA-420	WPL9
(25) 9	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N
10	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
(25) 11	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N
12	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
13	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
14	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
15	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
16	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1
17	2 $\frac{1}{2}$ Ni	Pipe	SA-333	7
18	2 $\frac{1}{2}$ Ni	Tube	SA-334	7
19	2 $\frac{1}{2}$ Ni	Plate	SA-203	A
20	2 $\frac{1}{2}$ Ni	Plate	SA-203	B
21	2 $\frac{1}{2}$ Ni	Castings	SA-352	LC2
22	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C
23	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C
24	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C
(25) 25	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-372	P
26	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
(25) 27	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-372	P
28	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
29	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
30	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
31	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
32	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2
33	3Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	B
34	3Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo	Forgings	SA-372	M
35	3Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	B
36	3Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	B
37	3Ni-1 $\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo	Forgings	SA-372	M
38	3 $\frac{1}{2}$ Ni	Pipe	SA-333	3
39	3 $\frac{1}{2}$ Ni	Tube	SA-334	3
40	3 $\frac{1}{2}$ Ni	Fittings	SA-420	WPL3
41	3 $\frac{1}{2}$ Ni	Plate	SA-203	D
42	3 $\frac{1}{2}$ Ni	Forgings	SA-350	LF3
43	3 $\frac{1}{2}$ Ni	Forgings	SA-765	III
44	3 $\frac{1}{2}$ Ni	Plate	SA-203	E
45	3 $\frac{1}{2}$ Ni	Castings	SA-352	LC3

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	K24064	2	≤240	1070
2	K24064	1	≤200	1140
3	K22035	...	...	435
4	K22035	...	...	435
5	K22035	...	...	435
6	K22035	...	...	435
7	K22036	...	...	435
8	K22035	...	...	435
9	K23550	100	...	795
10	K23550	1	...	795
11	K23550	120	...	930
12	K23550	2	...	930
13	K23550	2a	...	1000
14	K23550	3	...	1070
15	K23550	4	...	1205
16	K23550	5	...	1310
17	K21903	...	...	450
18	K21903	...	...	450
19	K21703	...	...	450
20	K22103	...	...	485
21	J22500	...	...	485
22	...	3	...	620
23	...	1	...	725
24	...	2	...	795
25	K34035	100	...	795
26	K34035	1	...	795
27	K34035	120	...	930
28	K34035	2	...	930
29	K34035	2a	...	1000
30	K34035	3	...	1070
31	K34035	4	...	1205
32	K34035	5	...	1310
33	K42339	3	...	620
34	K42365	85	...	725
35	K42339	1	...	725
36	K42339	2	...	795
37	K42365	100	...	825
38	K31918	...	...	450
39	K31918	...	...	450
40	...	...	...	450
41	K31718	...	...	450
42	K32025	...	...	485
43	K32026	...	...	485
44	K32018	...	...	485
45	J31550	...	...	485

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	897	870	858
2	1140	1140	1140	1140	1140	1140	1140	1130	1090	1060	1020	989	955	927	913
3	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	434	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
10	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
11	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
12	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
13	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	...	...	...
14	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
15	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
16	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
17	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
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	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
21	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
22	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
23	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
24	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
25	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
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	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
29	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	...	...	...
30	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
31	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
32	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
33	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
34	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
35	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
36	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
37	827	827	827	819	815	807	800	790	776	758	736	709	677	639	595
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	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
41	448	448	448	448	448	448	448	445	421	396	372	349	327	303	270
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	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291
45	483	483	483	483	483	483	483	480	454	426	401	377	353	326	291

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	F
2	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	F
(25) 3	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17
(25) 4	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17
(25) 5	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17
(25) 6	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17
7	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N
(25) 8	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	4N
9	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N
(25) 10	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	5
11	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N
(25) 12	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	4N
(25) 13	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	5
14	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
15	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
16	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
17	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
18	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
19	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3
20	$5\text{Ni}-\frac{1}{4}\text{Mo}$	Plate	SA-645	A
21	7Ni	Plate	SA-553	III
22	8Ni	Forgings	SA-522	II
23	8Ni	Plate	SA-553	II
24	9Ni	Plate	SA/EN 10028-4	X8Ni9
25	9Ni	Plate	SA/EN 10028-4	X8Ni9
26	9Ni	Plate	SA/EN 10028-4	X7Ni9
27	9Ni	Plate	SA/EN 10028-4	X8Ni9
28	9Ni	Smls. & wld. pipe	SA-333	8
29	9Ni	Smls. & wld. tube	SA-334	8
30	9Ni	Plate	SA-353	...
31	9Ni	Smls. & wld. ftgs.	SA-420	WPL8
32	9Ni	Forgings	SA-522	I
33	9Ni	Plate	SA-553	I
(25) 34	46Fe-24Ni-21Cr-6Mo-N	Smls. & wld. fittings	SA-403	...
(25) 35	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-182	F62
(25) 36	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-965	F62
(25) 37	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...
(25) 38	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...
(25) 39	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...
(25) 40	46Fe-24Ni-21Cr-6Mo-N	Plate	SA-240	...
(25) 41	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...
(25) 42	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-276	...
(25) 43	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-479	...
(25) 44	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...
(25) 45	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	...	...	>50	515
2	...	...	≤50	550
3	...	A	300 < t ≤ 360	705
4	...	A	200 < t ≤ 300	730
5	...	A	150 < t ≤ 200	760
6	...	A	≤150	780
7	K22375	3	...	620
8	K42343	3	...	620
9	K22375	1	...	725
10	K42343	1	...	725
11	K22375	2	...	795
12	K42343	2	...	795
13	K42343	2	...	795
14	K44045	1	...	795
15	K44045	2	...	930
16	K44045	2a	...	1000
17	K44045	3	...	1070
18	K44045	4	...	1205
19	K44045	5	...	1310
20	K41583	...	...	655
21	K61365	...	≤50	690
22	K71340	...	...	690
23	K71340	...	...	690
24	...	NNT640	≤50	640
25	...	QT640	≤50	640
26	...	QT	≤50	680
27	...	QT680	≤50	680
28	K81340	...	...	690
29	K81340	...	...	690
30	K81340	...	...	690
31	K81340	...	...	690
32	K81340	...	...	690
33	K81340	...	...	690
34	N08367	...	...	655
35	N08367	...	...	655
36	N08367	...	...	655
37	N08367	...	>5	655
38	N08367	...	>5	655
39	N08367	...	>5	655
40	N08367	...	≥5	655
41	N08367	...	>5	655
42	N08367	...	...	655
43	N08367	...	...	655
44	N08367	...	≤5	690
45	N08367	...	≤5	690

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	514	486	457	429	404	378	350	311
2	552	552	552	552	552	552	552	547	519	487	458	430	403	373	332
3	703	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	731	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	758	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	779	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
8	621	621	620	615	611	605	600	592	582	569	552	531	507	479	446
9	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
10	724	724	724	717	713	706	700	691	679	664	644	620	592	559	521
11	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
12	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
13	793	793	793	785	781	773	767	757	744	727	706	679	648	612	570
14	793	793	793	793	793	793	790	776	759	737	714	689	...	...	...
15	931	931	931	931	931	931	928	911	891	866	838	809	...	...	...
16	1000	1000	1000	1000	1000	1000	997	979	957	930	900	869	...	...	...
17	1070	1070	1070	1070	1070	1070	1070	1050	1020	994	962	929	...	...	...
18	1210	1210	1210	1210	1210	1210	1200	1180	1160	1120	1090	1050	...	...	...
19	1310	1310	1310	1310	1310	1310	1310	1280	1250	1220	1180	1140	...	...	...
20	655	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	689	622	...	...	...	...	...	...	...	...	...	...	...	...	...
22	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
23	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
24	640	640	636	...	...	...	...	...	...	...	...	...	...	...	...
25	640	640	636	...	...	...	...	...	...	...	...	...	...	...	...
26	680	680	676	...	...	...	...	...	...	...	...	...	...	...	...
27	680	680	676	...	...	...	...	...	...	...	...	...	...	...	...
28	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
29	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
30	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
31	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
32	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
33	689	689	686	...	...	...	...	...	...	...	...	...	...	...	...
34	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
35	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
36	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
37	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
38	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
39	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
40	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
41	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
42	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
43	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
44	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
45	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

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

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
(25) 1	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...
(25) 2	46Fe-24Ni-21Cr-6Mo-N	Sheet, strip	SA-240	...
(25) 3	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...
4	25Ni-15Cr-2Ti	Bolting	SA-453	660
5	25Ni-15Cr-2Ti	Bolting	SA-453	660
6	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660
7	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660
(25) 8	25Ni-47Fe-21Cr-5Mo	Forgings	SA-182	F700
(25) 9	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SA-240	...
(25) 10	25Ni-47Fe-21Cr-5Mo	Bar	SA-276	...
(25) 11	25Ni-47Fe-21Cr-5Mo	Wld. pipe	SA-358	...
(25) 12	25Ni-47Fe-21Cr-5Mo	Fittings	SA-403	700
(25) 13	25Ni-47Fe-21Cr-5Mo	Bar	SA-479	...
(25) 14	25Ni-47Fe-21Cr-5Mo	Forgings	SA-965	F700
15	27Ni-22Cr-7Mo-Mn-Cu-N	Forgings	SA-182	...
16	27Ni-22Cr-7Mo-Mn-Cu-N	Smls. tube	SA-213	...
17	27Ni-22Cr-7Mo-Mn-Cu-N	Plate	SA-240	...
18	27Ni-22Cr-7Mo-Mn-Cu-N	Wld. tube	SA-249	...
19	29Ni-20Cr-3Cu-2Mo	Castings	SA-351	CN7M
(25) 20	35Ni-35Fe-20Cr-Cb	Forgings	SA-182	F20
(25) 21	35Ni-35Fe-20Cr-Cb	Forgings	SA-965	F20
(25) 22	35Ni-35Fe-20Cr-Cb	Plate	SA-240	...
(25) 23	35Ni-35Fe-20Cr-Cb	Bar	SA-276	Alloy 20
(25) 24	35Ni-35Fe-20Cr-Cb	Bar	SA-479	Alloy 20
(25) 25	35Ni-35Fe-20Cr-Cb	Smls. pipe	SA-312	Alloy 20
(25) 26	35Ni-35Fe-20Cr-Cb	Wld. pipe	SA-312	Alloy 20
(25) 27	35Ni-35Fe-20Cr-Cb	Smls. tube	SA-213	Alloy 20
(25) 28	35Ni-35Fe-20Cr-Cb	Wld. tube	SA-249	Alloy 20
(25) 29	35Ni-35Fe-20Cr-Cb	Smls. & wld. ftgs.	SA-403	...
(25) 30	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11
(25) 31	42Fe-33Ni-21Cr	Smls. tube	SA-213	...
(25) 32	42Fe-33Ni-21Cr	Plate	SA-240	...
(25) 33	42Fe-33Ni-21Cr	Wld. tube	SA-249	...
(25) 34	42Fe-33Ni-21Cr	Bar	SA-276	...
(25) 35	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...
(25) 36	42Fe-33Ni-21Cr	Bar	SA-479	...
(25) 37	42Fe-33Ni-21Cr	Wld. tube	SA-688	...
(25) 38	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11
39	14Cr-16Ni-6Si-Cu-Mo	Smls. tube	SA-213	...
40	14Cr-16Ni-6Si-Cu-Mo	Plate	SA-240	...
41	14Cr-16Ni-6Si-Cu-Mo	Wld. tube	SA-249	...
42	14Cr-16Ni-6Si-Cu-Mo	Wld. pipe	SA-312	...
43	14Cr-16Ni-6Si-Cu-Mo	Smls. & wld. fittings	SA-403	...
44	14Cr-16Ni-6Si-Cu-Mo	Bar	SA-479	...
45	16Cr-4Ni-6Mn	Plate	SA-240	201LN

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	N08367	...	≤5	690
2	N08367	...	<5	690
3	N08367	...	≤5	690
4	S66286	A	...	895
5	S66286	B	...	895
6	S66286	1	...	895
7	S66286	2	...	895
8	N08700	...	...	550
9	N08700	...	...	550
10	N08700	...	...	550
11	N08700	...	...	550
12	N08700	...	...	550
13	N08700	...	...	550
14	N08700	...	...	550
15	S31277	...	...	772
16	S31277	...	...	772
17	S31277	...	...	772
18	S31277	...	...	772
19	J95150	...	...	425
20	N08020	...	...	550
21	N08020	...	...	550
22	N08020	...	...	550
23	N08020	...	...	550
24	N08020	...	...	550
25	N08020	...	...	550
26	N08020	...	...	550
27	N08020	...	...	550
28	N08020	...	...	550
29	N08020	...	...	585
30	N08811	...	...	450
31	N08811	...	...	450
32	N08811	...	...	450
33	N08811	...	...	450
34	N08811	...	...	450
35	N08811	...	...	450
36	N08811	...	...	450
37	N08811	...	...	450
38	N08811	...	...	450
39	S38815	...	...	540
40	S38815	...	...	540
41	S38815	...	...	540
42	S38815	...	...	540
43	S38815	...	...	540
44	S38815	...	...	540
45	S20153	...	...	655

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
2	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
3	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
4	896	896	896	895	880	864	858	851	844	836	827	817	806	794	780
5	896	896	896	895	880	864	858	851	844	836	827	817	806	794	780
6	896	896	896	896	884	868	860	853	845	836	827	816	805	794	780
7	896	896	896	896	884	868	860	853	845	836	827	816	805	794	780
8	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
9	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
10	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
11	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
12	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
13	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
14	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
15	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
16	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
17	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
18	772	707	673	644	626	609	601	593	586	581	576	575	...	...	...
19	427	356	328	309	295	283	278	274	270	...	...	...	...	...	...
20	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
21	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
22	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
23	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
24	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
25	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
26	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
27	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
28	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
29	586	586	580	569	567	566	566	564	561	559	559	559	...	...	...
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	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
37	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
38	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
39	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
40	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
41	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
42	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
43	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
44	538	538	536	521	509	501	499	497	497	497	496	494	...	...	...
45	655	562	511	486	477	475	473	471	467	462	455	446	437	429	422

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
31	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
32	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
33	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
34	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
35	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
36	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
37	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
38	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	16Cr-9Mn-2Ni-N	Plate	SA-240	204
2	16Cr-12Ni-2Mo	Forgings	SA-182	F316L
3	16Cr-12Ni-2Mo	Forgings	SA-965	F316L
4	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316L
5	16Cr-12Ni-2Mo	Forgings	SA-182	F316L
6	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L
7	16Cr-12Ni-2Mo	Plate	SA-240	316L
8	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L
9	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316L
10	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L
11	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L
12	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L
13	16Cr-12Ni-2Mo	Smls. & wld. ftgs.	SA-403	316L
14	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316L
15	16Cr-12Ni-2Mo	Bar	SA-479	316L
16	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L
17	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316L
18	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316L
19	16Cr-12Ni-2Mo	Forgings	SA-182	F316
20	16Cr-12Ni-2Mo	Forgings	SA-965	F316
21	16Cr-12Ni-2Mo	Forgings	SA-182	F316H
22	16Cr-12Ni-2Mo	Forgings	SA-965	F316H
23	16Cr-12Ni-2Mo	Forgings	SA-182	F316
24	16Cr-12Ni-2Mo	Bolting	SA-193	B8M
25	16Cr-12Ni-2Mo	Bolting	SA-193	B8MA
26	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316
27	16Cr-12Ni-2Mo	Plate	SA-240	316
28	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316
29	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316
30	16Cr-12Ni-2Mo	Bolting	SA-320	B8M
31	16Cr-12Ni-2Mo	Bolting	SA-320	B8MA
32	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316
33	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316
34	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316
35	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316
36	16Cr-12Ni-2Mo	Smls. & wld. ftgs.	SA-403	316
37	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316
38	16Cr-12Ni-2Mo	Bar	SA-479	316
39	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316
40	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316
41	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316
42	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316
43	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2
44	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2
45	16Cr-12Ni-2Mo	Forgings	SA-182	F316H

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S20400	...	...	655
2	S31603	...	>130	450
3	S31603	...	...	450
4	...	...	...	480
5	S31603	...	≤130	485
6	S31603	...	...	485
7	S31603	...	...	485
8	S31603	...	...	485
9	S31603	...	...	485
10	S31603	1	...	485
11	S31603	3	...	485
12	S31603	4	...	485
13	S31603	...	...	485
14	S31603	...	...	485
15	S31603	Annealed	...	485
16	S31603	...	...	485
17	S31603	...	...	485
18	S31603	...	...	485
19	S31600	...	>130	485
20	S31600	...	...	485
21	S31609	...	>130	485
22	S31609	...	...	485
23	S31600	...	≤130	515
24	S31600	1	...	515
25	S31600	1A	...	515
26	S31600	...	...	515
27	S31600	...	...	515
28	S31600	...	...	515
29	S31600	...	...	515
30	S31600	1	...	515
31	S31600	1A	...	515
32	S31600	1	...	515
33	S31600	3	...	515
34	S31600	4	...	515
35	S31600	...	...	515
36	S31600	...	...	515
37	S31600	...	...	515
38	S31600	Annealed	...	515
39	S31600	...	...	515
40	S31600	...	...	515
41	S31600	...	...	515
42	...	...	...	520
43	...	...	≤75	520
44	...	...	≤75	520
45	S31609	...	≤130	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	655	560	497	459	440	433	432	432	431	429	426	421	411	398	379
2	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
3	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
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	467	441	429	426	426	425	425	424	421	417	413	406	398	387
7	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
8	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
9	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
10	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
11	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
12	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
13	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
14	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
15	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
16	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
17	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
18	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
19	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
20	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
21	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
22	483	482	469	463	462	462	462	462	462	460	456	450	442	433	421
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	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
33	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
34	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
35	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
36	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
37	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
38	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
39	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
40	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
41	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
42	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
43	520	500	479	464	457	457	457	457	457	455	451	445	437	427	417
44	520	517	507	499	497	497	497	497	497	495	491	485	476	466	453
45	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	352	344	333	322	308	...	...	...	...	...	...	...	...	...	...
3	352	344	333	322	308	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
6	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
7	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
8	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
9	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
10	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
11	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
12	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
13	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
14	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
15	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
16	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
17	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
18	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
19	406	380	355	331	307	285	263	242	222	202	184	166	...	...	...
20	406	380	355	331	307	285	263	242	222	202	184	166	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
24	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
25	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
26	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
27	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
28	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
29	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
30	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
31	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
32	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
33	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
34	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
35	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
36	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
37	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
38	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
39	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
40	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
41	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316H
2	16Cr-12Ni-2Mo	Plate	SA-240	316H
3	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H
4	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316H
5	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H
6	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H
7	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H
8	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H
9	16Cr-12Ni-2Mo	Smls. & wld. ftgs.	SA-403	316H
10	16Cr-12Ni-2Mo	Bar	SA-479	316H
11	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316H
12	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316H
13	16Cr-12Ni-2Mo	Bar	SA-276	316
14	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2
15	16Cr-12Ni-2Mo	Bolting	SA-193	B8M
16	16Cr-12Ni-2Mo	Bolting	SA-320	B8M
17	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2
18	16Cr-12Ni-2Mo	Bar	SA-276	316
19	16Cr-12Ni-2Mo	Bar	SA-276	316
20	16Cr-12Ni-2Mo	Bolting	SA-193	B8M
21	16Cr-12Ni-2Mo	Bolting	SA-320	B8M
22	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2
23	16Cr-12Ni-2Mo	Bar	SA-276	316
24	16Cr-12Ni-2Mo	Bar	SA-276	316
25	16Cr-12Ni-2Mo	Bolting	SA-193	B8M
26	16Cr-12Ni-2Mo	Bolting	SA-320	B8M
27	16Cr-12Ni-2Mo	Bar	SA-276	316
28	16Cr-12Ni-2Mo	Bolting	SA-193	B8M
29	16Cr-12Ni-2Mo	Bolting	SA-320	B8M
30	16Cr-12Ni-2Mo	Bar	SA-276	316
31	16Cr-12Ni-2Mo	Bar	SA-276	316
32	16Cr-12Ni-2Mo-Cb	Plate	SA-240	316Cb
33	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN
34	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316LN
35	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN
36	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316LN
37	16Cr-12Ni-2Mo-N	Plate	SA-240	316LN
38	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316LN
39	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316LN
40	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN
41	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN
42	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN
43	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316LN
44	16Cr-12Ni-2Mo-N	Fittings	SA-403	316LN
45	16Cr-12Ni-2Mo-N	Bar	SA-479	316LN

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S31609	...	...	515
2	S31609	...	...	515
3	S31609	...	...	515
4	S31609	...	...	515
5	S31609	1	...	515
6	S31609	3	...	515
7	S31609	4	...	515
8	S31609	...	...	515
9	S31609	...	...	515
10	S31609	...	...	515
11	S31609	...	...	515
12	S31609	...	...	515
13	S31600	S	$64 < t \leq 75$	550
14	S31600	2B	$64 < t \leq 72$	550
15	S31600	2	$32 < t \leq 36$	620
16	S31600	2	$32 < t \leq 40$	620
17	S31600	2B	$48 < t \leq 64$	620
18	S31600	S	$50 < t \leq 64$	620
19	S31600	B	$38 < t \leq 44$	655
20	S31600	2	$24 < t \leq 30$	655
21	S31600	2	$25 < t \leq 32$	655
22	S31600	2B	≤ 48	655
23	S31600	S	$t \leq 50$	655
24	S31600	B	$32 < t \leq 38$	690
25	S31600	2	$20 < t \leq 24$	690
26	S31600	2	$20 < t \leq 25$	690
27	S31600	B	$25 < t \leq 32$	725
28	S31600	2	≤ 20	760
29	S31600	2	≤ 20	760
30	S31600	B	$19 < t \leq 25$	795
31	S31600	B	$t \leq 19$	860
32	S31640	...	...	515
33	S31653	...	>130	485
34	S31653	...	...	485
35	S31653	...	≤ 130	515
36	S31653	...	...	515
37	S31653	...	...	515
38	S31653	...	...	515
39	S31653	...	...	515
40	S31653	1	...	515
41	S31653	3	...	515
42	S31653	4	...	515
43	S31653	...	...	515
44	S31653	...	...	515
45	S31653	...	...	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
2	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
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	552	551	536	530	529	529	529	...	...	...	...	...	...	...	...
14	552	551	532	513	513	513	513	513	513	509	507	500	489	477	467
15	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
16	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
17	621	619	598	577	577	577	577	577	577	574	571	562	550	537	525
18	622	621	604	597	596	596	596	...	...	...	...	...	...	...	...
19	658	656	638	631	630	630	630	...	...	...	...	...	...	...	...
20	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
21	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
22	655	654	631	609	609	609	609	609	609	605	602	593	580	567	554
23	658	656	638	631	630	630	630	...	...	...	...	...	...	...	...
24	693	691	673	665	663	663	663	...	...	...	...	...	...	...	...
25	689	689	680	665	660	660	660	660	660	657	651	643	632	618	601
26	689	689	680	665	660	660	660	660	660	657	651	643	632	618	601
27	728	726	707	698	697	697	697	...	...	...	...	...	...	...	...
28	758	758	747	731	726	726	726	726	726	722	716	707	695	680	661
29	758	758	747	731	726	726	726	726	726	722	716	707	695	680	661
30	798	797	775	766	764	764	764	...	...	...	...	...	...	...	...
31	863	862	838	828	827	827	827	...	...	...	...	...	...	...	...
32	517	517	517	517	517	517	517	517	517	517	517	517	517	...	...
33	483	482	454	433	418	409	406	404	402	399	397	394	390	385	380
34	483	482	454	433	418	409	406	404	402	399	397	394	390	385	380
35	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
36	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
37	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
38	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
39	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
40	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
41	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
42	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
43	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
44	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
45	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316LN
2	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316N
3	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N
4	16Cr-12Ni-2Mo-N	Plate	SA-240	316N
5	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N
6	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316N
7	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N
8	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N
9	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N
10	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N
11	16Cr-12Ni-2Mo-N	Smls. & wld. ftgs.	SA-403	316N
12	16Cr-12Ni-2Mo-N	Bar	SA-479	316N
13	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316N
14	16Cr-12Ni-2Mo-N	Wld. pipe	SA-813	TP316N
15	16Cr-12Ni-2Mo-N	Wld. pipe	SA-814	TP316N
16	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N
17	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-11-2
18	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-13-3
19	16Cr-12Ni-2Mo-Ti	Smls. tube	SA-213	TP316Ti
20	16Cr-12Ni-2Mo-Ti	Plate	SA-240	316Ti
21	16Cr-12Ni-2Mo-Ti	Smls. & wld. pipe	SA-312	TP316Ti
(25) 22	...	Plate	SA/EN 10088-2	X6CrNiMoTi17-12-2
23	17Cr-4Ni-6Mn	Plate	SA-240	201-1
24	17Cr-4Ni-6Mn	Plate	SA-666	201-1
25	17Cr-4Ni-6Mn	Plate	SA-240	201-2
26	17Cr-4Ni-6Mn	Plate	SA-666	201-2
27	17Cr-7Ni	Plate, sheet, strip	SA-240	301
28	17.5Cr-17.5Ni-5.3Si	Plate	SA-240	...
29	18Cr-3Ni-12Mn	Plate	SA-240	XM-29
30	18Cr-3Ni-12Mn	Wld. tube	SA-249	XM-29
31	18Cr-3Ni-12Mn	Wld. pipe	SA-312	XM-29
32	18Cr-3Ni-12Mn	Bar	SA-479	XM-29
33	18Cr-3Ni-12Mn	Wld. tube	SA-688	TPXM-29
34	18Cr-5Ni-3Mo	Smls. & wld. tube	SA-789	...
35	18Cr-5Ni-3Mo	Smls. & wld. pipe	SA-790	...
36	18Cr-8Ni	Forgings	SA-182	F304L
37	18Cr-8Ni	Forgings	SA-965	F304L
38	18Cr-8Ni	Bar	SA/JIS G4303	SUS304L
39	18Cr-8Ni	Forgings	SA-182	F304L
40	18Cr-8Ni	Smls. tube	SA-213	TP304L
41	18Cr-8Ni	Plate	SA-240	304L
42	18Cr-8Ni	Wld. tube	SA-249	TP304L
43	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304L
44	18Cr-8Ni	Wld. pipe	SA-358	304L
45	18Cr-8Ni	Wld. pipe	SA-358	304L

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S31653	...	...	515
2	S31651	...	...	550
3	S31651	...	...	550
4	S31651	...	...	550
5	S31651	...	...	550
6	S31651	...	...	550
7	S31651	1	...	550
8	S31651	3	...	550
9	S31651	4	...	550
10	S31651	...	...	550
11	S31651	...	...	550
12	S31651	...	...	550
13	S31651	...	...	550
14	S31651	...	...	550
15	S31651	...	...	550
16	S31651	...	...	550
17	...	...	≤75	580
18	...	...	≤75	580
19	S31635	...	...	515
20	S31635	...	...	515
21	S31635	...	...	515
22	...	...	$t \leq 8$	540
23	S20100	...	...	515
24	S20100	...	...	515
25	S20100	...	...	655
26	S20100	...	...	655
27	S30100	...	...	515
28	S30601	...	...	540
29	S24000	...	...	690
30	S24000	...	...	690
31	S24000	...	...	690
32	S24000	...	...	690
33	S24000	...	...	690
34	S31500	...	...	635
35	S31500	...	...	635
36	S30403	...	>130	450
37	S30403	...	...	450
38	...	...	...	480
39	S30403	...	≤130	485
40	S30403	...	...	485
41	S30403	...	...	485
42	S30403	...	...	485
43	S30403	...	...	485
44	S30403	1	...	485
45	S30403	3	...	485

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	517	516	487	464	448	438	435	432	430	428	426	422	418	413	407
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	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
6	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
7	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
8	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
9	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
10	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
11	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
12	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
13	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
14	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
15	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
16	552	550	530	518	513	512	512	512	512	512	510	506	501	494	484
17	580	573	547	522	503	491	487	485	483	480	477	474	469	463	456
18	580	573	547	522	503	491	487	485	483	480	477	474	469	463	456
19	517	475	439	417	406	403	403	403	403	403	403	403	403	399	394
20	517	475	439	417	406	403	403	403	403	403	403	403	403	399	394
21	517	475	439	417	406	403	403	403	403	403	403	403	403	399	394
22	541	514	475	450	436	427	425	425	424	424	424	424	423	421	418
23	515	444	414	402	...	...	...	...	...	...	...	...	...	...	...
24	515	444	414	402	...	...	...	...	...	...	...	...	...	...	...
25	655	565	526	511	...	...	...	...	...	...	...	...	...	...	...
26	655	565	526	511	...	...	...	...	...	...	...	...	...	...	...
27	517	414	379	372	372	372	372	372	369	362	353	345	340	340	...
28	538	537	510	485	460	435	...	...	...	...	...	...	...	...	...
29	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
30	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
31	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
32	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
33	689	669	627	603	589	578	571	563	553	541	527	512	496	483	474
34	634	609	589	585	585	585	585	585	585	585	...	...	...	...	...
35	634	609	589	585	585	585	585	585	585	585	...	...	...	...	...
36	448	419	392	377	369	366	364	362	361	358	355	350	345	338	330
37	448	419	392	377	369	366	364	362	361	358	355	350	345	338	330
38	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
39	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
40	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
41	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
42	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
43	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
44	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
45	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	387	377	366	352	337	319	299	278	255	231	207	183	...	...	...
20	387	377	366	352	337	319	299	278	255	231	207	183	...	...	...
21	387	377	366	352	337	319	299	278	255	231	207	183	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	326	320	315	308	302	...	...	...	...	...	...	...	...	...	...
37	326	320	315	308	302	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
40	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
41	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
42	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
43	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
44	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
45	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...

(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	18Cr-8Ni	Wld. pipe	SA-358	304L
2	18Cr-8Ni	Smls. & wld. ftgs.	SA-403	304L
3	18Cr-8Ni	Wld. pipe	SA-409	TP304L
4	18Cr-8Ni	Bar	SA-479	304L
5	18Cr-8Ni	Wld. tube	SA-688	TP304L
6	18Cr-8Ni	Wld. pipe	SA-813	TP304L
7	18Cr-8Ni	Wld. pipe	SA-814	TP304L
8	18Cr-8Ni	Forgings	SA-182	F304
9	18Cr-8Ni	Forgings	SA-182	F304H
10	18Cr-8Ni	Castings	SA-351	CF3
11	18Cr-8Ni	Castings	SA-351	CF8
12	18Cr-8Ni	Smls. pipe	SA-376	TP304
13	18Cr-8Ni	Cast pipe	SA-451	CPF3
14	18Cr-8Ni	Cast pipe	SA-451	CPF8
15	18Cr-8Ni	Forgings	SA-965	F304
16	18Cr-8Ni	Forgings	SA-965	F304H
17	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9
18	18Cr-8Ni	Forgings	SA-182	F304
19	18Cr-8Ni	Forgings	SA-182	F304H
20	18Cr-8Ni	Bolting	SA-193	B8
21	18Cr-8Ni	Bolting	SA-193	B8A
22	18Cr-8Ni	Smls. tube	SA-213	TP304
23	18Cr-8Ni	Smls. tube	SA-213	TP304H
24	18Cr-8Ni	Plate	SA-240	302
25	18Cr-8Ni	Plate	SA-240	304
26	18Cr-8Ni	Plate	SA-240	304H
27	18Cr-8Ni	Wld. tube	SA-249	TP304
28	18Cr-8Ni	Wld. tube	SA-249	TP304H
29	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304
30	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304H
31	18Cr-8Ni	Bolting	SA-320	B8
32	18Cr-8Ni	Bolting	SA-320	B8A
33	18Cr-8Ni	Wld. pipe	SA-358	304
34	18Cr-8Ni	Wld. pipe	SA-358	304
35	18Cr-8Ni	Wld. pipe	SA-358	304
36	18Cr-8Ni	Wld. pipe	SA-358	304H
37	18Cr-8Ni	Wld. pipe	SA-358	304H
38	18Cr-8Ni	Wld. pipe	SA-358	304H
39	18Cr-8Ni	Wld. pipe	SA-358	304LN
40	18Cr-8Ni	Wld. pipe	SA-358	304LN
41	18Cr-8Ni	Wld. pipe	SA-358	304LN
42	18Cr-8Ni	Smls. pipe	SA-376	TP304
43	18Cr-8Ni	Smls. pipe	SA-376	TP304H
44	18Cr-8Ni	Smls. & wld. ftgs.	SA-403	304
45	18Cr-8Ni	Smls. & wld. ftgs.	SA-403	304H

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S30403	4	...	485
2	S30403	...	...	485
3	S30403	...	...	485
4	S30403	Annealed	...	485
5	S30403	...	...	485
6	S30403	...	...	485
7	S30403	...	...	485
8	S30400	...	>130	485
9	S30409	...	>130	485
10	J92500	...	...	485
11	J92600	...	...	485
12	S30400	...	≥200	485
13	J92500	...	...	485
14	J92600	...	...	485
15	S30400	...	...	485
16	S30409	...	...	485
17	...	...	≤75	500
18	S30400	...	≤130	515
19	S30409	...	≤130	515
20	S30400	1	...	515
21	S30400	1A	...	515
22	S30400	...	...	515
23	S30409	...	...	515
24	S30200	...	...	515
25	S30400	...	...	515
26	S30409	...	...	515
27	S30400	...	...	515
28	S30409	...	...	515
29	S30400	...	...	515
30	S30409	...	...	515
31	S30400	1	...	515
32	S30400	1A	...	515
33	S30400	1	...	515
34	S30400	3	...	515
35	S30400	4	...	515
36	S30409	1	...	515
37	S30409	3	...	515
38	S30409	4	...	515
39	S30453	1	...	515
40	S30453	3	...	515
41	S30453	4	...	515
42	S30400	...	<200	515
43	S30409	...	...	515
44	S30400	...	...	515
45	S30409	...	...	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
2	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
3	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
4	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
5	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
6	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
7	483	452	421	406	398	393	392	391	389	386	382	377	372	364	355
8	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
9	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
10	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
11	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
12	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
13	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
14	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
15	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
16	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
17	500	466	440	421	410	406	405	405	403	401	397	391	384	376	367
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	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
41	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
42	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
43	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
44	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
45	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
2	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
3	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
4	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
5	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
6	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
7	352	345	339	332	325	...	...	...	...	...	...	...	...	...	...
8	370	358	343	325	305	283	259	234	209	186	166	150	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	370	358	343	325	305	283	259	234	209	186	166	150	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	370	358	343	325	305	283	259	234	209	186	166	150	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
21	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
22	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
32	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
33	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
34	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
35	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	18Cr-8Ni	Wld. pipe	SA-409	TP304
2	18Cr-8Ni	Bar	SA-479	302
3	18Cr-8Ni	Bar	SA-479	304
4	18Cr-8Ni	Bar	SA-479	304H
5	18Cr-8Ni	Wld. tube	SA-688	TP304
6	18Cr-8Ni	Wld. pipe	SA-813	TP304
7	18Cr-8Ni	Wld. pipe	SA-813	TP304H
8	18Cr-8Ni	Wld. pipe	SA-814	TP304
9	18Cr-8Ni	Wld. pipe	SA-814	TP304H
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
14	18Cr-8Ni	Castings	SA-351	CF8A
15	18Cr-8Ni	Cast pipe	SA-451	CPF3A
16	18Cr-8Ni	Cast pipe	SA-451	CPF8A
17	18Cr-8Ni	Bolting	SA-320	B8
18	18Cr-8Ni	Bolting	SA-320	B8
19	18Cr-8Ni	Bolting	SA-320	B8
20	18Cr-8Ni	Bolting	SA-320	B8
21	18Cr-8Ni-N	Forgings	SA-182	F304LN
22	18Cr-8Ni-N	Forgings	SA-965	F304LN
23	18Cr-8Ni-N	Forgings	SA-182	F304LN
24	18Cr-8Ni-N	Bolting	SA-193	B8NA
25	18Cr-8Ni-N	Smls. tube	SA-213	TP304LN
26	18Cr-8Ni-N	Plate	SA-240	304LN
27	18Cr-8Ni-N	Wld. tube	SA-249	TP304LN
28	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304LN
29	18Cr-8Ni-N	Smls. pipe	SA-376	TP304LN
30	18Cr-8Ni-N	Smls. & wld. ftgs.	SA-403	304LN
31	18Cr-8Ni-N	Bar	SA-479	304LN
32	18Cr-8Ni-N	Wld. tube	SA-688	TP304LN
33	18Cr-8Ni-N	Wld. pipe	SA-813	TP304LN
34	18Cr-8Ni-N	Wld. pipe	SA-814	TP304LN
35	18Cr-8Ni-N	Forgings	SA-182	F304N
36	18Cr-8Ni-N	Smls. tube	SA-213	TP304N
37	18Cr-8Ni-N	Plate	SA-240	304N
38	18Cr-8Ni-N	Wld. tube	SA-249	TP304N
39	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304N
40	18Cr-8Ni-N	Wld. pipe	SA-358	304N
41	18Cr-8Ni-N	Wld. pipe	SA-358	304N
42	18Cr-8Ni-N	Wld. pipe	SA-358	304N
43	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N
44	18Cr-8Ni-N	Smls. & wld. ftgs.	SA-403	304N
45	18Cr-8Ni-N	Bar	SA-479	304N

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S30400	...	...	515
2	S30200	...	...	515
3	S30400	Annealed	...	515
4	S30409	...	...	515
5	S30400	...	...	515
6	S30400	...	...	515
7	S30409	...	...	515
8	S30400	...	...	515
9	S30409	...	...	515
10	...	...	...	520
11	...	...	...	520
12	...	...	≤75	520
13	J92500	...	...	530
14	J92600	...	...	530
15	J92500	...	...	530
16	J92600	...	...	530
17	S30400	2	$32 < t \leq 40$	690
18	S30400	2	$25 < t \leq 32$	725
19	S30400	2	$20 < t \leq 25$	795
20	S30400	2	$t \leq 20$	860
21	S30453	...	>130	485
22	S30453	...	...	485
23	S30453	...	≤130	515
24	S30451	1A	...	515
25	S30453	...	...	515
26	S30453	...	...	515
27	S30453	...	...	515
28	S30453	...	...	515
29	S30453	...	...	515
30	S30453	WP	...	515
31	S30453	...	...	515
32	S30453	...	...	515
33	S30453	...	...	515
34	S30453	...	...	515
35	S30451	...	...	550
36	S30451	...	...	550
37	S30451	...	...	550
38	S30451	...	...	550
39	S30451	...	...	550
40	S30451	1	...	550
41	S30451	3	...	550
42	S30451	4	...	550
43	S30451	...	...	550
44	S30451	...	...	550
45	S30451	...	...	550

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	520	486	462	445	438	438	438	438	438	438	436	431	424	414	404
13	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
14	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
15	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
16	531	499	468	454	449	449	449	449	449	448	445	440	433	424	413
17	690	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	725	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	795	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
22	483	453	426	412	408	408	408	408	408	407	404	400	394	386	375
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	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
36	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
37	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
38	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
39	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
40	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
41	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
42	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
43	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
44	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
45	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
													Ferrous Materials (Cont'd)		
1	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
6	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	393	380	364	346	324	300	275	248	222	197	176	159	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	18Cr-8Ni-N	Wld. tube	SA-688	TP304N
2	18Cr-8Ni-N	Wld. pipe	SA-813	TP304N
3	18Cr-8Ni-N	Wld. pipe	SA-814	TP304N
4	18Cr-8Ni-N	Forgings	SA-965	F304N
5	18Cr-8Ni-N	Plate	SA/EN 10028-7	X2CrNiN18-10
6	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9
(25) 7	18Cr-8Ni-S	Bolting	SA-320	B8F
(25) 8	18Cr-8Ni-S	Bolting	SA-320	B8FA
9	18Cr-8Ni-Se	Bolting	SA-320	B8F
10	18Cr-8Ni-Se	Bolting	SA-320	B8FA
11	18Cr-8Ni-4Si-N	Bar	SA-479	...
12	18Cr-9Ni-3Cu-Cb-N	Smls. tube	SA-213	...
13	18Cr-10Ni-Cb	Forgings	SA-965	F348H
14	18Cr-10Ni-Cb	Castings	SA-351	CF8C
15	18Cr-10Ni-Cb	Cast pipe	SA-451	CPF8C
16	18Cr-10Ni-Cb	Forgings	SA-182	F347
17	18Cr-10Ni-Cb	Forgings	SA-965	F347
18	18Cr-10Ni-Cb	Forgings	SA-182	F347H
19	18Cr-10Ni-Cb	Forgings	SA-965	F347H
20	18Cr-10Ni-Cb	Forgings	SA-182	F348
21	18Cr-10Ni-Cb	Forgings	SA-965	F348
22	18Cr-10Ni-Cb	Forgings	SA-182	F348H
23	18Cr-10Ni-Cb	Forgings	SA-182	F347
24	18Cr-10Ni-Cb	Bolting	SA-193	B8C
25	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347
26	18Cr-10Ni-Cb	Plate	SA-240	347
27	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347
28	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347
29	18Cr-10Ni-Cb	Bolting	SA-320	B8C
30	18Cr-10Ni-Cb	Bolting	SA-320	B8CA
31	18Cr-10Ni-Cb	Wld. pipe	SA-358	347
32	18Cr-10Ni-Cb	Wld. pipe	SA-358	347
33	18Cr-10Ni-Cb	Wld. pipe	SA-358	347
34	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347
35	18Cr-10Ni-Cb	Smls. & wld. ftgs.	SA-403	347
36	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP347
37	18Cr-10Ni-Cb	Bar	SA-479	347
38	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347
39	18Cr-10Ni-Cb	Forgings	SA-182	F347H
40	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H
41	18Cr-10Ni-Cb	Plate	SA-240	347H
42	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H
43	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347H
44	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347H
45	18Cr-10Ni-Cb	Smls. & wld. ftgs.	SA-403	347H

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S30451	...	...	550
2	S30451	...	...	550
3	S30451	...	...	550
4	S30451	...	...	550
5	...	...	≤75	550
6	...	...	≤75	550
7	S30300	1	...	515
8	S30300	1A	...	515
9	S30323	1	...	515
10	S30323	1A	...	515
11	S21800	...	...	655
12	S30432	...	...	590
13	S34809	...	...	450
14	J92710	...	...	485
15	J92710	...	...	485
16	S34700	...	>130	485
17	S34700	...	...	485
18	S34709	...	>130	485
19	S34709	...	...	485
20	S34800	...	>130	485
21	S34800	...	...	485
22	S34809	...	>130	485
23	S34700	...	≤130	515
24	S34700	1	...	515
25	S34700	...	...	515
26	S34700	...	...	515
27	S34700	...	...	515
28	S34700	...	...	515
29	S34700	1	...	515
30	S34700	1A	...	515
31	S34700	1	...	515
32	S34700	3	...	515
33	S34700	4	...	515
34	S34700	...	...	515
35	S34700	...	...	515
36	S34700	...	...	515
37	S34700	...	...	515
38	S34700	...	...	515
39	S34709	...	≤130	515
40	S34709	...	...	515
41	S34709	...	...	515
42	S34709	...	...	515
43	S34709	...	...	515
44	S34709	...	...	515
45	S34709	...	...	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
2	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
3	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
4	552	550	524	506	493	483	479	476	472	468	464	460	453	447	439
5	550	515	489	470	463	463	463	463	463	463	461	456	448	438	427
6	550	544	525	506	491	481	477	474	471	468	463	458	452	445	438
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	655	644	599	568	550	539	536	534	531	529	526	521	517	510	503
12	590	585	563	551	546	543	542	541	540	537	533	528	522	513	503
13	448	425	393	373	360	354	352	352	352	352	352	351	350	348	345
14	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
15	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
16	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
17	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
18	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
19	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
20	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
21	483	457	423	401	388	381	380	379	379	379	379	378	377	375	372
22	483	458	423	401	388	381	379	379	379	379	379	378	377	375	372
23	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
24	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
25	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
26	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
27	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
28	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
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	490	454	430	416	409	407	406	405	405	405	405	404	402	398
35	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
36	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
37	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
38	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
39	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
40	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
41	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
42	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
43	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
44	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
45	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	370	356	340	321	302	281	259	237	215	193	171	151	...	...	...
17	370	356	340	321	302	281	259	237	215	193	171	151	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	370	356	340	321	302	281	259	237	215	193	171	151	...	...	...
21	370	356	340	321	302	281	259	237	215	193	171	151	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
24	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
25	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
26	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
27	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
28	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
29	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
30	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
31	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
32	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
33	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
34	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
35	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
36	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
37	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
38	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)
(25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	18Cr-10Ni-Cb	Bar	SA-479	347H
2	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347H
3	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP347H
4	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347LN
5	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347LN
6	18Cr-10Ni-Cb	Forgings	SA-182	F348
7	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348
8	18Cr-10Ni-Cb	Plate	SA-240	348
9	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348
10	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348
11	18Cr-10Ni-Cb	Wld. pipe	SA-358	348
12	18Cr-10Ni-Cb	Wld. pipe	SA-358	348
13	18Cr-10Ni-Cb	Wld. pipe	SA-358	348
14	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348
15	18Cr-10Ni-Cb	Smls. & wld. ftgs.	SA-403	348
16	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP348
17	18Cr-10Ni-Cb	Bar	SA-479	348
18	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348
19	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348
20	18Cr-10Ni-Cb	Forgings	SA-182	F348H
21	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H
22	18Cr-10Ni-Cb	Plate	SA-240	348H
23	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H
24	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348H
25	18Cr-10Ni-Cb	Smls. & wld. ftgs.	SA-403	348H
26	18Cr-10Ni-Cb	Bar	SA-479	348H
27	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348H
28	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348H
29	18Cr-10Ni-Cb	Bar	SA/JIS G4303	SUS347
30	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347HFG
31	18Cr-10Ni-Cb	Bolting	SA-320	B8C
32	18Cr-10Ni-Cb	Bolting	SA-320	B8C
33	18Cr-10Ni-Cb	Bolting	SA-320	B8C
34	18Cr-10Ni-Cb	Bolting	SA-320	B8C
35	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321
36	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321
37	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321H
38	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H
39	18Cr-10Ni-Ti	Forgings	SA-182	F321
40	18Cr-10Ni-Ti	Forgings	SA-965	F321
41	18Cr-10Ni-Ti	Forgings	SA-182	F321H
42	18Cr-10Ni-Ti	Forgings	SA-965	F321H
43	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10
44	18Cr-10Ni-Ti	Forgings	SA-182	F321
45	18Cr-10Ni-Ti	Bolting	SA-193	B8T

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S34709	...	...	515
2	S34709	...	...	515
3	S34709	...	...	515
4	S34751	...	...	515
5	S34751	...	...	515
6	S34800	...	≤130	515
7	S34800	...	...	515
8	S34800	...	...	515
9	S34800	...	...	515
10	S34800	...	...	515
11	S34800	1	...	515
12	S34800	3	...	515
13	S34800	4	...	515
14	S34800	...	...	515
15	S34800	...	...	515
16	S34800	...	...	515
17	S34800	...	...	515
18	S34800	...	...	515
19	S34800	...	...	515
20	S34809	...	≤130	515
21	S34809	...	...	515
22	S34809	...	...	515
23	S34809	...	...	515
24	S34809	...	...	515
25	S34809	...	...	515
26	S34809	...	...	515
27	S34809	...	...	515
28	S34809	...	...	515
29	...	...	...	520
30	S34710	...	...	550
31	S34700	2	32 < t ≤ 40	690
32	S34700	2	25 < t ≤ 32	725
33	S34700	2	20 < t ≤ 25	795
34	S34700	2	t ≤ 20	860
35	S32100	...	>9.5	485
36	S32100	...	>9.5	485
37	S32109	...	>9.5	485
38	S32109	...	>9.5	485
39	S32100	...	>130	485
40	S32100	...	...	485
41	S32109	...	>130	485
42	S32109	...	...	485
43	...	...	≤75	500
44	S32100	...	≤130	515
45	S32100	1	...	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	498	461	432	412	400	397	395	394	394	393	392	391	389	385
5	517	498	461	432	412	400	397	395	394	394	393	392	391	389	385
6	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
7	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
8	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
9	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
10	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
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	490	454	430	416	409	407	406	405	405	405	405	404	402	398
15	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
16	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
17	517	490	454	430	416	409	407	406	405	405	405	405	404	402	398
18	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
19	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
20	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
21	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
22	517	491	454	430	416	408	406	406	405	405	405	405	404	402	399
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	490	454	430	416	409	407	406	405	405	405	405	404	402	398
30	552	531	501	481	469	462	459	458	456	455	454	452	449	445	440
31	690	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	725	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	795	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
36	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
37	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
38	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
39	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
40	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
41	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
42	483	454	430	421	421	421	421	421	421	421	421	421	421	421	417
43	500	469	451	438	433	433	433	433	433	433	433	433	433	433	430
44	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
45	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

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
7	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
8	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
9	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
10	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
11	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
12	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
13	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
14	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
15	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
16	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
17	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
18	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
19	393	378	361	341	320	298	275	251	228	204	182	160	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	406	395	381	366	349	330	310	289	267	245	223	201	...	...	...
36	406	395	381	366	349	330	310	289	267	245	223	201	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	406	395	381	366	349	330	310	289	267	245	223	201	...	...	...
40	406	395	381	366	349	330	310	289	267	245	223	201	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
45	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321
2	18Cr-10Ni-Ti	Plate	SA-240	321
3	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321
4	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321
5	18Cr-10Ni-Ti	Bolting	SA-320	B8T
6	18Cr-10Ni-Ti	Bolting	SA-320	B8TA
7	18Cr-10Ni-Ti	Wld. pipe	SA-358	321
8	18Cr-10Ni-Ti	Wld. pipe	SA-358	321
9	18Cr-10Ni-Ti	Wld. pipe	SA-358	321
10	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321
11	18Cr-10Ni-Ti	Smls. & wld. ftgs.	SA-403	321
12	18Cr-10Ni-Ti	Wld. pipe	SA-409	TP321
13	18Cr-10Ni-Ti	Bar	SA-479	321
14	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321
15	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321
16	18Cr-10Ni-Ti	Forgings	SA-182	F321H
17	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321H
18	18Cr-10Ni-Ti	Plate	SA-240	321H
19	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H
20	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321H
21	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H
22	18Cr-10Ni-Ti	Smls. & wld. ftgs.	SA-403	321H
23	18Cr-10Ni-Ti	Bar	SA-479	321H
24	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321H
25	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321H
26	18Cr-10Ni-Ti	Bar	SA/JIS G4303	SUS321
27	18Cr-10Ni-Ti	Bolting	SA-320	B8T
28	18Cr-10Ni-Ti	Bolting	SA-320	B8T
29	18Cr-10Ni-Ti	Bolting	SA-320	B8T
30	18Cr-10Ni-Ti	Bolting	SA-320	B8T
31	18Cr-11Ni	Plate	SA-240	305
32	18Cr-12Ni-2Mo	Castings	SA-351	CF3M
33	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF3M
34	18Cr-12Ni-2Mo	Castings	SA-351	CF8M
35	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF8M
36	18Cr-13Ni-3Mo	Forgings	SA-182	F317L
37	18Cr-13Ni-3Mo	Forgings	SA-182	F317L
38	18Cr-13Ni-3Mo	Forgings	SA-182	F317
39	18Cr-13Ni-3Mo	Plate	SA-240	317
40	18Cr-13Ni-3Mo	Plate	SA-240	317L
41	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317
42	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317L
43	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317
44	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317L
45	18Cr-13Ni-3Mo	Smls. & wld. ftgs.	SA-403	317

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S32100	...	...	515
2	S32100	...	...	515
3	S32100	...	...	515
4	S32100	...	≤9.5	515
5	S32100	1	...	515
6	S32100	1A	...	515
7	S32100	1	...	515
8	S32100	3	...	515
9	S32100	4	...	515
10	S32100	...	≤9.5	515
11	S32100	...	...	515
12	S32100	...	...	515
13	S32100	...	...	515
14	S32100	...	...	515
15	S32100	...	...	515
16	S32109	...	≤130	515
17	S32109	...	...	515
18	S32109	...	...	515
19	S32109	...	...	515
20	S32109	...	≤9.5	515
21	S32109	...	≤9.5	515
22	S32109	...	...	515
23	S32109	...	...	515
24	S32109	...	...	515
25	S32109	...	...	515
26	...	...	...	520
27	S32100	2	32 < t ≤ 40	690
28	S32100	2	25 < t ≤ 32	725
29	S32100	2	20 < t ≤ 25	795
30	S32100	2	t ≤ 20	860
31	S30500	...	...	515
32	J92800	...	...	485
33	J92800	...	...	485
34	J92900	...	...	485
35	J92900	...	...	485
36	S31703	...	>130	450
37	S31703	...	≤130	485
38	S31700	...	≤130	515
39	S31700	...	...	515
40	S31703	...	...	515
41	S31700	...	...	515
42	S31703	...	...	515
43	S31700	...	...	515
44	S31703	...	...	515
45	S31700	...	...	515

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	487	461	452	452	452	452	452	452	452	452	452	452	452	447
16	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
17	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
18	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
19	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
20	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
21	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
22	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
23	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
24	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
25	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
26	517	487	461	452	452	452	452	452	452	452	452	452	452	452	447
27	690	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	725	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	795	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	860	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
32	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
33	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
34	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
35	483	482	469	463	463	463	463	463	463	460	457	451	443	434	422
36	448	433	410	399	395	395	395	394	393	391	388	383	377	369	360
37	483	467	441	429	426	426	425	425	424	421	417	413	406	398	387
38	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
39	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
40	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
41	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
42	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
43	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450
44	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
45	517	516	502	496	495	495	495	495	495	493	489	482	474	463	450

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
2	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
3	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
4	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
5	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
6	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
7	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
8	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
9	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
10	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
11	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
12	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
13	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
14	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
15	432	419	405	388	370	350	329	307	284	260	237	214	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	352	344	333	322	308	...	...	...	...	...	...	...	...	...	...
37	379	370	359	347	332	...	...	...	...	...	...	...	...	...	...
38	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
39	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
40	403	393	382	368	353	...	...	...	...	...	...	...	...	...	...
41	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
42	403	393	382	368	353	...	...	...	...	...	...	...	...	...	...
43	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...
44	403	393	382	368	353	...	...	...	...	...	...	...	...	...	...
45	431	404	377	351	326	302	279	257	235	215	195	176	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	18Cr-13Ni-3Mo	Fittings	SA-403	317L
2	18Cr-15Ni-4Si	Forgings	SA-182	...
3	18Cr-15Ni-4Si	Plate	SA-240	...
4	18Cr-15Ni-4Si	Smls. & wld. pipe	SA-312	...
5	18Cr-15Ni-4Si	Bar	SA-479	...
6	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15
7	18Cr-18Ni-2Si	Plate	SA-240	XM-15
8	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15
9	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15
10	18Cr-20Ni-5.5Si	Smls. tube	SA-213	...
11	18Cr-20Ni-5.5Si	Plate	SA-240	...
12	18Cr-20Ni-5.5Si	Smls. & wld. pipe	SA-312	...
13	18Cr-20Ni-5.5Si	Bar	SA-479	...
14	19Cr-9Ni- $\frac{1}{2}$ Mo	Castings	SA-351	CF10
15	19Cr-9Ni-Mo-W	Bolting	SA-453	651
16	19Cr-9Ni-Mo-W	Bolting	SA-453	651
17	19Cr-9Ni-2Mo	Castings	SA-351	CF10M
18	19Cr-10Ni-3Mo	Castings	SA-351	CG8M
19	19Cr-15Ni-4Mo	Smls. tube	SA-213	...
20	19Cr-15Ni-4Mo	Plate	SA-240	...
21	19Cr-15Ni-4Mo	Wld. tube	SA-249	...
22	19Cr-15Ni-4Mo	Smls. & wld. pipe	SA-312	...
23	19Cr-15Ni-4Mo	Wld. pipe	SA-358	...
24	19Cr-15Ni-4Mo	Smls. pipe	SA-376	...
25	19Cr-15Ni-4Mo	Wld. pipe	SA-409	...
26	19Cr-15Ni-4Mo	Bar	SA-479	...
27	20Cr-3Ni-1.5Mo-N	Plate	SA-240	...
28	20Cr-3Ni-1.5Mo-N	Wld. pipe	SA-790	...
29	20Cr-3Ni-1.5Mo-N	Sheet	SA-240	...
30	20Cr-3Ni-1.5Mo-N	Smls. & wld. tube	SA-789	...
31	20Cr-10Ni	Bar	SA-479	ER308
32	20Cr-18Ni-6Mo	Castings	SA-351	CK3MCuN
33	20Cr-18Ni-6Mo	Forgings	SA-182	F44
34	20Cr-18Ni-6Mo	Smls. tube	SA-213	...
35	20Cr-18Ni-6Mo	Wld. tube	SA-249	...
36	20Cr-18Ni-6Mo	Smls. & wld. pipe	SA-312	...
37	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...
38	20Cr-18Ni-6Mo	Smls. tube	SA-213	...
39	20Cr-18Ni-6Mo	Wld. tube	SA-249	...
40	20Cr-18Ni-6Mo	Smls. & wld. pipe	SA-312	...
41	20Cr-18Ni-6Mo	Plate	SA-240	...
42	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...
43	20.5Cr-8.8Ni-Mo-N	Plate	SA-240	...
44	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...
45	21Cr-5Mn-1.5Ni-Cu-N	Bar	SA-479	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S31703	...	...	515
2	S30600	Solution ann.	...	540
3	S30600	Solution ann.	≤50	540
4	S30600	Solution ann.	...	540
5	S30600	Solution ann.	≤100	540
6	S38100	...	...	515
7	S38100	...	...	515
8	S38100	...	...	515
9	S38100	...	...	515
10	S32615	Solution ann.	...	550
11	S32615	Solution ann.	...	550
12	S32615	Solution ann.	...	550
13	S32615	Solution ann.	...	550
14	J92590	...	...	485
15	S63198	B	...	655
16	S63198	A	...	690
17	...	...	...	485
18	J93000	...	...	515
19	S31725	...	...	515
20	S31725	...	...	515
21	S31725	...	...	515
22	S31725	...	...	515
23	S31725	...	...	515
24	S31725	...	...	515
25	S31725	...	...	515
26	S31725	...	...	515
27	S32003	...	>5	655
28	S32003	...	...	655
29	S32003	...	≤5	690
30	S32003	...	...	690
31	S30880	...	...	515
32	J93254	...	...	550
33	S31254	...	...	650
34	S31254	...	$t > 5$	655
35	S31254	...	$t > 5$	655
36	S31254	...	$t > 5$	655
37	S31254	...	$t \geq 5$	655
38	S31254	...	$t \leq 5$	675
39	S31254	...	$t \leq 5$	675
40	S31254	...	$t \leq 5$	675
41	S31254	...	$t < 5$	690
42	S31254	...	$t < 5$	690
43	S31655	...	...	635
44	S32101	...	>5	650
45	S32101	...	...	650

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	517	499	472	460	457	456	456	455	454	451	448	442	435	426	415
2	538	511	472	...	...	...	...	...	...	...	...	...	...	...	...
3	538	511	472	...	...	...	...	...	...	...	...	...	...	...	...
4	538	511	472	...	...	...	...	...	...	...	...	...	...	...	...
5	538	511	472	...	...	...	...	...	...	...	...	...	...	...	...
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	552	548	524	509	494	...	...	...	...	...	...	...	...	...	...
11	552	548	524	509	494	...	...	...	...	...	...	...	...	...	...
12	552	548	524	509	494	...	...	...	...	...	...	...	...	...	...
13	552	548	524	509	494	...	...	...	...	...	...	...	...	...	...
14	483	454	428	415	410	409	409	408	407	405	403	399	393	387	378
15	655	643	609	588	576	568	566	563	560	556	551	545	536	525	511
16	689	676	641	619	606	598	595	593	590	585	580	573	564	553	538
17	483	481	470	467	465	461	458	454	449	444	440	434	428	423	417
18	517	499	474	461	456	455	455	455	455	454	452	449	443	436	426
19	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
20	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
21	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
22	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
23	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
24	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
25	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
26	517	498	472	460	456	456	456	455	454	452	448	442	435	426	415
27	655	572	543	537	537	537	537	537	537	537	537	537	...	...	...
28	655	572	543	537	537	537	537	537	537	537	537	537	...	...	...
29	689	602	571	565	565	565	565	565	565	565	565	565	...	...	...
30	689	602	571	565	565	565	565	565	565	565	565	565	...	...	...
31	517	485	456	442	437	437	437	437	437	436	433	429	422	413	402
32	552	550	523	501	485	474	471	468	466	465	462	459	455	...	...
33	648	646	616	589	570	557	553	550	548	546	543	539	534	...	...
34	655	653	623	595	576	563	559	556	554	552	549	545	540	...	...
35	655	653	623	595	576	563	559	556	554	552	549	545	540	...	...
36	655	653	623	595	576	563	559	556	554	552	549	545	540	...	...
37	655	653	623	595	576	563	559	556	554	552	549	545	540	...	...
38	675	673	642	613	594	580	576	573	571	569	566	561	556	...	...
39	675	673	642	613	594	580	576	573	571	569	566	561	556	...	...
40	675	673	642	613	594	580	576	573	571	569	566	561	556	...	...
41	689	688	655	627	607	593	589	585	583	580	575	572	571	...	...
42	689	688	655	627	607	593	589	585	583	580	575	572	571	...	...
43	635	620	586	562	546	535	531	528	524	520	515	509	501	...	...
44	650	650	618	599	596	596	596	596	...	...	...	...	...	...	...
45	650	650	618	599	596	596	596	596	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	403	393	382	368	353	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. tube	SA-789	...
2	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. pipe	SA-790	...
3	21Cr-5Mn-1.5Ni-Cu-N	Fittings	SA-815	...
4	21Cr-5Mn-1.5Ni-Cu-N	Sheet, strip	SA-240	...
5	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. tube	SA-789	...
6	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. pipe	SA-790	...
7	21Cr-6Ni-9Mn	Forgings	SA-182	FXM-11
8	21Cr-6Ni-9Mn	Smls. & wld. pipe	SA-312	TPXM-11
9	21Cr-6Ni-9Mn	Plate	SA-666	XM-11
10	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11
11	21Cr-11Ni-N	Forgings	SA-182	F45
12	21Cr-11Ni-N	Smls. tube	SA-213	...
13	21Cr-11Ni-N	Plate	SA-240	...
14	21Cr-11Ni-N	Wld. tube	SA-249	...
15	21Cr-11Ni-N	Smls. & wld. pipe	SA-312	...
16	21Cr-11Ni-N	Bar	SA-479	...
17	22Cr-2Ni-Mo-N	Forgings	SA-182	F66
18	22Cr-2Ni-Mo-N	Plate	SA-240	...
19	22Cr-2Ni-Mo-N	Bar	SA-479	...
20	22Cr-2Ni-Mo-N	Smls. & wld. tube	SA-789	...
21	22Cr-2Ni-Mo-N	Smls. & wld. pipe	SA-790	...
22	22Cr-2Ni-Mo-N	Smls. & wld. fittings	SA-815	...
23	22Cr-5Ni-3Mo-N	Castings	SA-995	4A
24	22Cr-5Ni-3Mo-N	Forgings	SA-182	F51
25	22Cr-5Ni-3Mo-N	Plate	SA-240	...
26	22Cr-5Ni-3Mo-N	Bar	SA-479	...
27	22Cr-5Ni-3Mo-N	Smls. & wld. tube	SA-789	...
28	22Cr-5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...
29	22Cr-5Ni-3Mo-N	Smls. & wld. ftgs.	SA-815	...
30	22Cr-5Ni-3Mo-N	Forgings	SA-182	F60
31	22Cr-5Ni-3Mo-N	Plate	SA-240	...
32	22Cr-5Ni-3Mo-N	Bar	SA-479	...
33	22Cr-5Ni-3Mo-N	Smls. & wld. tube	SA-789	...
34	22Cr-5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...
35	22Cr-5Ni-3Mo-N	Smls. & wld. ftgs.	SA-815	...
36	22Cr-13Ni-5Mn	Castings	SA-351	CG6MMN
37	22Cr-13Ni-5Mn	Forgings	SA-182	FXM-19
38	22Cr-13Ni-5Mn	Bolting	SA-193	B8R
39	22Cr-13Ni-5Mn	Bolting	SA-193	B8RA
40	22Cr-13Ni-5Mn	Smls. tube	SA-213	XM-19
41	22Cr-13Ni-5Mn	Plate	SA-240	XM-19
42	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19
43	22Cr-13Ni-5Mn	Smls. & wld. pipe	SA-312	TPXM-19
44	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19
45	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S32101	...	>5	650
2	S32101	...	>5	650
3	S32101	...	...	650
4	S32101	...	≤5	700
5	S32101	...	≤5	700
6	S32101	...	≤5	700
7	S21904	...	...	620
8	S21904	...	...	620
9	S21904	...	...	620
10	S21904	...	...	620
11	S30815	...	...	600
12	S30815	...	...	600
13	S30815	...	...	600
14	S30815	...	...	600
15	S30815	...	...	600
16	S30815	...	...	600
17	S32202	...	...	650
18	S32202	...	...	650
19	S32202	...	...	650
20	S32202	...	...	650
21	S32202	...	...	650
22	S32202	...	...	650
23	J92205	...	...	620
24	S31803	...	...	620
25	S31803	...	...	620
26	S31803	...	...	620
27	S31803	...	...	620
28	S31803	...	...	620
29	S31803	...	...	620
30	S32205	...	...	655
31	S32205	...	...	655
32	S32205	...	...	655
33	S32205	...	...	655
34	S32205	...	...	655
35	S32205	...	...	655
36	J93790	...	...	585
37	S20910	...	...	690
38	S20910	Annealed	...	690
39	S20910	Annealed	...	690
40	S20910	...	...	690
41	S20910	...	...	690
42	S20910	...	...	690
43	S20910	...	...	690
44	S20910	1	...	690
45	S20910	3	...	690

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	650	650	618	599	596	596	596	596	...	...	...	...	...	...	...
2	650	650	618	599	596	596	596	596	...	...	...	...	...	...	...
3	650	650	618	599	596	596	596	596	...	...	...	...	...	...	...
4	700	700	666	645	642	642	642	642	...	...	...	...	...	...	...
5	700	700	666	645	642	642	642	642	...	...	...	...	...	...	...
6	700	700	666	645	642	642	642	642	...	...	...	...	...	...	...
7	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
8	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
9	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
10	621	618	579	551	533	522	517	513	510	504	499	492	483	472	460
11	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
12	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
13	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
14	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
15	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
16	600	594	562	542	529	519	514	510	506	502	497	491	485	478	470
17	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
18	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
19	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
20	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
21	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
22	648	640	600	595	595	595	595	...	...	...	...	...	...	...	...
23	621	621	594	587	587	587	...	...	...	...	...	...	...	...	...
24	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
25	621	619	598	577	564	558	556	555	...	...	...	...	...	...	...
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	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
31	655	655	631	610	596	588	587	586	...	...	...	...	...	...	...
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	586	580	552	534	523	516	512	509	506	502	497	492	485	477	467
37	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
38	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
39	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
40	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
41	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
42	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
43	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
44	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
45	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
38	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
39	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
40	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
41	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
42	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
43	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
44	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
45	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19
2	22Cr-13Ni-5Mn	Smls. & wld. ftgs.	SA-403	XM-19
3	22Cr-13Ni-5Mn	Bar	SA-479	XM-19
4	22Cr-13Ni-5Mn	Bar	SA-479	XM-19
5	22Cr-13Ni-5Mn	Wld. pipe	SA-813	TPXM-19
6	22Cr-13Ni-5Mn	Wld. pipe	SA-814	TPXM-19
7	22Cr-13Ni-5Mn	Forgings	SA-965	FXM-19
8	22Cr-13Ni-5Mn	Bar	SA-479	XM-19
9	22Cr-13Ni-5Mn	Bar	SA-479	XM-19
10	23Cr-4Ni-Mo-Cu-N	Plate	SA-240	...
11	23Cr-4Ni-Mo-Cu-N	Smls. & wld. tube	SA-789	...
12	23Cr-4Ni-Mo-Cu-N	Smls. & wld. pipe	SA-790	...
13	23Cr-4Ni-Mo-Cu-N	Smls. & wld. tube	SA-789	...
14	23Cr-12Ni	Smls. & wld. ftgs.	SA-403	309
15	23Cr-12Ni	Smls. tube	SA-213	TP309S
16	23Cr-12Ni	Plate	SA-240	309S
17	23Cr-12Ni	Wld. tube	SA-249	TP309S
18	23Cr-12Ni	Smls. & wld. pipe	SA-312	TP309S
19	23Cr-12Ni	Wld. pipe	SA-358	309S
20	23Cr-12Ni	Wld. pipe	SA-358	309S
21	23Cr-12Ni	Wld. pipe	SA-358	309S
22	23Cr-12Ni	Bar	SA-479	309S
23	23Cr-12Ni	Wld. pipe	SA-813	TP309S
24	23Cr-12Ni	Wld. pipe	SA-814	TP309S
25	23Cr-12Ni	Smls. tube	SA-213	TP309H
26	23Cr-12Ni	Plate	SA-240	309H
27	23Cr-12Ni	Wld. tube	SA-249	TP309H
28	23Cr-12Ni	Smls. & wld. pipe	SA-312	TP309H
29	23Cr-12Ni	Bar	SA-479	309H
30	23Cr-12Ni	Bar	SA/JIS G4303	SUS309S
31	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb
32	23Cr-12Ni-Cb	Plate	SA-240	309Cb
33	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb
34	23Cr-12Ni-Cb	Smls. & wld. pipe	SA-312	TP309Cb
35	23Cr-12Ni-Cb	Bar	SA-479	309Cb
36	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb
37	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb
38	23Cr-25Ni-5.5Mo-N	Forgings	SA-182	...
39	23Cr-25Ni-5.5Mo-N	Bolting	SA-193	...
40	23Cr-25Ni-5.5Mo-N	Plate	SA-240	...
41	23Cr-25Ni-5.5Mo-N	Wld. tube	SA-249	...
42	23Cr-25Ni-5.5Mo-N	Smls. & wld. pipe	SA-312	...
43	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-358	...
44	23Cr-25Ni-5.5Mo-N	Fittings	SA-403	...
45	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-409	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S20910	4	...	690
2	S20910	...	...	690
3	S20910	Annealed	...	690
4	S20910	Hot rolled	$76.2 < t \leq 203.2$	690
5	S20910	...	...	690
6	S20910	...	...	690
7	S20910	...	...	690
8	S20910	Hot rolled	$50.8 < t \leq 76.2$	795
9	S20910	Hot rolled	≤ 50.8	930
10	S32304	...	...	600
11	S32304	...	> 25	600
12	S32304	...	...	600
13	S32304	...	≤ 25	690
14	S30900	...	...	515
15	S30908	...	...	515
16	S30908	...	...	515
17	S30908	...	...	515
18	S30908	...	...	515
19	S30908	1	...	515
20	S30908	3	...	515
21	S30908	4	...	515
22	S30908	...	...	515
23	S30908	...	...	515
24	S30908	...	...	515
25	S30909	...	...	515
26	S30909	...	...	515
27	S30909	...	...	515
28	S30909	...	...	515
29	S30909	...	...	515
30	...	...	...	520
31	S30940	...	...	515
32	S30940	...	...	515
33	S30940	...	...	515
34	S30940	...	...	515
35	S30940	...	...	515
36	S30940	...	...	515
37	S30940	...	...	515
38	S32053	...	...	640
39	S32053	...	...	640
40	S32053	...	...	640
41	S32053	...	...	640
42	S32053	...	...	640
43	S32053	...	...	640
44	S32053	...	...	640
45	S32053	...	...	640

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	689	683	649	629	617	607	603	599	595	590	585	579	572	564	555
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	793	784	747	724	709	698	693	689	684	678	673	665	657	649	638
9	931	920	876	850	832	820	814	809	803	797	789	781	772	761	749
10	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
11	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
12	600	575	542	525	516	509	505	501	496	491	485	479	...	...	...
13	689	661	624	605	595	588	584	579	574	...	...	...	...	...	...
14	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
15	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
16	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
17	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
18	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
19	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
20	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
21	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
22	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
23	517	517	515	504	495	487	482	476	470	463	454	444	434	422	408
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	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
39	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
40	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
41	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
42	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
43	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
44	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
45	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
2	540	530	528	505	489	...	...	...	...	...	...	...	...	...	...
3	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
4	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
5	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
6	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
7	540	530	518	505	489	...	...	...	...	...	...	...	...	...	...
8	622	610	597	581	564	...	...	...	...	...	...	...	...	...	...
9	727	714	698	680	659	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
16	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
17	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
18	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
19	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
20	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
21	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
22	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
23	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
24	390	372	354	334	313	292	270	248	226	204	182	160	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	23Cr-25Ni-5.5Mo-N	Bar	SA-479	...
2	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-813	...
3	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-814	...
4	24Cr-10Ni-4Mo-N	Castings	SA-995	2A
5	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-182	F58
6	24Cr-22Ni-6Mo-2W-Cu-N	Smls. tube	SA-213	...
7	24Cr-22Ni-6Mo-2W-Cu-N	Plate	SA-240	...
8	24Cr-22Ni-6Mo-2W-Cu-N	Wld. tube	SA-249	...
9	24Cr-22Ni-6Mo-2W-Cu-N	Smls. & wld. pipe	SA-312	...
10	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-358	...
11	24Cr-22Ni-6Mo-2W-Cu-N	Smls. & wld. fittings	SA-403	...
12	24Cr-22Ni-6Mo-2W-Cu-N	Bar, shapes	SA-479	...
13	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-813	...
14	25Cr-4Ni-4Mo-Ti	Plate	SA-240	...
15	25Cr-4Ni-4Mo-Ti	Wld. tube	SA-268	...
16	25Cr-5Ni-3Mo-2Cu	Castings	SA-995	1B
17	25Cr-5Ni-3Mo-2Cu	Plate	SA-240	...
18	25Cr-5Ni-3Mo-2Cu	Bar	SA-479	...
19	25Cr-5Ni-3Mo-2Cu	Smls. & wld. tube	SA-789	...
20	25Cr-5Ni-3Mo-2Cu	Smls. & wld. pipe	SA-790	...
21	25Cr-6Ni-Mo-N	Forgings	SA-182	...
22	25Cr-6Ni-Mo-N	Plate, sheet	SA-240	...
23	25Cr-6Ni-Mo-N	Bar	SA-479	...
24	25Cr-6Ni-Mo-N	Smls. tube	SA-789	...
25	25Cr-6Ni-Mo-N	Wld. tube	SA-789	...
26	25Cr-6Ni-Mo-N	Smls. pipe	SA-790	...
27	25Cr-6Ni-Mo-N	Wld. pipe	SA-790	...
28	25Cr-6Ni-Mo-N	Plate	SA-240	...
29	25Cr-6.5Ni-3Mo-N	Smls. & wld. tube	SA-789	...
30	25Cr-6.5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...
31	25Cr-6.5Ni-3Mo-N	Plate	SA-240	...
32	25Cr-7Ni-3Mo-W-Cu-N	Forgings	SA-182	F54
33	25Cr-7Ni-3Mo-W-Cu-N	Smls. & wld. tube	SA-789	...
34	25Cr-7Ni-3Mo-W-Cu-N	Smls. & wld. pipe	SA-790	...
35	25Cr-7Ni-4Mo-N	Forgings	SA-182	F53
36	25Cr-7Ni-4Mo-N	Plate	SA-240	...
37	25Cr-7Ni-4Mo-N	Smls. & wld. tube	SA-789	...
38	25Cr-7Ni-4Mo-N	Smls. & wld. pipe	SA-790	...
39	25Cr-7.5Ni-3.5Mo-N-Cu-W	Castings	SA-995	CD3MWCuN
40	25Cr-7.5Ni-3.5Mo-N-Cu-W	Forgings	SA-182	F55
41	25Cr-7.5Ni-3.5Mo-N-Cu-W	Plate	SA-240	...
42	25Cr-7.5Ni-3.5Mo-N-Cu-W	Bar	SA-479	...
43	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. tube	SA-789	...
44	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. pipe	SA-790	...
45	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. ftgs.	SA-815	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S32053	...	...	640
2	S32053	...	...	640
3	S32053	...	...	640
4	J93345	...	...	655
5	S31266	...	...	750
6	S31266	...	...	750
7	S31266	...	...	750
8	S31266	...	...	750
9	S31266	...	...	750
10	S31266	...	...	750
11	S31266	...	...	750
12	S31266	...	...	750
13	S31266	...	...	750
14	S44635	...	...	620
15	S44635	...	...	620
16	J93372	...	...	690
17	S32550	...	...	760
18	S32550	...	...	760
19	S32550	...	...	760
20	S32550	...	...	760
21	S32506	...	...	620
22	S32506	...	...	620
23	S32506	...	...	620
24	S32506	...	...	620
25	S32506	...	...	620
26	S32506	...	...	620
27	S32506	...	...	620
28	S31200	...	...	690
29	S31260	...	...	690
30	S31260	...	...	690
31	S31260	...	...	690
32	S39274	...	...	800
33	S39274	...	...	800
34	S39274	...	...	800
35	S32750	...	...	800
36	S32750	...	...	800
37	S32750	...	...	800
38	S32750	...	...	800
39	J93380	...	...	690
40	S32760	...	...	750
41	S32760	...	...	750
42	S32760	Annealed	...	750
43	S32760	...	...	750
44	S32760	...	...	750
45	S32760	...	...	750

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
2	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
3	640	638	605	579	558	542	536	531	...	...	...	...	...	...	...
4	655	652	604	583	583	583	583	580	557	...	...	...	...	...	...
5	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
6	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
7	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
8	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
9	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
10	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
11	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
12	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
13	752	736	697	670	651	638	633	628	624	619	614	607	...	...	...
14	621	597	565	545	532	528	525	521	...	...	...	...	...	...	...
15	621	597	565	545	532	528	525	521	...	...	...	...	...	...	...
16	689	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
18	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
19	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
20	758	752	712	691	682	...	...	...	...	...	...	...	...	...	...
21	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
22	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
23	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
24	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
25	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
26	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
27	620	614	588	581	581	581	581	...	...	...	...	...	...	...	...
28	689	687	653	635	631	631	631	...	...	...	...	...	...	...	...
29	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
30	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
31	689	687	654	638	636	636	636	636	...	...	...	...	...	...	...
32	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
33	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
34	800	796	762	756	756	756	756	756	756	756	...	...	...	...	...
35	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
36	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
37	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
38	800	792	752	729	715	711	709	...	...	...	...	...	...	...	...
39	690	680	649	642	642	642	642	...	...	...	...	...	...	...	...
40	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
41	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
42	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
43	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
44	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...
45	750	698	647	638	638	638	638	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Ferrous Materials (Cont'd)				
1	25Cr-12Ni	Castings	SA-351	CH8
2	25Cr-12Ni	Cast pipe	SA-451	CPH8
3	25Cr-12Ni	Castings	SA-351	CH20
4	25Cr-12Ni	Cast pipe	SA-451	CPH20
5	25Cr-20Ni	Castings	SA-351	CK20
6	25Cr-20Ni	Cast pipe	SA-451	CPK20
7	25Cr-20Ni	Forgings	SA-182	F310
8	25Cr-20Ni	Forgings	SA-965	F310
9	25Cr-20Ni	Smls. tube	SA-213	...
10	25Cr-20Ni	Smls. pipe	SA-312	...
11	25Cr-20Ni	Smls. tube	SA-213	TP310S
12	25Cr-20Ni	Plate	SA-240	310S
13	25Cr-20Ni	Wld. tube	SA-249	TP310S
14	25Cr-20Ni	Smls. & wld. pipe	SA-312	TP310S
15	25Cr-20Ni	Wld. pipe	SA-358	310S
16	25Cr-20Ni	Wld. pipe	SA-358	310S
17	25Cr-20Ni	Wld. pipe	SA-358	310S
18	25Cr-20Ni	Smls. & wld. ftgs.	SA-403	310S
19	25Cr-20Ni	Bar	SA-479	310S
20	25Cr-20Ni	Wld. pipe	SA-813	TP310S
21	25Cr-20Ni	Wld. pipe	SA-814	TP310S
22	25Cr-20Ni	Smls. tube	SA-213	TP310H
23	25Cr-20Ni	Plate	SA-240	310H
24	25Cr-20Ni	Wld. tube	SA-249	TP310H
25	25Cr-20Ni	Smls. & wld. pipe	SA-312	TP310H
26	25Cr-20Ni	Bar	SA-479	310H
27	25Cr-20Ni	Bar	SA/JIS G4303	SUS310S
28	25Cr-20Ni-Cb	Smls. tube	SA-213	TP310Cb
29	25Cr-20Ni-Cb	Plate	SA-240	310Cb
30	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb
31	25Cr-20Ni-Cb	Smls. & wld. pipe	SA-312	TP310Cb
32	25Cr-20Ni-Cb	Bar	SA-479	310Cb
33	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb
34	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb
35	25Cr-20Ni-Cb-N	Smls. tube	SA-213	TP310HCbN
36	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLN
37	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN
38	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN
39	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN
40	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN
41	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN
42	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN
43	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN
44	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN
45	26Cr-4Ni-Mo	Plate	SA-240	329

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	J93400	...	...	450
2	J93400	...	...	450
3	J93402	...	...	485
4	J93402	...	...	485
5	J94202	...	...	450
6	J94202	...	...	450
7	S31000	...	≤130	515
8	S31000	...	...	515
9	S31002	...	...	500
10	S31002	...	...	500
11	S31008	...	...	515
12	S31008	...	...	515
13	S31008	...	...	515
14	S31008	...	...	515
15	S31008	1	...	515
16	S31008	3	...	515
17	S31008	4	...	515
18	S31008	...	...	515
19	S31008	...	...	515
20	S31008	...	...	515
21	S31008	...	...	515
22	S31009	...	...	515
23	S31009	...	...	515
24	S31009	...	...	515
25	S31009	...	...	515
26	S31009	...	...	515
27	...	...	...	520
28	S31040	...	...	515
29	S31040	...	...	515
30	S31040	...	...	515
31	S31040	...	...	515
32	S31040	...	...	515
33	S31040	...	...	515
34	S31040	...	...	515
35	S31042	...	...	655
36	S31050	...	...	540
37	S31050	...	6 < t ≤ 32	540
38	S31050	...	t > 6	540
39	S31050	...	6 < t ≤ 32	540
40	S31050	...	6 < t ≤ 32	540
41	S31050	...	≤6	580
42	S31050	...	t ≤ 6	580
43	S31050	...	≤6	580
44	S31050	...	≤6	580
45	S32900	...	...	620

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
2	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
3	483	437	411	401	399	399	399	398	395	391	384	375	364	350	334
4	483	437	411	401	399	399	399	398	395	391	384	375	364	350	334
5	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
6	448	406	382	372	371	371	371	370	367	362	356	348	338	325	310
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	503	503	489	468	454	444	441	436	432	426	421	417	414	414	...
10	503	503	489	468	454	444	441	436	432	426	421	417	414	414	...
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	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
22	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
23	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
24	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
25	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
26	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
27	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
28	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
29	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
30	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
31	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
32	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
33	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
34	517	509	488	480	479	479	479	479	477	474	469	463	454	444	432
35	655	643	613	594	584	579	577	576	574	572	570	568	561	555	547
36	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
37	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
38	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
39	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
40	538	528	502	485	472	462	458	454	450	447	444	439	435	428	418
41	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
42	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
43	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
44	579	569	541	522	508	497	493	488	485	482	478	473	468	460	450
45	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
12	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
13	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
14	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
15	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
16	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
17	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
18	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
19	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
20	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
21	410	393	373	352	328	303	277	250	223	195	169	144	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Ferrous Materials (Cont'd)			
1	26Cr-4Ni-Mo	Smls. & wld. tube	SA-789	...
2	26Cr-4Ni-Mo	Smls. & wld. pipe	SA-790	...
3	26Cr-4Ni-Mo-N	Plate	SA-240	...
4	26Cr-4Ni-Mo-N	Smls. & wld. tube	SA-789	...
5	26Cr-4Ni-Mo-N	Smls. & wld. pipe	SA-790	...
6	27Cr-7.5Ni-4.5Mo-Co-N	Smls. tube	SA-789	...
7	27Cr-7.5Ni-4.5Mo-Co-N	Smls. pipe	SA-790	...
8	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...
9	29Cr-6.5Ni-2Mo-N	Bar	SA-479	...
10	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...
11	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...
12	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...
13	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...
14	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Design./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Ferrous Materials (Cont'd)				
1	S32900	...	...	620
2	S32900	...	...	620
3	S32950	...	...	690
4	S32950	...	...	690
5	S32950	...	...	690
6	S32707	...	...	920
7	S32707	...	...	920
8	S32906	...	≥10	750
9	S32906	...	...	750
10	S32906	...	≥10	750
11	S32906	...	≥10	750
12	S32906	...	<10	800
13	S32906	...	<10	800
14	S32906	...	<10	800

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)														
1	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...
2	621	620	597	586	585	585	585	585	585	...	...	...	...	...	...
3	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
4	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
5	689	685	652	638	638	638	638	638	638	...	...	...	...	...	...
6	917	917	910	893	859	851	...	...	...	...	...	...	...	...	...
7	917	917	910	893	859	851	...	...	...	...	...	...	...	...	...
8	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
9	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
10	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
11	752	746	714	694	684	683	683	...	...	...	...	...	...	...	...
12	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...
13	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...
14	800	794	760	739	728	726	726	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials				
1	...	Plate, sheet	SB-209	...
2	...	Plate, sheet	SB-209	...
3	...	Plate, sheet	SB-209	...
4	...	Plate, sheet	SB-209	...
5	...	Plate, sheet	SB-209	...
6	...	Plate, sheet	SB-209	...
7	...	Plate, sheet	SB-209	...
8	...	Plate, sheet	SB-209	...
9	...	Plate, sheet	SB-209	...
10	...	Drawn smls. tube	SB-210	...
11	...	Drawn smls. tube	SB-210	...
12	...	Drawn smls. tube	SB-210	...
13	...	Drawn smls. tube	SB-210	...
14	...	Cond. & heat exch. tubes	SB-234	...
15	...	Cond. & heat exch. tubes	SB-234	...
16	...	Smls. extr. tube	SB-241	...
17	...	Smls. extr. tube	SB-241	...
18	...	Plate, sheet	SB-209	...
19	...	Plate, sheet	SB-209	...
20	...	Plate, sheet	SB-209	...
21	...	Plate, sheet	SB-209	...
22	...	Plate, sheet	SB-209	...
23	...	Plate, sheet	SB-209	...
24	...	Plate, sheet	SB-209	...
25	...	Plate, sheet	SB-209	...
26	...	Plate, sheet	SB-209	...
27	...	Plate, sheet	SB-209	...
28	...	Plate, sheet	SB-209	...
29	...	Plate, sheet	SB-209	...
30	...	Plate, sheet	SB-209	...
31	...	Plate, sheet	SB-209	...
32	...	Plate, sheet	SB-209	...
33	...	Plate, sheet	SB-209	...
34	...	Plate, sheet	SB-209	...
35	...	Plate, sheet	SB-209	...
36	...	Plate, sheet	SB-209	...
37	...	Castings	SB/EN 1706	...
38	...	Plate, sheet	SB-209	...
39	...	Plate, sheet	SB-209	...
40	...	Plate, sheet	SB-209	...
41	...	Plate, sheet	SB-209	...
42	...	Plate, sheet	SB-209	...
43	...	Plate, sheet	SB-209	...
44	...	Drawn smls. tube	SB-210	...
45	...	Drawn smls. tube	SB-210	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
				Nonferrous Materials
1	Alclad 3003	O	0.15–12.67	90.0
2	Alclad 3003	O	12.70–76.20	95.0
3	Alclad 3003	H112	6.35–12.67	110
4	Alclad 3003	H112	12.70–50.80	105
5	Alclad 3003	H112	50.83–76.20	100
6	Alclad 3003	H12	0.43–12.67	110
7	Alclad 3003	H12	12.70–50.80	115
8	Alclad 3003	H14	0.23–12.67	130
9	Alclad 3003	H14	12.70–25.40	140
10	Alclad 3003	O	0.25–12.70	90.0
11	Alclad 3003	H113	1.27–12.70	90.0
12	Alclad 3003	H14	0.25–12.70	130
13	Alclad 3003	H18	0.25–12.70	180
14	Alclad 3003	H14	0.25–5.08	130
15	Alclad 3003	H25	0.25–5.08	145
16	Alclad 3003	O	...	90.0
17	Alclad 3003	H112	...	90.0
18	Alclad 3004	O	0.15–12.67	145
19	Alclad 3004	O	12.70–76.20	150
20	Alclad 3004	H112	6.35–12.67	150
21	Alclad 3004	H112	12.70–76.20	160
22	Alclad 3004	H32	0.43–12.67	185
23	Alclad 3004	H32	12.70–50.80	195
24	Alclad 3004	H34	0.23–12.67	215
25	Alclad 3004	H34	12.70–25.40	220
26	Alclad 6061	T4	0.25–6.34	185
27	Alclad 6061	T451	6.35–12.69	185
28	Alclad 6061	T451	12.70–76.20	205
29	Alclad 6061	T4 wld.	0.25–6.34	165
30	Alclad 6061	T451 wld.	6.35–76.20	165
31	Alclad 6061	T6	0.25–6.34	260
32	Alclad 6061	T651	6.35–12.69	260
33	Alclad 6061	T651	12.70–101.60	290
34	Alclad 6061	T651	101.61–127.00	275
35	Alclad 6061	T6 wld.	0.25–6.34	165
36	Alclad 6061	T651 wld.	6.35–127.00	165
37	AC-42000-S	T6	...	220
38	A91060	O	0.15–76.2	55.0
39	A91060	H112	6.35–12.7	75.0
40	A91060	H112	12.7–25.4	70.0
41	A91060	H112	25.4–76.2	60.0
42	A91060	H12	0.43–50.8	75.0
43	A91060	H14	0.23–25.4	85.0
44	A91060	O	0.46–12.7	60.0
45	A91060	H14	0.46–12.7	85.0

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials														
1	89.6	80.9	66.7	52.7	...	...	...	...	...	...	...	...	...	...	...
2	96.5	87.1	71.9	56.7	...	...	...	...	...	...	...	...	...	...	...
3	110	98.5	82.5	61.8	...	...	...	...	...	...	...	...	...	...	...
4	103	93.8	79.4	63.9	...	...	...	...	...	...	...	...	...	...	...
5	100	90.7	76.8	61.8	...	...	...	...	...	...	...	...	...	...	...
6	110	107	92.9	76.1	...	...	...	...	...	...	...	...	...	...	...
7	117	114	98.7	80.9	...	...	...	...	...	...	...	...	...	...	...
8	131	131	115	92.6	...	...	...	...	...	...	...	...	...	...	...
9	138	138	121	97.5	...	...	...	...	...	...	...	...	...	...	...
10	89.6	81.4	67.9	54.8	...	...	...	...	...	...	...	...	...	...	...
11	89.6	81.4	67.9	54.8	...	...	...	...	...	...	...	...	...	...	...
12	131	131	115	92.6	...	...	...	...	...	...	...	...	...	...	...
13	179	170	138	70.3	...	...	...	...	...	...	...	...	...	...	...
14	131	131	115	92.6	...	...	...	...	...	...	...	...	...	...	...
15	145	145	127	99.2	...	...	...	...	...	...	...	...	...	...	...
16	89.6	81.4	67.9	54.8	...	...	...	...	...	...	...	...	...	...	...
17	89.6	81.4	67.9	54.8	...	...	...	...	...	...	...	...	...	...	...
18	145	145	132	84.4	...	...	...	...	...	...	...	...	...	...	...
19	152	152	138	88.5	...	...	...	...	...	...	...	...	...	...	...
20	152	152	138	88.5	...	...	...	...	...	...	...	...	...	...	...
21	159	159	129	70.6	...	...	...	...	...	...	...	...	...	...	...
22	186	186	178	144	...	...	...	...	...	...	...	...	...	...	...
23	193	193	185	149	...	...	...	...	...	...	...	...	...	...	...
24	214	214	197	145	...	...	...	...	...	...	...	...	...	...	...
25	221	221	203	150	...	...	...	...	...	...	...	...	...	...	...
26	186	186	178	126	...	...	...	...	...	...	...	...	...	...	...
27	186	186	178	126	...	...	...	...	...	...	...	...	...	...	...
28	207	207	196	135	...	...	...	...	...	...	...	...	...	...	...
29	165	165	157	108	...	...	...	...	...	...	...	...	...	...	...
30	165	165	157	108	...	...	...	...	...	...	...	...	...	...	...
31	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
32	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
33	290	290	239	140	...	...	...	...	...	...	...	...	...	...	...
34	276	276	228	132	...	...	...	...	...	...	...	...	...	...	...
35	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
36	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
37	221	220	197	...	...	...	...	...	...	...	...	...	...	...	...
38	55.2	45.8	36.4	28.2	...	...	...	...	...	...	...	...	...	...	...
39	75.8	63.6	50.6	40.2	...	...	...	...	...	...	...	...	...	...	...
40	68.9	57.5	45.8	36.4	...	...	...	...	...	...	...	...	...	...	...
41	62.1	51.7	41.2	32.7	...	...	...	...	...	...	...	...	...	...	...
42	75.8	69.5	56.5	43.4	...	...	...	...	...	...	...	...	...	...	...
43	82.7	82.7	79.9	71.0	...	...	...	...	...	...	...	...	...	...	...
44	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
45	82.7	82.7	79.9	71.0	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Drawn smls. tube	SB-210	...
2	...	Bar, rod, shapes	SB-221	...
3	...	Bar, rod, shapes	SB-221	...
4	...	Cond. & heat exch. tubes	SB-234	...
5	...	Smls. extr. tube	SB-241	...
6	...	Smls. extr. tube	SB-241	...
7	...	Plate, sheet	SB-209	...
8	...	Plate, sheet	SB-209	...
9	...	Plate, sheet	SB-209	...
10	...	Plate, sheet	SB-209	...
11	...	Plate, sheet	SB-209	...
12	...	Plate, sheet	SB-209	...
13	...	Bar, rod, shapes	SB-221	...
14	...	Bar, rod, shapes	SB-221	...
15	...	Smls. extr. tube	SB-241	...
16	...	Smls. extr. tube	SB-241	...
17	...	Plate, sheet	SB-209	...
18	...	Plate, sheet	SB-209	...
19	...	Plate, sheet	SB-209	...
20	...	Plate, sheet	SB-209	...
21	...	Plate, sheet	SB-209	...
22	...	Plate, sheet	SB-209	...
23	...	Drawn smls. tube	SB-210	...
24	...	Drawn smls. tube	SB-210	...
25	...	Drawn smls. tube	SB-210	...
26	...	Drawn smls. tube	SB-210	...
27	...	Drawn smls. tube	SB-210	...
28	...	Bar, rod, shapes	SB-221	...
29	...	Bar, rod, shapes	SB-221	...
30	...	Cond. & heat exch. tubes	SB-234	...
31	...	Cond. & heat exch. tubes	SB-234	...
32	...	Smls. extr. tube	SB-241	...
33	...	Smls. extr. tube	SB-241	...
34	...	Smls. pipe	SB-241	...
35	...	Smls. pipe	SB-241	...
36	...	Die forgings	SB-247	...
37	...	Die forgings	SB-247	...
38	...	Plate, sheet	SB-209	...
39	...	Plate, sheet	SB-209	...
40	...	Plate, sheet	SB-209	...
41	...	Plate, sheet	SB-209	...
42	...	Plate, sheet	SB-209	...
43	...	Plate, sheet	SB-209	...
44	...	Plate, sheet	SB-209	...
45	...	Plate, sheet	SB-209	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	A91060	H113	0.46–12.7	60.0
2	A91060	O	...	60.0
3	A91060	H112	...	60.0
4	A91060	H14	0.25–5.08	85.0
5	A91060	O	...	60.0
6	A91060	H112	...	60.0
7	A91100	O	0.15–76.2	75.0
8	A91100	H112	6.35–12.7	90.0
9	A91100	H112	12.7–50.8	85.0
10	A91100	H112	50.8–76.2	80.0
11	A91100	H12	0.43–50.8	95.0
12	A91100	H14	0.23–25.4	110
13	A91100	O	...	75.0
14	A91100	H112	...	75.0
15	A91100	O	...	75.0
16	A91100	H112	...	75.0
17	A93003	O	0.15–76.20	95.0
18	A93003	H112	6.35–12.67	115
19	A93003	H112	12.70–50.80	105
20	A93003	H112	50.83–76.20	100
21	A93003	H12	0.43–50.80	115
22	A93003	H14	0.23–25.40	140
23	A93003	O	0.25–12.70	95.0
24	A93003	H113	0.25–12.70	95.0
25	A93003	H12	0.25–12.70	115
26	A93003	H14	0.25–12.70	140
27	A93003	H18	0.25–12.70	185
28	A93003	O	...	95.0
29	A93003	H112	...	95.0
30	A93003	H14	0.25–5.08	140
31	A93003	H25	0.25–5.08	150
32	A93003	O	...	95.0
33	A93003	H112	...	95.0
34	A93003	H112	≥25.40	95.0
35	A93003	H18	<25.40	185
36	A93003	H112	≤101.60	95.0
37	A93003	H112 wld.	≤101.60	95.0
38	A93004	O	0.15–76.20	150
39	A93004	H112	6.35–76.20	160
40	A93004	H32	0.43–50.80	195
41	A93004	H34	0.23–25.40	220
42	A95052	O	0.15–76.20	170
43	A95052	H112	6.35–12.69	195
44	A95052	H112	12.70–76.20	170
45	A95052	H32	0.43–50.80	215

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
2	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
3	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
4	82.7	82.7	79.9	71.0	...	...	...	...	...	...	...	...	...	...	...
5	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
6	58.6	48.6	38.7	30.0	...	...	...	...	...	...	...	...	...	...	...
7	75.8	68.6	55.1	38.4	...	...	...	...	...	...	...	...	...	...	...
8	89.6	81.4	65.7	49.6	...	...	...	...	...	...	...	...	...	...	...
9	82.7	75.2	60.5	44.2	...	...	...	...	...	...	...	...	...	...	...
10	79.3	72.0	58.1	43.7	...	...	...	...	...	...	...	...	...	...	...
11	96.5	93.6	79.0	61.6	...	...	...	...	...	...	...	...	...	...	...
12	110	108	90.4	69.5	...	...	...	...	...	...	...	...	...	...	...
13	75.8	68.6	55.1	38.4	...	...	...	...	...	...	...	...	...	...	...
14	75.8	68.6	55.1	38.4	...	...	...	...	...	...	...	...	...	...	...
15	75.8	68.6	55.1	38.4	...	...	...	...	...	...	...	...	...	...	...
16	75.8	68.6	55.1	38.4	...	...	...	...	...	...	...	...	...	...	...
17	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
18	117	105	87.6	65.7	...	...	...	...	...	...	...	...	...	...	...
19	103	93.8	79.4	63.9	...	...	...	...	...	...	...	...	...	...	...
20	100	91.0	77.1	62.5	...	...	...	...	...	...	...	...	...	...	...
21	117	114	98.7	80.9	...	...	...	...	...	...	...	...	...	...	...
22	138	138	121	97.5	...	...	...	...	...	...	...	...	...	...	...
23	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
24	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
25	117	114	98.7	80.9	...	...	...	...	...	...	...	...	...	...	...
26	138	138	121	97.5	...	...	...	...	...	...	...	...	...	...	...
27	186	176	144	73.0	...	...	...	...	...	...	...	...	...	...	...
28	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
29	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
30	138	138	121	97.5	...	...	...	...	...	...	...	...	...	...	...
31	152	152	133	104	...	...	...	...	...	...	...	...	...	...	...
32	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
33	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
34	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
35	186	176	144	73.0	...	...	...	...	...	...	...	...	...	...	...
36	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
37	96.5	87.7	73.1	59.1	...	...	...	...	...	...	...	...	...	...	...
38	152	152	138	88.5	...	...	...	...	...	...	...	...	...	...	...
39	159	159	129	70.6	...	...	...	...	...	...	...	...	...	...	...
40	193	193	185	149	...	...	...	...	...	...	...	...	...	...	...
41	221	221	203	150	...	...	...	...	...	...	...	...	...	...	...
42	172	172	164	121	...	...	...	...	...	...	...	...	...	...	...
43	193	193	182	134	...	...	...	...	...	...	...	...	...	...	...
44	172	172	164	121	...	...	...	...	...	...	...	...	...	...	...
45	214	214	206	178	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Plate, sheet	SB-209	...
2	...	Drawn smls. tube	SB-210	...
3	...	Drawn smls. tube	SB-210	...
4	...	Drawn smls. tube	SB-210	...
5	...	Cond. & heat exch. tubes	SB-234	...
6	...	Cond. & heat exch. tubes	SB-234	...
7	...	Smls. extr. tube	SB-241	...
8	...	Plate, sheet	SB-209	...
9	...	Plate, sheet	SB-209	...
10	...	Plate, sheet	SB-209	...
11	...	Plate, sheet	SB-209	...
12	...	Plate, sheet	SB-209	...
13	...	Plate, sheet	SB-209	...
14	...	Plate, sheet	SB-209	...
15	...	Plate, sheet	SB-209	...
16	...	Plate, sheet	SB-209	...
17	...	Bar, rod, shapes	SB-221	...
18	...	Bar, rod, shapes	SB-221	...
19	...	Bar, rod, shapes	SB-221	...
20	...	Smls. extr. tube	SB-241	...
21	...	Smls. extr. tube	SB-241	...
22	...	Smls. extr. tube	SB-241	...
23	...	Die & hand forgings	SB-247	...
24	...	Die & hand forgings	SB-247	...
25	...	Die & hand forgings	SB-247	...
26	...	Die & hand forgings	SB-247	...
27	...	Plate, sheet	SB-928	...
28	...	Plate, sheet	SB-928	...
29	...	Plate, sheet	SB-209	...
30	...	Plate, sheet	SB-209	...
31	...	Plate, sheet	SB-209	...
32	...	Plate, sheet	SB-209	...
33	...	Plate, sheet	SB-209	...
34	...	Plate, sheet	SB-209	...
35	...	Bar, rod, shapes	SB-221	...
36	...	Smls. extr. tube	SB-241	...
37	...	Smls. extr. tube	SB-241	...
38	...	Smls. extr. tube	SB-241	...
39	...	Plate, sheet	SB-928	...
40	...	Plate, sheet	SB-209	...
41	...	Plate, sheet	SB-209	...
42	...	Plate, sheet	SB-209	...
43	...	Plate, sheet	SB-209	...
44	...	Plate, sheet	SB-209	...
45	...	Drawn smls. tube	SB-210	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	A95052	H34	0.23–25.40	235
2	A95052	O	0.25–11.43	170
3	A95052	H32	0.25–11.43	215
4	A95052	H34	0.25–11.43	235
5	A95052	H32	0.25–5.08	215
6	A95052	H34	0.25–5.08	235
7	A95052	O	...	170
8	A95083	O	1.30–38.10	275
9	A95083	O	38.11–76.20	270
10	A95083	O	76.21–127.00	260
11	A95083	O	127.01–177.80	255
12	A95083	O	177.81–203.20	250
13	A95083	H112	6.35–38.10	275
14	A95083	H112	38.11–76.20	270
15	A95083	H32	$3.20 < t \leq 40.00$	305
16	A95083	H32	$40.00 < t \leq 80.00$	285
17	A95083	O	≤ 127.00	270
18	A95083	H111	≤ 127.00	275
19	A95083	H112	≤ 127.00	270
20	A95083	O	...	270
21	A95083	H111	...	275
22	A95083	H112	...	270
23	A95083	H111	≤ 101.60	270
24	A95083	H112	≤ 101.60	270
25	A95083	H111 wld.	≤ 101.60	260
26	A95083	H112 wld.	≤ 101.60	260
27	A95083	H321	$3.20 < t \leq 40.00$	305
28	A95083	H321	$40.00 < t \leq 80.00$	285
29	A95086	O	0.51–50.80	240
30	A95086	H112	4.78–12.69	250
31	A95086	H112	12.70–50.80	240
32	A95086	H112	50.81–76.20	235
33	A95086	H32	0.51–50.80	275
34	A95086	H34	0.23–25.40	305
35	A95086	H112	≤ 127.00	240
36	A95086	O	...	240
37	A95086	H111	...	250
38	A95086	H112	...	240
39	A95086	H116	$1.60 < t \leq 50.00$	275
40	A95154	O	0.51–76.2	205
41	A95154	H112	6.35–12.7	220
42	A95154	H112	12.7–76.2	205
43	A95154	H32	0.51–50.8	250
44	A95154	H34	0.23–25.4	270
45	A95154	O	0.25–11.4	205

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	234	234	223	180	...	...	...	...	...	...	...	...	...	...	...
2	172	172	164	121	...	...	...	...	...	...	...	...	...	...	...
3	214	214	206	178	...	...	...	...	...	...	...	...	...	...	...
4	234	234	223	180	...	...	...	...	...	...	...	...	...	...	...
5	214	214	206	178	...	...	...	...	...	...	...	...	...	...	...
6	234	234	223	180	...	...	...	...	...	...	...	...	...	...	...
7	172	172	164	121	...	...	...	...	...	...	...	...	...	...	...
8	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	262	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	255	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	248	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	303	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	262	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	262	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	303	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	241	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	248	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	241	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	234	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	303	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	241	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	241	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	248	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	241	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	221	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	248	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Drawn smls. tube	SB-210	...
2	...	Bar, rod, shapes	SB-221	...
3	...	Bar, rod, shapes	SB-221	...
4	...	Plate, sheet	SB-209	...
5	...	Plate, sheet	SB-209	...
6	...	Plate, sheet	SB-209	...
7	...	Plate, sheet	SB-209	...
8	...	Plate, sheet	SB-209	...
9	...	Plate, sheet	SB-209	...
10	...	Plate, sheet	SB-209	...
11	...	Plate, sheet	SB-209	...
12	...	Plate, sheet	SB-209	...
13	...	Plate, sheet	SB-209	...
14	...	Bar, rod, shapes	SB-221	...
15	...	Bar, rod, shapes	SB-221	...
16	...	Bar, rod, shapes	SB-221	...
17	...	Cond. & heat exch. tubes	SB-234	...
18	...	Cond. & heat exch. tubes	SB-234	...
19	...	Smls. extr. tube	SB-241	...
20	...	Smls. extr. tube	SB-241	...
21	...	Smls. extr. tube	SB-241	...
22	...	Plate, sheet	SB-209	...
23	...	Plate, sheet	SB-209	...
24	...	Plate, sheet	SB-209	...
25	...	Plate, sheet	SB-209	...
26	...	Plate, sheet	SB-209	...
27	...	Plate, sheet	SB-209	...
28	...	Plate, sheet	SB-209	...
29	...	Plate, sheet	SB-209	...
30	...	Plate, sheet	SB-209	...
31	...	Plate, sheet	SB-209	...
32	...	Bar, rod, shapes	SB-221	...
33	...	Bar, rod, shapes	SB-221	...
34	...	Bar, rod, shapes	SB-221	...
35	...	Smls. extr. tube	SB-241	...
36	...	Smls. extr. tube	SB-241	...
37	...	Smls. extr. tube	SB-241	...
38	...	Plate, sheet	SB-928	...
39	...	Plate, sheet	SB-928	...
40	...	Plate, sheet	SB-928	...
41	...	Plate, sheet	SB-209	...
42	...	Plate, sheet	SB-209	...
43	...	Plate, sheet	SB-209	...
44	...	Plate, sheet	SB-209	...
45	...	Plate, sheet	SB-209	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	A95154	H34	0.25–11.4	270
2	A95154	O	...	205
3	A95154	H112	...	205
4	A95254	O	1.30–76.2	205
5	A95254	H112	6.35–12.7	220
6	A95254	H112	12.7–76.2	205
7	A95254	H32	1.30–50.8	250
8	A95254	H34	1.30–25.4	270
9	A95454	O	0.51–76.2	215
10	A95454	H112	6.35–12.7	220
11	A95454	H112	12.7–76.2	215
12	A95454	H32	0.51–50.8	250
13	A95454	H34	0.51–25.4	270
14	A95454	O	≤127	215
15	A95454	H111	≤127	230
16	A95454	H112	≤127	215
17	A95454	H32	0.25–5.08	250
18	A95454	H34	0.25–5.08	270
19	A95454	O	...	215
20	A95454	H111	...	230
21	A95454	H112	...	215
22	A95456	O	1.30–38.10	290
23	A95456	O	38.13–76.20	285
24	A95456	O	76.23–127.00	275
25	A95456	O	127.03–177.80	270
26	A95456	O	177.83–203.20	260
27	A95456	H112	6.35–38.10	290
28	A95456	H112	38.13–76.20	285
29	A95456	H32	4.78–12.69	315
30	A95456	H32	12.70–38.10	305
31	A95456	H32	38.11–76.20	285
32	A95456	O	≤127.00	285
33	A95456	H111	≤127.00	290
34	A95456	H112	≤127.00	285
35	A95456	O	...	285
36	A95456	H111	...	290
37	A95456	H112	...	285
38	A95456	H321	4.00–12.50	315
39	A95456	H321	12.51–40.00	305
40	A95456	H321	40.01–80.00	285
41	A96061	T4	0.15–6.34	205
42	A96061	T451	6.35–76.20	205
43	A96061	T6	0.15–6.34	290
44	A96061	T651	6.35–101.60	290
45	A96061	T651	101.61–152.40	275

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	221	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	207	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	248	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
10	221	221	206	180	...	...	...	...	...	...	...	...	...	...	...
11	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
12	248	248	223	166	...	...	...	...	...	...	...	...	...	...	...
13	269	269	236	165	...	...	...	...	...	...	...	...	...	...	...
14	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
15	228	228	214	188	...	...	...	...	...	...	...	...	...	...	...
16	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
17	248	248	223	166	...	...	...	...	...	...	...	...	...	...	...
18	269	269	236	165	...	...	...	...	...	...	...	...	...	...	...
19	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
20	228	228	214	188	...	...	...	...	...	...	...	...	...	...	...
21	214	214	184	120	...	...	...	...	...	...	...	...	...	...	...
22	290	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	276	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	269	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	262	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	290	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	317	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	303	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	290	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	290	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	317	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	303	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	283	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	207	207	196	135	...	...	...	...	...	...	...	...	...	...	...
42	207	207	196	135	...	...	...	...	...	...	...	...	...	...	...
43	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
44	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
45	276	276	228	134	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Plate, sheet	SB-209	...
2	...	Plate, sheet	SB-209	...
3	...	Plate, sheet	SB-209	...
4	...	Plate, sheet	SB-209	...
5	...	Drawn smls. tube	SB-210	...
6	...	Drawn smls. tube	SB-210	...
7	...	Drawn smls. tube	SB-210	...
8	...	Drawn smls. tube	SB-210	...
9	...	Bar, rod, wire	SB-211	...
10	...	Bar, rod, wire	SB-211	...
11	...	Bar, rod, wire	SB-211	...
12	...	Bar, rod, wire	SB-211	...
13	...	Bar, rod, shapes	SB-221	...
14	...	Bar, rod, shapes	SB-221	...
15	...	Bar, rod, shapes	SB-221	...
16	...	Bar, rod, shapes	SB-221	...
17	...	Cond. & heat exch. tubes	SB-234	...
18	...	Cond. & heat exch. tubes	SB-234	...
19	...	Cond. & heat exch. tubes	SB-234	...
20	...	Cond. & heat exch. tubes	SB-234	...
21	...	Smls. extr. tube	SB-241	...
22	...	Smls. extr. tube	SB-241	...
23	...	Smls. extr. tube	SB-241	...
24	...	Smls. extr. tube	SB-241	...
25	...	Smls. pipe	SB-241	...
26	...	Smls. pipe	SB-241	...
27	...	Smls. pipe	SB-241	...
28	...	Die forgings	SB-247	...
29	...	Hand forgings	SB-247	...
30	...	Hand forgings	SB-247	...
31	...	Die & hand forgings	SB-247	...
32	...	Shapes	SB-308	...
33	...	Shapes	SB-308	...
34	...	Drawn smls. tube	SB-210	...
35	...	Drawn smls. tube	SB-210	...
(25) 36	...	Bar, rod, shapes	SB-221	...
37	...	Bar, rod, shapes	SB-221	...
38	...	Bar, rod, shapes	SB-221	...
39	...	Bar, rod, shapes	SB-221	...
40	...	Bar, rod, shapes	SB-221	...
41	...	Bar, rod, shapes	SB-221	...
42	...	Bar, rod, shapes	SB-221	...
43	...	Smls. extr. tube	SB-241	...
(25) 44	...	Smls. extr. tube	SB-241	...
45	...	Smls. extr. tube	SB-241	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	A96061	T4 wld.	0.15–6.34	165
2	A96061	T451 wld.	6.35–76.20	165
3	A96061	T6 wld.	0.15–6.34	165
4	A96061	T651 wld.	6.35–152.40	165
5	A96061	T4	0.64–12.70	205
6	A96061	T6	0.64–12.70	290
7	A96061	T4 wld.	0.64–12.70	165
8	A96061	T6 wld.	0.64–12.70	165
9	A96061	T6	3.18–203.20	290
10	A96061	T651	3.18–203.20	290
11	A96061	T6 wld.	3.18–203.20	165
12	A96061	T651 wld.	3.18–203.20	165
13	A96061	T4	...	180
14	A96061	T6	...	260
15	A96061	T4 wld.	...	165
16	A96061	T6 wld.	...	165
17	A96061	T4	0.64–5.08	205
18	A96061	T6	0.64–5.08	290
19	A96061	T4 wld.	0.64–5.08	165
20	A96061	T6 wld.	0.64–5.08	165
21	A96061	T4	...	180
22	A96061	T6	...	260
23	A96061	T4 wld.	...	165
24	A96061	T6 wld.	...	165
25	A96061	T6 drawn	<25.40	290
26	A96061	T6	≥25.40	260
27	A96061	T6 wld.	...	165
28	A96061	T6	≤101.60	260
29	A96061	T6	≤101.60	255
30	A96061	T6	101.61–203.20	240
31	A96061	T6 wld.	≤203.20	165
32	A96061	T6	...	260
33	A96061	T6 wld.	...	165
34	A96063	T6	0.64–12.70	230
35	A96063	T6 wld.	0.64–12.70	115
36	A96063	T1	≤12.70	115
37	A96063	T1	12.71–25.40	110
38	A96063	T5	≤12.70	150
39	A96063	T5	12.71–25.40	145
40	A96063	T6	≤25.40	205
41	A96063	T5 wld.	≤25.40	115
42	A96063	T6 wld.	≤25.40	115
43	A96063	O	...	110
44	A96063	T1	≤12.70	115
45	A96063	T1	12.71–25.40	110

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
2	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
3	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
4	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
5	207	207	196	135	...	...	...	...	...	...	...	...	...	...	...
6	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
7	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
8	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
9	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
10	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
11	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
12	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
13	179	179	172	121	...	...	...	...	...	...	...	...	...	...	...
14	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
15	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
16	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
17	207	207	196	135	...	...	...	...	...	...	...	...	...	...	...
18	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
19	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
20	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
21	179	179	172	121	...	...	...	...	...	...	...	...	...	...	...
22	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
23	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
24	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
25	290	290	239	138	...	...	...	...	...	...	...	...	...	...	...
26	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
27	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
28	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
29	255	255	241	167	...	...	...	...	...	...	...	...	...	...	...
30	241	241	231	163	...	...	...	...	...	...	...	...	...	...	...
31	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
32	262	262	216	126	...	...	...	...	...	...	...	...	...	...	...
33	165	165	159	112	...	...	...	...	...	...	...	...	...	...	...
34	228	227	159	89.5	...	...	...	...	...	...	...	...	...	...	...
35	117	117	106	33.8	...	...	...	...	...	...	...	...	...	...	...
36	117	117	117	65.8	...	...	...	...	...	...	...	...	...	...	...
37	110	110	110	104	...	...	...	...	...	...	...	...	...	...	...
38	152	152	147	115	...	...	...	...	...	...	...	...	...	...	...
39	145	141	121	70.7	...	...	...	...	...	...	...	...	...	...	...
40	207	202	139	64.0	...	...	...	...	...	...	...	...	...	...	...
41	117	117	106	33.8	...	...	...	...	...	...	...	...	...	...	...
42	117	117	106	33.8	...	...	...	...	...	...	...	...	...	...	...
43	110	110	110	104	...	...	...	...	...	...	...	...	...	...	...
44	117	117	117	...	...	...	...	...	...	...	...	...	...	...	...
45	110	110	110	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Smls. extr. tube	SB-241	...
2	...	Smls. extr. tube	SB-241	...
3	...	Smls. extr. tube/pipe	SB-241	...
4	...	Smls. extr. tube	SB-241	...
5	...	Smls. extr. tube/pipe	SB-241	...
6	...	Smls. pipe	SB-241	...
7	...	Castings	SB/EN 1706	AlSi7Mg
8	...	Castings	SB/EN 1706	...
9	...	Bar, rod	SB-187	...
10	...	Smls. tube	SB-75	...
11	...	Smls. pipe	SB-42	...
(25) 12	...	Plate, sheet, strip, bar	SB-152	...
(25) 13	...	Plate, sheet, strip, bar	SB-152	...
(25) 14	...	Plate, sheet, strip, bar	SB-152	...
(25) 15	...	Plate, sheet, strip, bar	SB-152	...
(25) 16	...	Plate, sheet, strip, bar	SB-152	...
(25) 17	...	Plate, sheet, strip, bar	SB-152	...
18	...	Smls. pipe	SB-42	...
19	...	Smls. tube	SB-75	...
20	...	Smls. cond. tube	SB-111	...
21	...	Smls. U-bend tube	SB-395	...
22	...	Smls. pipe	SB-42	...
23	...	Smls. tube	SB-75	...
24	...	Smls. cond. tube	SB-111	...
(25) 25	...	Plate, sheet, strip, bar	SB-152	...
(25) 26	...	Plate, sheet, strip, bar	SB-152	...
(25) 27	...	Plate, sheet, strip, bar	SB-152	...
(25) 28	...	Plate, sheet, strip, bar	SB-152	...
(25) 29	...	Plate, sheet, strip, bar	SB-152	...
(25) 30	...	Plate, sheet, strip, bar	SB-152	...
(25) 31	...	Plate, sheet, strip, bar	SB-152	...
(25) 32	...	Plate, sheet, strip, bar	SB-152	...
(25) 33	...	Plate, sheet, strip, bar	SB-152	...
(25) 34	...	Plate, sheet, strip, bar	SB-152	...
(25) 35	...	Plate, sheet, strip, bar	SB-152	...
(25) 36	...	Plate, sheet, strip, bar	SB-152	...
(25) 37	...	Plate, sheet, strip, bar	SB-152	...
(25) 38	...	Plate, sheet, strip, bar	SB-152	...
(25) 39	...	Plate, sheet, strip, bar	SB-152	...
(25) 40	...	Plate, sheet, strip, bar	SB-152	...
(25) 41	...	Plate, sheet, strip, bar	SB-152	...
(25) 42	...	Plate, sheet, strip, bar	SB-152	...
43	...	Bar	SB-187	...
44	...	Bar, rod	SB-187	...
45	...	Plate, sheet, strip, bar	SB-152	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	A96063	T5	≤12.70	150
2	A96063	T5	12.71–25.40	145
3	A96063	T6	≤25.40	205
4	A96063	T5 wld.	≤25.40	115
5	A96063	T6 wld.	≤25.40	115
6	A96063	O	...	110
7	AC-42000	...	...	140
8	AC-44300	F	...	240
9	C10200	O60	All	195
10	C10200	O60	All	205
11	C10200	O61	All	205
12	C10200	H00	...	205
13	C10200	H01	...	205
14	C10200	H02	...	205
15	C10200	H03	...	205
16	C10200	H04	...	205
17	C10200	M20, O25	...	205
18	C10200	H55	50 < DN ≤ 300	250
19	C10200	H55	All	250
20	C10200	H55	...	250
21	C10200	H55	...	250
22	C10200	H80	6 < DN ≤ 50	310
23	C10200	H80	<102	310
24	C10200	H80	...	310
25	C10400	H00	...	205
26	C10400	H01	...	205
27	C10400	H02	...	205
28	C10400	H03	...	205
29	C10400	H04	...	205
30	C10400	M20, O25	...	205
31	C10500	H00	...	205
32	C10500	H01	...	205
33	C10500	H02	...	205
34	C10500	H03	...	205
35	C10500	H04	...	205
36	C10500	M20, O25	...	205
37	C10700	H00	...	205
38	C10700	H01	...	205
39	C10700	H02	...	205
40	C10700	H03	...	205
41	C10700	H04	...	205
42	C10700	M20, O25	...	205
43	C11000	H04	All	195
44	C11000	O60	All	195
45	C11000	H00	...	205

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	152	152	147	115	101	...	...	...	...	...	...	...	...	...	...
2	145	141	121	70.7	...	...	...	...	...	...	...	...	...	...	...
3	207	203	138	63.2	...	...	...	...	...	...	...	...	...	...	...
4	117	117	106	33.8	...	...	...	...	...	...	...	...	...	...	...
5	117	117	106	33.8	...	...	...	...	...	...	...	...	...	...	...
6	110	110	110	104	...	...	...	...	...	...	...	...	...	...	...
7	140	135	131	...	...	...	...	...	...	...	...	...	...	...	...
8	240	207	207	...	...	...	...	...	...	...	...	...	...	...	...
9	193	187	175	162	...	...	...	...	...	...	...	...	...	...	...
10	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
11	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
12	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
13	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
14	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
15	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
16	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
17	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
18	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
19	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
20	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
21	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
22	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
23	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
24	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
25	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
26	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
27	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
28	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
29	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
30	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
31	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
32	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
33	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
34	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
35	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
36	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
37	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
38	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
39	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
40	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
41	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
42	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
43	193	187	175	162	...	...	...	...	...	...	...	...	...	...	...
44	193	187	175	162	...	...	...	...	...	...	...	...	...	...	...
45	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Plate, sheet, strip, bar	SB-152	...
2	...	Plate, sheet, strip, bar	SB-152	...
3	...	Plate, sheet, strip, bar	SB-152	...
4	...	Plate, sheet, strip, bar	SB-152	...
5	...	Plate, sheet, strip, bar	SB-152	...
6	...	Smls. tube	SB-75	...
7	...	Smls. tube	SB-75	...
8	...	Smls. pipe	SB-42	...
9	...	Smls. pipe	SB-42	...
10	...	Smls. tube	SB-75	...
11	...	Smls. cond. tube	SB-111	...
12	...	Smls. U-bend tube	SB-395	...
13	...	Smls. pipe	SB-42	...
14	...	Smls. tube	SB-75	...
15	...	Smls. cond. tube	SB-111	...
16	...	Smls. tube	SB-75	...
17	...	Smls. tube	SB-75	...
18	...	Smls. pipe	SB-42	...
19	...	Finned tube	SB-359	...
20	...	Finned tube	SB-359	...
21	...	Wld. cond. tube	SB-543	...
(25) 22	...	Plate, sheet, strip, bar	SB-152	...
(25) 23	...	Plate, sheet, strip, bar	SB-152	...
(25) 24	...	Plate, sheet, strip, bar	SB-152	...
(25) 25	...	Plate, sheet, strip, bar	SB-152	...
(25) 26	...	Plate, sheet, strip, bar	SB-152	...
(25) 27	...	Plate, sheet, strip, bar	SB-152	...
28	...	Wld. cond. tube	SB-543	...
29	...	Smls. pipe	SB-42	...
30	...	Smls. tube	SB-75	...
31	...	Smls. cond. tube	SB-111	...
32	...	Finned tube	SB-359	...
33	...	Smls. U-bend tube	SB-395	...
34	...	Smls. pipe	SB-42	...
35	...	Smls. cond. tube	SB-75	...
36	...	Smls. tube	SB-111	...
(25) 37	...	Finned tube	SB-359	...
38	...	Plate, sheet, strip, bar	SB-152	...
39	...	Plate, sheet, strip, bar	SB-152	...
40	...	Plate, sheet, strip, bar	SB-152	...
41	...	Plate, sheet, strip, bar	SB-152	...
42	...	Plate, sheet, strip, bar	SB-152	...
43	...	Plate, sheet, strip, bar	SB-152	...
(25) 44	...	Plate, sheet, strip, bar	SB-152	...
45	...	Smls. cond. tube	SB-111	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	C11000	H01	...	205
2	C11000	H02	...	205
3	C11000	H03	...	205
4	C11000	H04	...	205
5	C11000	M20, O25	...	205
6	C12000	O50	All	205
7	C12000	O60	All	205
8	C12000	O61	All	205
9	C12000	H55	50 < DN ≤ 300	250
10	C12000	H55	All	250
11	C12000	H55	...	250
12	C12000	H55	...	250
13	C12000	H80	6 < DN ≤ 50	310
14	C12000	H80	<102	310
15	C12000	H80	...	310
16	C12200	O50	All	205
17	C12200	O60	All	205
18	C12200	O61	All	205
19	C12200	O61	...	205
20	C12200	O62	...	205
21	C12200	W061	...	205
22	C12200	H00	...	205
23	C12200	H01	...	205
24	C12200	H02	...	205
25	C12200	H03	...	205
26	C12200	H04	...	205
27	C12200	M20, O25	...	205
28	C12200	WC55	...	220
29	C12200	H55	50 < DN ≤ 300	250
30	C12200	H55	All	250
31	C12200	H55	...	250
32	C12200	H55	...	250
33	C12200	H55	...	250
34	C12200	H80	6 < DN ≤ 50	310
35	C12200	H80	<102	310
36	C12200	H80	...	310
37	C12200	H80	...	310
38	C12300	H00	...	205
39	C12300	H01	...	205
40	C12300	H02	...	205
41	C12300	H03	...	205
42	C12300	H04	...	205
43	C12300	M20, O25	...	205
44	C14200	M20, O25	...	205
45	C14200	H55	...	250

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
2	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
3	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
4	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
5	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
6	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
7	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
8	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
9	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
10	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
11	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
12	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
13	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
14	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
15	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
16	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
17	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
18	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
19	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
20	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
21	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
22	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
23	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
24	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
25	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
26	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
27	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
28	221	220	214	203	...	...	...	...	...	...	...	...	...	...	...
29	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
30	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
31	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
32	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
33	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...
34	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
35	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
36	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
37	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
38	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
39	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
40	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
41	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
42	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
43	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
44	207	200	187	174	...	...	...	...	...	...	...	...	...	...	...
45	248	248	240	228	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Smls. U-bend tube	SB-395	...
2	...	Smls. cond. tube	SB-111	...
3	...	Smls. cond. tube	SB-111	...
4	...	Smls. U-bend tube	SB-395	...
5	...	Wld. cond. tube	SB-543	...
6	...	Wld. cond. tube	SB-543	...
7	...	Smls. pipe	SB-43	...
8	...	Smls. cond. tube	SB-111	...
9	...	Smls. tube	SB-135	...
10	...	Smls. U-bend tube	SB-395	...
11	...	Wld. cond. tube	SB-543	...
12	...	Smls. tube	SB-111	...
13	...	Plate	SB-171	...
14	...	Plate	SB-171	...
(25) 15	...	Plate, sheet	SB-171	...
(25) 16	...	Forgings, brass	SB-283	...
(25) 17	...	...	...	...
(25) 18	...	...	...	...
(25) 19	...	Forgings, brass	SB-283	...
(25) 20	...	...	...	...
(25) 21	...	...	...	...
(25) 22	...	Plate, sheet	SB-171	...
(25) 23	...	Plate, sheet	SB-171	...
24	...	Smls. cond. tube	SB-111	...
25	...	Finned tube	SB-359	...
26	...	Smls. U-bend tube	SB-395	...
27	...	Wld. cond. tube	SB-543	...
(25) 28	...	Plate, sheet	SB-171	...
(25) 29	...	Plate, sheet	SB-171	...
30	...	Smls. cond. tube	SB-111	...
31	...	Finned tube	SB-359	...
32	...	Smls. U-bend tube	SB-395	...
33	...	Wld. cond. tube	SB-543	...
(25) 34	...	Plate, sheet	SB-171	...
(25) 35	...	Plate, sheet	SB-171	...
36	...	Smls. cond. tube	SB-111	...
37	...	Finned tube	SB-359	...
38	...	Smls. U-bend tube	SB-395	...
39	...	Wld. cond. tube	SB-543	...
(25) 40	...	Plate, sheet	SB-171	...
(25) 41	...	Plate, sheet	SB-171	...
42	...	Smls. cond. tube	SB-111	...
43	...	Smls. U-bend tube	SB-395	...
(25) 44	...	Plate, sheet, bar	SB-169	...
45	...	Plate	SB-171	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	C14200	H55	...	250
2	C14200	H80	...	310
3	C19200	O61	...	260
4	C19200	O61	...	260
5	C19400	W061	...	310
6	C19400	WC55	...	310
7	C23000	O61 and H58	...	275
8	C23000	O61	...	275
9	C23000	O50 and O60	...	275
10	C23000	O61	...	275
11	C23000	W061 and WC55	...	275
12	C28000	O25	...	345
13	C36500	O25 and M20	$100 < t \leq 140$	275
14	C36500	O25 and M20	$50 < t \leq 100$	310
15	C36500	O25 and M20	≤ 50	345
16	C37700	M10, O20	> 38	315
17	...	...	...	...
18	...	...	...	...
19	C37700	M10, O20	≤ 38	345
20	...	...	...	...
21	...	...	...	...
22	C44300	M10, M20	≤ 100	310
23	C44300	O20, O25	≤ 100	310
24	C44300	O61	...	310
25	C44300	O61	...	310
26	C44300	O61	...	310
27	C44300	W061	...	310
28	C44400	M10, M20	≤ 100	310
29	C44400	O20, O25	≤ 100	310
30	C44400	O61	...	310
31	C44400	O61	...	310
32	C44400	O61	...	310
33	C44400	W061	...	310
34	C44500	M10, M20	≤ 100	310
35	C44500	O20, O25	≤ 100	310
36	C44500	O61	...	310
37	C44500	O61	...	310
38	C44500	O61	...	310
39	C44500	W061	...	310
40	C46400	M10, M20, O20, O25	≤ 140	345
41	C46500	M10, M20, O20, O25	≤ 140	345
42	C60800	O61	...	345
43	C60800	O61	...	345
44	C61400	M20, O25, O60	$50 < t \leq 140$	450
45	C61400	M10, M20, O20, O25	$50 < t \leq 140$	450

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	310	310	302	267	...	...	...	...	...	...	...	...	...	...	...
3	262	245	224	206	...	...	...	...	...	...	...	...	...	...	...
4	262	245	224	206	...	...	...	...	...	...	...	...	...	...	...
5	310	309	287	268	...	...	...	...	...	...	...	...	...	...	...
6	310	309	287	268	...	...	...	...	...	...	...	...	...	...	...
7	276	276	276	275	256	...	...	...	...	...	...	...	...	...	...
8	276	276	276	275	256	...	...	...	...	...	...	...	...	...	...
9	276	276	276	275	256	...	...	...	...	...	...	...	...	...	...
10	276	276	276	275	256	...	...	...	...	...	...	...	...	...	...
11	276	276	276	275	256	...	...	...	...	...	...	...	...	...	...
12	345	345	345	340	...	...	...	...	...	...	...	...	...	...	...
13	276	276	276	272	...	...	...	...	...	...	...	...	...	...	...
14	310	310	310	306	...	...	...	...	...	...	...	...	...	...	...
15	345	345	345	340	...	...	...	...	...	...	...	...	...	...	...
16	317	310	303	293	277	257	235	211	185	158	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	345	345	330	318	301	280	255	229	202	172	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
23	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
24	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
25	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
26	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
27	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
28	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
29	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
30	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
31	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
32	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
33	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
34	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
35	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
36	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
37	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
38	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
39	310	310	302	291	276	255	...	...	...	...	...	...	...	...	...
40	345	345	345	331	305	...	...	...	...	...	...	...	...	...	...
41	345	345	345	331	305	...	...	...	...	...	...	...	...	...	...
42	345	345	345	329	277	...	...	...	...	...	...	...	...	...	...
43	345	345	345	329	277	...	...	...	...	...	...	...	...	...	...
44	448	448	448	441	415	...	...	...	...	...	...	...	...	...	...
45	448	448	448	441	415	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
(25) 1	...	Plate, sheet, bar	SB-169	...
2	...	Plate	SB-171	...
(25) 3	...	Plate, sheet, bar	SB-169	...
4	...	Plate	SB-171	...
5	...	Bar, rod	SB-150	...
6	...	Bar, rod	SB-150	...
7	...	Bar, rod	SB-150	...
8	...	Plate	SB-171	...
9	...	Bar, rod	SB-150	...
10	...	Bar, rod	SB-150	...
11	...	Bar, rod	SB-150	...
(25) 12	...	Plate	SB-171	...
13	...	Bar, rod	SB-150	...
14	...	Bar, rod	SB-150	...
(25) 15	...	Forgings	SB-283	...
(25) 16	...	Forgings	SB-283	...
17	...	Bar, rod	SB-150	...
18	...	Bar, rod	SB-150	...
19	...	Bar, rod	SB-150	...
20	...	Bar, rod	SB-150	...
21	...	Bar, rod	SB-150	...
22	...	Bar, rod	SB-150	...
23	...	Bar, rod	SB-98	...
24	...	Bar, rod	SB-98	...
25	...	Rod	SB-98	...
26	...	Rod	SB-98	...
(25) 27	...	Plate, sheet, strip, bar	SB-96	...
(25) 28	...	Smls. pipe & tube	SB-315	...
29	...	Bar, rod	SB-98	...
(25) 30	...	Bar, rod	SB-98	...
31	...	Bar, rod	SB-98	...
(25) 32	...	Bar, rod	SB-98	...
(25) 33	...	Bar, rod	SB-98	...
(25) 34	...	Bar, rod	SB-98	...
35	...	Smls. cond. tube	SB-111	...
36	...	Smls. U-bend tube	SB-395	...
37	...	Wld. cond. tube	SB-543	...
38	...	Smls. cond. tube	SB-111	...
39	...	Wld. tube	SB-543	...
40	...	Smls. cond. tube	SB-111	...
41	...	Smls. pipe & tube	SB-466	...
42	...	Wld. pipe	SB-467	...
43	...	Bar, rod	SB-151	...
44	...	Plate, sheet	SB-171	...
45	...	Plate, sheet	SB-171	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	C61400	M20, O25, O60	$12 < t \leq 50$	485
2	C61400	M10, M20, O20, O25	≤ 50	485
3	C61400	M20, O25, O60	≤ 12	495
4	C63000	M10, M20, O20, O25	$100 < t \leq 140$	550
5	C63000	M20, M30	> 100	550
6	C63000	O20, O25, O30	> 100	550
7	C63000	HR50	> 100	550
8	C63000	M10, M20, O20, O25	$50 < t \leq 100$	585
9	C63000	HR50	$50 < t \leq 100$	585
10	C63000	M20, M30	$50 < t \leq 100$	585
11	C63000	O20, O25, O30	$50 < t \leq 100$	585
12	C63000	M10, M20, O20, O25	≤ 50	620
13	C63000	HR50	$25 < t \leq 50$	620
14	C63000	HR50	$12 < t \leq 25$	690
15	C64200	M10, O20	> 38	469
16	C64200	M10, O20	≤ 38	483
17	C64200	M10, M20, M30	> 100	485
18	C64200	M10, M20, M30	$80 < t \leq 100$	485
19	C64200	HR50	$50 < t \leq 80$	515
20	C64200	HR50	$25 < t \leq 50$	550
21	C64200	HR50	$12 < t \leq 25$	585
22	C64200	HR50	≤ 12	620
23	C65100	O60	All	275
24	C65100	H02	≤ 50	380
25	C65100	H06	$12 < t \leq 38$	515
26	C65100	H06	$t \leq 12$	585
27	C65500	O61	≤ 50	345
28	C65500	O30, O61	...	345
29	C65500	O60	All	360
30	C65500	H01	All	380
31	C65500	H02	≤ 50	485
32	C66100	O60	All	360
33	C66100	H01	All	380
34	C66100	H02	≤ 50	485
35	C68700	O61	...	345
36	C68700	O61	...	345
37	C68700	W061	...	345
38	C70400	O61	...	260
39	C70400	W061	...	260
40	C70400	H55	...	275
41	C70600	O60	...	260
42	C70600	W061	> 114	260
43	C70600	O60	All	260
44	C70600	M10, M20	≤ 140	275
45	C70600	O20, O25	≤ 140	275

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	483	483	483	475	447	...	...	...	...	...	...	...	...	...	...
2	483	483	483	475	447	...	...	...	...	...	...	...	...	...	...
3	496	496	496	488	460	...	...	...	...	...	...	...	...	...	...
4	552	552	552	552	552	512	463	399	325	...	...	...	...	...	...
5	552	552	552	552	552	512	463	399	325	...	...	...	...	...	...
6	552	552	552	552	552	512	463	399	325	...	...	...	...	...	...
7	552	552	552	552	552	512	463	399	325	...	...	...	...	...	...
8	586	586	586	586	586	544	492	424	345	...	...	...	...	...	...
9	586	586	586	586	586	544	492	424	345	...	...	...	...	...	...
10	586	586	586	586	586	544	492	424	345	...	...	...	...	...	...
11	586	586	586	586	586	544	492	424	345	...	...	...	...	...	...
12	621	621	621	621	621	576	521	449	366	...	...	...	...	...	...
13	621	621	621	621	621	576	521	449	366	...	...	...	...	...	...
14	689	689	689	689	689	640	579	499	406	...	...	...	...	...	...
15	469	469	469	469	469	444	402	346	276	187	76	...	...	...	...
16	482	482	482	482	482	457	414	357	284	192	79	...	...	...	...
17	482	482	482	482	482	457	414	357	284	192	79	...	...	...	...
18	482	482	482	482	482	457	414	357	284	192	79	...	...	...	...
19	517	517	517	517	517	490	443	382	304	206	84	...	...	...	...
20	551	551	551	551	551	523	473	408	325	220	90	...	...	...	...
21	586	586	586	586	586	555	502	433	345	234	95	...	...	...	...
22	620	620	620	620	620	588	532	459	365	247	101	...	...	...	...
23	276	276	276	276	258	...	...	...	...	...	...	...	...	...	...
24	379	379	379	363	320	...	...	...	...	...	...	...	...	...	...
25	517	517	517	493	462	...	...	...	...	...	...	...	...	...	...
26	586	586	586	559	524	...	...	...	...	...	...	...	...	...	...
27	345	345	345	329	302	...	...	...	...	...	...	...	...	...	...
28	345	345	345	329	302	...	...	...	...	...	...	...	...	...	...
29	359	359	359	342	314	...	...	...	...	...	...	...	...	...	...
30	379	379	379	378	351	...	...	...	...	...	...	...	...	...	...
31	483	483	483	483	471	...	...	...	...	...	...	...	...	...	...
32	359	359	359	342	314	...	...	...	...	...	...	...	...	...	...
33	379	379	379	378	351	...	...	...	...	...	...	...	...	...	...
34	483	483	483	483	471	...	...	...	...	...	...	...	...	...	...
35	345	345	345	345	345	328	318	306	290	271	247	216	177	129	...
36	345	345	345	345	345	328	318	306	290	271	247	216	177	129	...
37	345	345	345	345	345	328	318	306	290	271	247	216	177	129	...
38	262	262	253	242	234	228	226	224	222	219	216	...	...	...	...
39	262	262	253	242	234	228	226	224	222	219	216	...	...	...	...
40	276	276	266	254	246	240	238	236	234	231	227	...	...	...	...
41	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
42	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
43	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
44	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
45	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

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

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Smls. cond. tube	SB-111	...
2	...	Finned tube	SB-359	...
3	...	Smls. U-bend tube	SB-395	...
4	...	Wld. pipe	SB-467	...
5	...	Wld. tube	SB-543	...
6	...	Finned wld. tube	SB-956	...
7	...	Wld. pipe	SB-467	...
8	...	Smls. tube	SB-111	...
9	...	Smls. pipe & tube	SB-466	...
10	...	Wld. tube	SB-543	...
11	...	Finned wld. tube	SB-956	...
12	...	Wld. pipe	SB-467	...
13	...	Smls. pipe & tube	SB-466	...
14	...	Wld. pipe	SB-467	...
15	...	Bar, rod	SB-151	...
16	...	Forgings	SB-283	...
17	...	Plate, sheet	SB-171	...
18	...	Forgings	SB-283	...
19	...	Plate, sheet	SB-171	...
20	...	Smls. cond. tube	SB-111	...
21	...	Finned tube	SB-359	...
22	...	Smls. U-bend tube	SB-395	...
23	...	Wld. pipe	SB-467	...
24	...	Wld. tube	SB-543	...
25	...	Finned wld. tube	SB-956	...
26	...	Forgings	SB-283	...
27	...	Wld. pipe	SB-467	...
28	...	Smls. tube	SB-111	...
29	...	Smls. pipe & tube	SB-466	...
30	...	Wld. tube	SB-543	...
31	...	Finned wld. tube	SB-956	...
32	...	Wld. pipe	SB-467	...
33	...	Smls. tube	SB-466	...
34	...	Smls. cond. tube	SB-111	...
35	...	Finned tube	SB-359	...
36	...	Smls. tube	SB-395	...
37	...	Wld. pipe	SB-467	...
38	...	Plate, sheet	SB-171	...
39	...	Plate, sheet	SB-171	...
40	...	Wld. pipe	SB-467	...
41	...	Smls. pipe & tube	SB-466	...
42	...	Smls. cond. tube	SB-111	...
43	...	Finned tube	SB-359	...
44	...	Smls. U-bend tube	SB-395	...
45	...	Wld. tube	SB-543	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	C70600	O61	...	275
2	C70600	O61	...	275
3	C70600	O61	...	275
4	C70600	W061	≤114	275
5	C70600	W061	...	275
6	C70600	W061	...	275
7	C70600	WM50	≤114	310
8	C70600	H55	...	310
9	C70600	H55	...	310
10	C70600	WC55	...	310
11	C70600	WC55	...	310
12	C70600	Wld. fr. cold rld. strip	≤114	370
13	C70620	O60	...	260
14	C70620	W061	>114	260
15	C70620	O60	All	260
16	C70620	M10	>152	276
17	C70620	M20	≤140	275
18	C70620	O20	...	276
19	C70620	O25	≤140	275
20	C70620	O61	...	275
21	C70620	O61	...	275
22	C70620	O61	...	275
23	C70620	W061	≤114	275
24	C70620	W061	...	275
25	C70620	W061	...	275
26	C70620	M10	≤152	310
27	C70620	WM50	≤114	310
28	C70620	H55	...	310
29	C70620	H55	...	310
30	C70620	WC55	...	310
31	C70620	WC55	...	310
32	C70620	Wld. fr. cold rld. strip	≤114	370
33	C71000	O60	...	310
34	C71000	O61	...	310
35	C71000	O61	...	310
36	C71000	O61	...	310
37	C71500	W061	>114	310
38	C71500	M10, M20, O20, O25	60 < t ≤ 140	310
39	C71500	M10, M20, O20, O25	≤60	345
40	C71500	W061	≤114	345
41	C71500	O60	...	360
42	C71500	O61	...	360
43	C71500	O61	...	360
44	C71500	O61	...	360
45	C71500	W061	...	360

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
2	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
3	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
4	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
5	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
6	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
7	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
8	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
9	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
10	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
11	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
12	372	365	339	321	309	305	303	...	...	...	...	...	...	...	...
13	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
14	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
15	262	258	239	226	218	214	212	...	...	...	...	...	...	...	...
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	276	272	251	237	229	225	224	...	...	...	...	...	...	...	...
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	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
31	310	305	283	267	257	253	252	...	...	...	...	...	...	...	...
32	372	365	339	321	309	305	303	...	...	...	...	...	...	...	...
33	310	310	302	293	286	276	274	269	262	255	245	235	222	207	...
34	310	310	302	293	286	276	274	269	262	255	245	235	222	207	...
35	310	310	302	293	286	276	274	269	262	255	245	235	222	207	...
36	310	310	302	293	286	276	274	269	262	255	245	235	222	207	...
37	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
38	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
39	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
40	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
41	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
42	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
43	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
44	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
45	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	...	Finned wld. tube	SB-956	...
2	...	Smls. cond. tube	SB-111	...
3	...	Smls. U-bend tube	SB-395	...
4	...	Wld. pipe	SB-467	...
5	...	Forgings	SB-283	...
6	...	Forgings	SB-283	...
7	...	Plate, sheet	SB-171	...
8	...	Forgings	SB-283	...
9	...	Plate, sheet	SB-171	...
10	...	Wld. pipe	SB-467	...
11	...	Smls. pipe & tube	SB-466	...
12	...	Smls. cond. tube	SB-111	...
13	...	Finned tube	SB-359	...
14	...	Smls. U-bend tube	SB-395	...
15	...	Wld. tube	SB-543	...
16	...	Finned wld. tube	SB-956	...
17	...	Smls. cond. tube	SB-111	...
18	...	Smls. U-bend tube	SB-395	...
19	...	Smls. cond. tube	SB-111	...
20	...	Castings	SB-62	...
21	...	Castings	SB-61	...
22	...	Castings	SB-584	...
23	...	Castings	SB-584	...
24	...	Castings	SB-148	...
25	...	Castings	SB-271	...
26	...	Castings	SB-505	...
27	...	Castings	SB-148	...
28	...	Castings	SB-271	...
29	...	Castings	SB-148	...
30	...	Castings	SB-148	...
31	...	Castings	SB-369	...
32	...	Castings	SB-584	...
33	99Ni	Plate, sheet, strip	SB-162	...
34	99Ni	Smls. pipe & tube	SB-161	...
35	99Ni	Smls. tube	SB-163	...
36	99Ni-Low C	Smls. pipe & tube	SB-161	...
37	99Ni-Low C	Smls. & wld. ftgs.	SB-366	...
38	99Ni-Low C	Bar, rod	SB-160	...
39	99Ni-Low C	Smls. pipe & tube	SB-161	...
40	99Ni-Low C	Smls. tube	SB-163	...
41	99Ni-Low C	Plate, sheet, strip	SB-162	...
42	67Ni-30Cu	Bar	SB-164	...
43	67Ni-30Cu	Smls. pipe & tube	SB-165	...
44	67Ni-30Cu	Forgings	SB-564	...
45	67Ni-30Cu	Plate	SB-127	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	C71500	W061	...	360
2	C71500	HR50	...	495
3	C71500	HR50	...	495
4	C71520	W061	>114	310
5	C71520	M10	>152	310
6	C71520	O20	...	310
7	C71520	O25	$60 < t \leq 140$	310
8	C71520	M10	≤ 152	345
9	C71520	O25	≤ 60	345
10	C71520	W061	≤ 114	345
11	C71520	O60	...	360
12	C71520	O61	...	360
13	C71520	O61	...	360
14	C71520	O61	...	360
15	C71520	W061	...	360
16	C71520	W061	...	360
17	C71520	HR50	...	495
18	C71520	HR50	...	495
19	C72200	O61	...	310
20	C83600	M01	...	205
21	C92200	M01	...	235
22	C92200	M01	...	234
23	C93700	M01	...	207
24	C95200	M01	...	450
25	C95200	M02	...	450
26	C95200	M07	...	470
27	C95400	M01	...	515
28	C95400	M02	...	515
29	C95800	M01	...	585
30	C95820	M01	...	650
31	C96200	M01	...	310
32	C97600	M01	...	276
33	N02200	As rolled	...	380
34	N02200	Stress rel.	...	450
35	N02200	Stress rel.	...	450
36	N02201	Annealed	>125 O.D.	345
37	N02201	Annealed	...	345
38	N02201	Hot rolled/ann.	...	345
39	N02201	Annealed	≤ 125 O.D.	345
40	N02201	Annealed	...	345
41	N02201	Hot rolled/ann.	...	345
42	N04400	Annealed	...	485
43	N04400	Annealed	>125 O.D.	485
44	N04400	Annealed	...	485
45	N04400	Annealed	...	485

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
2	496	496	496	496	492	484	477	471	465	460	...	...	...	...	...
3	496	496	496	496	492	484	477	471	465	460	...	...	...	...	...
4	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
5	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
6	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
7	310	310	310	310	310	310	310	310	310	...	...	...	...	...	...
8	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
9	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
10	345	345	345	345	345	345	345	345	345	...	...	...	...	...	...
11	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
12	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
13	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
14	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
15	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
16	359	359	359	359	359	359	359	359	359	...	...	...	...	...	...
17	496	496	496	496	492	484	477	471	465	460	...	...	...	...	...
18	496	496	496	496	492	484	477	471	465	460	...	...	...	...	...
19	310	301	287	266	256	256	...	...	...	...	...	...	...	...	...
20	207	207	202	196	191	190	189	189	...	...	...	...	...	...	...
21	234	234	234	230	210	165	124	61.8	...	...	...	...	...	...	...
22	234	234	234	230	210	165	124	61.8	...	...	...	...	...	...	...
23	207	202	190	180	170	156	143	121	...	...	...	...	...	...	...
24	448	448	448	431	398	351	326	...	...	...	...	...	...	...	...
25	448	448	448	431	398	351	326	...	...	...	...	...	...	...	...
26	469	469	469	450	416	368	341	...	...	...	...	...	...	...	...
27	517	517	517	517	517	...	...	...	...	...	...	...	...	...	...
28	517	517	517	517	517	...	...	...	...	...	...	...	...	...	...
29	586	580	552	531	...	...	...	...	...	...	...	...	...	...	...
30	648	642	611	587	567	...	...	...	...	...	...	...	...	...	...
31	310	305	282	...	...	...	...	...	...	...	...	...	...	...	...
32	276	271	265	...	...	...	...	...	...	...	...	...	...	...	...
33	379	379	379	379	379	379	379	379	379	379	379	379	379	...	...
34	448	448	448	448	444	432	422	409	...	...	...	...	...	...	...
35	448	448	448	448	444	432	422	409	...	...	...	...	...	...	...
36	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
37	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
38	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
39	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
40	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
41	345	345	345	344	332	319	312	304	297	296	282	268	252	236	220
42	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
43	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
44	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
45	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
37	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
38	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
39	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
40	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
41	204	189	176	165	157	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	67Ni-30Cu	Smls. tube	SB-163	...
2	67Ni-30Cu	Smls. pipe & tube	SB-165	...
3	67Ni-30Cu	Smls. & wld. ftgs.	SB-366	...
4	67Ni-30Cu	Plate	SB-127	...
5	67Ni-30Cu	Rounds	SB-164	...
6	67Ni-30Cu	Rounds	SB-164	...
7	67Ni-30Cu	Rounds	SB-164	...
8	67Ni-30Cu	Rounds	SB-164	...
9	67Ni-30Cu	Smls. tube	SB-163	...
10	67Ni-30Cu	Smls. pipe & tube	SB-165	...
11	67Ni-30Cu	Rounds	SB-164	...
12	67Ni-30Cu	Rounds	SB-164	...
13	67Ni-30Cu-S	Bar	SB-164	...
14	67Ni-30Cu-S	Bar	SB-164	...
15	67Ni-28Cu-3Al	Bolting	SF-468	...
16	47Ni-22Cr-9Mo-18Fe	Plate	SB-435	...
17	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...
18	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...
19	47Ni-22Cr-9Mo-18Fe	Smls. & wld. ftgs.	SB-366	...
20	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...
21	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...
22	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...
23	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...
24	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...
25	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...
26	47Ni-22Cr-19Fe-6Mo	Smls. & wld. ftgs.	SB-366	...
27	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...
28	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...
29	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...
30	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...
31	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...
32	55Ni-21Cr-13.5Mo	Smls. & wld. ftgs.	SB-366	...
33	55Ni-21Cr-13.5Mo	Forgings	SB-462	...
34	55Ni-21Cr-13.5Mo	Forgings	SB-564	...
35	55Ni-21Cr-13.5Mo	Rod	SB-574	...
36	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...
37	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...
38	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...
39	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...
40	60Ni-25Cr-9.5Fe-2.1Al	Smls. tube	SB-163	...
41	60Ni-25Cr-9.5Fe-2.1Al	Plate, sheet, strip	SB-168	...
42	60Ni-25Cr-9.5Fe-2.1Al	Wrought fittings	SB-366	...
43	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-462	...
44	60Ni-25Cr-9.5Fe-2.1Al	Wld. tube	SB-516	...
45	60Ni-25Cr-9.5Fe-2.1Al	Wld. pipe	SB-517	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N04400	Annealed	≤ 75	485
2	N04400	Annealed	≤ 125 O.D.	485
3	N04400	Annealed	...	485
4	N04400	As rolled	...	515
5	N04400	Hot worked	$300 < t \leq 350$	515
6	N04400	Hot worked	$t \leq 300$	550
7	N04400	CW & SR	$t < 13$	580
8	N04400	CW & SR	$89 < t \leq 100$	580
9	N04400	Stress rel.	...	585
10	N04400	Stress rel.	...	585
11	N04400	CW & SR	$13 \leq t \leq 89$	600
12	N04400	Cold worked	$t < 13$	760
13	N04405	Annealed	...	485
14	N04405	Hot worked	...	515
15	N05500	Ann./aged	6-38	895
16	N06002	Annealed	> 5	655
17	N06002	Solution ann.	≤ 5	655
18	N06002	Annealed	...	655
19	N06002	Annealed	...	690
20	N06002	Annealed	$1.5 < t \leq 5$	690
21	N06002	Solution ann.	...	690
22	N06002	Solution ann.	...	690
23	N06002	Solution ann.	...	690
24	N06007	Solution ann.	> 19	585
25	N06007	Solution ann.	> 19	585
26	N06007	Annealed	...	620
27	N06007	Solution ann.	≤ 19	620
28	N06007	Solution ann.	≤ 19	620
29	N06007	Solution ann.	...	620
30	N06007	Solution ann.	...	620
31	N06007	Solution ann.	...	620
32	N06022	Solution ann.	...	690
33	N06022	Solution ann.	...	690
34	N06022	Solution ann.	...	690
35	N06022	Solution ann.	...	690
36	N06022	Solution ann.	...	690
37	N06022	Solution ann.	...	690
38	N06022	Solution ann.	...	690
39	N06022	Solution ann.	...	690
40	N06025	Annealed	...	676
41	N06025	Annealed	...	676
42	N06025	Annealed	...	676
43	N06025	Annealed	$t \leq 102$	676
44	N06025	Annealed	...	676
45	N06025	Annealed	...	676

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
2	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
3	483	483	483	483	483	483	483	483	479	463	443	420	396	373	355
4	517	517	517	517	517	517	517	514	495	475	451	424	398	374	357
5	517	517	517	517	517	517	517	514	495	475	451	424	...	...	...
6	551	551	551	551	551	546	540	530	517	498	475	445	...	...	...
7	579	579	579	579	579	573	567	557	542	523	498	468	...	...	...
8	579	579	579	579	579	573	567	557	542	523	498	468	...	...	...
9	586	586	586	585	585	581	574	563	548	529	504	478	451	424	404
10	586	586	586	585	585	581	574	563	548	529	504	478	451	424	404
11	...	600	600	600	600	594	587	577	562	542	516	484	...	...	...
12	...	758	758	758	758	751	742	729	710	685	653	612	...	...	...
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	896	896	896	896	896	896	890	880	869	...	...	...	...	...	...
16	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
17	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
18	655	655	646	632	617	601	593	584	576	568	561	554	548	543	540
19	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
20	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
21	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
22	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
23	689	689	681	665	649	633	624	615	607	598	591	584	577	572	569
24	586	586	577	571	563	553	548	543	539	536	533	528	524	516	502
25	586	586	577	571	563	553	548	543	539	536	533	528	524	516	502
26	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
27	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
28	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
29	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
30	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
31	621	620	611	605	596	586	581	576	571	567	564	560	554	546	531
32	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
33	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
34	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
35	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
36	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
37	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
38	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
39	689	689	679	659	643	631	626	622	618	614	610	606	602	597	592
40	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
41	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
42	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
43	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
44	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
45	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	524	513	500	484	466	445	421	395	366	336	304	271	238	206	175
17	524	513	500	484	466	445	421	395	366	336	304	271	238	206	175
18	524	513	500	484	466	445	421	395	366	336	304	271	238	206	175
19	552	541	527	510	491	468	443	416	386	354	320	285	251	217	185
20	552	541	527	510	491	468	443	416	386	354	320	285	251	217	185
21	552	541	527	510	491	468	443	416	386	354	320	285	251	217	185
22	552	541	527	510	491	468	443	416	386	354	320	285	251	217	185
23	552	541	527	510	491	468	443	416	386	354	320	285	251	217	185
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
33	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
34	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
35	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
36	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
37	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
38	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
39	580	573	566	558	550	540	529	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-564	...
2	60Ni-25Cr-9.5Fe-2.1Al	Bar	SB-166	...
3	60Ni-25Cr-9.5Fe-2.1Al	Smls. pipe & tube	SB-167	...
4	40Ni-29Cr-15Fe-5Mo	Smls. & wld. ftgs.	SB-366	...
5	40Ni-29Cr-15Fe-5Mo	Forgings	SB-462	...
6	40Ni-29Cr-15Fe-5Mo	Rod	SB-581	...
7	40Ni-29Cr-15Fe-5Mo	Plate, sheet, strip	SB-582	...
8	40Ni-29Cr-15Fe-5Mo	Wld. pipe	SB-619	...
9	40Ni-29Cr-15Fe-5Mo	Smls. pipe & tube	SB-622	...
10	40Ni-29Cr-15Fe-5Mo	Wld. tube	SB-626	...
11	58Ni-33Cr-8Mo	Smls. & wld. ftgs.	SB-366	...
12	58Ni-33Cr-8Mo	Forgings	SB-462	...
13	58Ni-33Cr-8Mo	Forgings	SB-564	...
14	58Ni-33Cr-8Mo	Rod	SB-574	...
15	58Ni-33Cr-8Mo	Plate, sheet, strip	SB-575	...
16	58Ni-33Cr-8Mo	Wld. pipe	SB-619	...
17	58Ni-33Cr-8Mo	Smls. pipe & tube	SB-622	...
18	58Ni-33Cr-8Mo	Wld. tube	SB-626	...
19	46Ni-27Cr-23Fe-2.75Si	Rod	SB-166	...
20	46Ni-27Cr-23Fe-2.75Si	Smls. pipe & tube	SB-167	...
21	46Ni-27Cr-23Fe-2.75Si	Plate, sheet, strip	SB-168	...
22	46Ni-27Cr-23Fe-2.75Si	Smls. & wld. ftgs.	SB-366	...
23	46Ni-27Cr-23Fe-2.75Si	Wld. tube	SB-516	...
24	46Ni-27Cr-23Fe-2.75Si	Wld. pipe	SB-517	...
25	46Ni-27Cr-23Fe-2.75Si	Forgings	SB-564	...
26	59Ni-23Cr-16Mo	Fittings	SB-366	CR5923
27	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923
28	59Ni-23Cr-16Mo	Wld. fittings	SB-366	WP5923W
29	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923WX
30	59Ni-23Cr-16Mo	Forged fittings	SB-462	...
31	59Ni-23Cr-16Mo	Forgings	SB-564	...
32	59Ni-23Cr-16Mo	Rod	SB-574	...
33	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...
34	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...
35	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...
36	59Ni-23Cr-16Mo	Wld. tube	SB-626	...
37	59Ni-23Cr-16Mo-1.6Cu	Fittings	SB-366	...
38	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-462	...
39	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-564	...
40	59Ni-23Cr-16Mo-1.6Cu	Rod	SB-574	...
41	59Ni-23Cr-16Mo-1.6Cu	Plate, sheet, strip	SB-575	...
42	59Ni-23Cr-16Mo-1.6Cu	Wld. pipe	SB-619	...
43	59Ni-23Cr-16Mo-1.6Cu	Smls. pipe & tube	SB-622	...
44	59Ni-23Cr-16Mo-1.6Cu	Wld. tube	SB-626	...
45	60Ni-19Cr-19Mo-1.8Ta	Smls. & wld. ftgs.	SB-366	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N06025	Annealed	$t \leq 102$	676
2	N06025	HW or CW ann.	$t \leq 102$	676
3	N06025	HW or CW ann.	...	676
4	N06030	Solution ann.	...	585
5	N06030	Solution ann.	...	585
6	N06030	Solution ann.	...	585
7	N06030	Solution ann.	...	585
8	N06030	Solution ann.	...	585
9	N06030	Solution ann.	...	585
10	N06030	Solution ann.	...	585
11	N06035	Solution ann.	...	586
12	N06035	Solution ann.	...	586
13	N06035	Solution ann.	...	586
14	N06035	Solution ann.	...	586
15	N06035	Solution ann.	...	586
16	N06035	Solution ann.	...	586
17	N06035	Solution ann.	...	586
18	N06035	Solution ann.	...	586
19	N06045	...	...	620
20	N06045	...	...	620
21	N06045	...	...	620
22	N06045	...	...	620
23	N06045	...	...	620
24	N06045	...	...	620
25	N06045	...	...	620
26	N06059	Annealed	...	690
27	N06059	Annealed	...	690
28	N06059	Annealed	...	690
29	N06059	Annealed	...	690
30	N06059	Solution ann.	...	690
31	N06059	Solution ann.	...	690
32	N06059	Solution ann.	...	690
33	N06059	Solution ann.	...	690
34	N06059	Solution ann.	...	690
35	N06059	Solution ann.	...	690
36	N06059	Solution ann.	...	690
37	N06200	Solution ann.	...	690
38	N06200	Solution ann.	...	690
39	N06200	Solution ann.	...	690
40	N06200	Solution ann.	...	690
41	N06200	Solution ann.	...	690
42	N06200	Solution ann.	...	690
43	N06200	Solution ann.	...	690
44	N06200	Solution ann.	...	690
45	N06210	Solution ann.	...	690

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
2	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
3	676	676	676	675	675	675	675	675	675	675	675	672	665	655	642
4	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
5	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
6	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
7	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
8	586	585	561	544	531	520	515	511	507	503	499	495	490	485	477
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	586	576	551	532	519	514	509	505	500	496	490	483	476	468
12	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
13	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
14	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
15	586	586	576	551	532	519	514	509	505	500	496	490	483	476	468
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	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
20	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
21	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
22	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
23	621	620	600	570	548	535	531	527	523	520	516	511	505	497	488
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	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
27	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
28	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
29	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
30	689	689	689	677	655	635	625	616	608	600	594	589	585	582	579
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	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
38	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
39	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
40	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
41	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
42	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
43	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
44	690	690	690	690	649	636	631	626	621	615	609	602	595	588	582
45	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	60Ni-19Cr-19Mo-1.8Ta	Forgings	SB-564	...
2	60Ni-19Cr-19Mo-1.8Ta	Rod	SB-574	...
3	60Ni-19Cr-19Mo-1.8Ta	Plate, sheet, strip	SB-575	...
4	60Ni-19Cr-19Mo-1.8Ta	Wld. pipe	SB-619	...
5	60Ni-19Cr-19Mo-1.8Ta	Smls. pipe & tube	SB-622	...
6	60Ni-19Cr-19Mo-1.8Ta	Wld. tube	SB-626	...
7	57Ni-22Cr-14W-2Mo-La	Plate, sheet, strip	SB-435	...
8	57Ni-22Cr-14W-2Mo-La	Forgings	SB-564	...
9	57Ni-22Cr-14W-2Mo-La	Bar	SB-572	...
10	57Ni-22Cr-14W-2Mo-La	Wld. pipe	SB-619	...
11	57Ni-22Cr-14W-2Mo-La	Smls. pipe & tube	SB-622	...
12	57Ni-22Cr-14W-2Mo-La	Wld. tube	SB-626	...
13	61Ni-16Mo-16Cr	Smls. & wld. ftgs.	SB-366	...
14	61Ni-16Mo-16Cr	Rod	SB-574	...
15	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...
16	61Ni-16Mo-16Cr	Wld. pipe	SB-619	...
17	61Ni-16Mo-16Cr	Smls. pipe & tube	SB-622	...
18	61Ni-16Mo-16Cr	Wld. tube	SB-626	...
19	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...
20	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...
21	72Ni-15Cr-8Fe	Smls. & wld. ftgs.	SB-366	...
22	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...
23	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...
24	72Ni-15Cr-8Fe	Smls. tube	SB-163	...
25	72Ni-15Cr-8Fe	Bar	SB-166	...
26	72Ni-15Cr-8Fe	Plate	SB-168	...
27	72Ni-15Cr-8Fe	Wld. tube	SB-516	...
28	72Ni-15Cr-8Fe	Forgings	SB-564	...
29	72Ni-15Cr-8Fe	Pipe, tube	SB-167	...
30	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...
31	72Ni-15Cr-8Fe	Bar, rod	SB-166	...
32	72Ni-15Cr-8Fe	Plate, sheet, strip	SB-168	...
33	72Ni-15Cr-8Fe	Rounds	SB-166	...
34	72Ni-15Cr-8Fe	Rounds	SB-166	...
35	72Ni-15Cr-8Fe	Rounds	SB-166	...
36	60Ni-23Cr-Fe	Smls. tube	SB-163	...
37	60Ni-23Cr-Fe	Bar	SB-166	...
38	60Ni-23Cr-Fe	Smls. pipe & tube	SB-167	...
39	60Ni-23Cr-Fe	Plate, sheet, strip	SB-168	...
40	52Ni-22Cr-13Co-9Mo	Bar, rod	SB-166	...
41	52Ni-22Cr-13Co-9Mo	Smls. pipe & tube	SB-167	...
42	52Ni-22Cr-13Co-9Mo	Plate, sheet, strip	SB-168	...
43	52Ni-22Cr-13Co-9Mo	Forgings	SB-564	...
44	52Ni-22Cr-13Co-9Mo	Wld. tube	SB-626	...
45	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet, strip	SB-443	2

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N06210	Solution ann.	...	690
2	N06210	Solution ann.	...	690
3	N06210	Solution ann.	...	690
4	N06210	Solution ann.	...	690
5	N06210	Solution ann.	...	690
6	N06210	Solution ann.	...	690
7	N06230	Solution ann.	...	760
8	N06230	Solution ann.	...	760
9	N06230	Solution ann.	...	760
10	N06230	Solution ann.	...	760
11	N06230	Solution ann.	...	760
12	N06230	Solution ann.	...	760
13	N06455	Annealed	...	690
14	N06455	Solution ann.	...	690
15	N06455	Solution ann.	...	690
16	N06455	Solution ann.	...	690
17	N06455	Solution ann.	...	690
18	N06455	Solution ann.	...	690
19	N06600	Hot fin./ann.	>125	515
20	N06600	Hot fin./ann.	>125	550
21	N06600	Annealed	...	550
22	N06600	Cold drawn/ann.	>125	550
23	N06600	Hot fin./ann.	≤125	550
24	N06600	Annealed	≤75	550
25	N06600	Annealed	...	550
26	N06600	Annealed	...	550
27	N06600	Annealed	...	550
28	N06600	...	...	550
29	N06600	Cold drawn/ann.	≤125	550
30	N06600	Cold drawn/ann.	...	550
31	N06600	Hot fin.	...	585
32	N06600	Hot rolled	...	585
33	N06600	Hot worked	$t > 75$	585
34	N06600	Hot worked	$13 < t \leq 75$	620
35	N06600	Hot worked	$6 \leq t \leq 13$	655
36	N06601	Annealed	≤75 O.D.	552
37	N06601	Annealed	...	552
38	N06601	Annealed	...	552
39	N06601	Annealed	...	552
40	N06617	Annealed	...	655
41	N06617	Annealed	...	655
42	N06617	Annealed	...	655
43	N06617	Annealed	...	655
44	N06617	Solution ann.	...	655
45	N06625	Solution ann.	...	690

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
2	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
3	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
4	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
5	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
6	690	690	688	688	652	639	634	629	624	620	617	613	610	607	604
7	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
8	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
9	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
10	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
11	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
12	758	758	758	744	726	712	708	705	702	700	699	697	695	693	690
13	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
14	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
15	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
16	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
17	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
18	689	689	689	689	684	676	672	668	663	658	652	646	640	636	634
19	517	517	517	517	517	517	517	517	517	517	517	517	515	503	489
20	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
21	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
22	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
23	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
24	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
25	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
26	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
27	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
28	552	552	552	552	552	552	552	552	552	552	552	552	549	537	523
29	552	552	552	552	552	552	552	552	552	552	552	543	549	537	523
30	552	552	552	552	552	552	552	552	552	552	552	543	549	537	523
31	586	586	586	586	586	586	586	586	586	586	586	586	586	586	560
32	586	586	586	586	586	586	586	586	586	586	586	586	586	586	560
33	586	586	586	586	586	586	586	586	586	586	586	586	...	...	560
34	620	620	620	620	620	620	620	620	620	620	620	620	...	...	594
35	655	655	655	655	655	655	655	655	655	655	655	655	...	...	627
36	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
37	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
38	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
39	552	552	552	552	552	552	552	552	552	552	552	552	551	549	546
40	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
41	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
42	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
43	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
44	655	655	655	655	655	647	640	635	629	624	620	616	611	607	603
45	690	690	690	690	687	685	685	685	685	685	685	685	685	682	675

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	473	454	433	408	382	...	...	...	...	...	...	...	...	...	...
20	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
21	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
22	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
23	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
24	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
25	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
26	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
27	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
28	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
29	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
30	505	485	462	436	407	...	...	...	...	...	...	...	...	...	...
31	539	513	485	453	418	...	...	...	...	...	...	...	...	...	...
32	539	513	485	453	418	...	...	...	...	...	...	...	...	...	...
33	539	513	485	453	418	...	...	...	...	...	...	...	...	...	...
34	571	544	514	480	443	...	...	...	...	...	...	...	...	...	...
35	603	575	543	507	468	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	666	654	639	620	597	570	539	505	467	426	383	337	291	245	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Nonferrous Materials (Cont'd)			
1	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe & tube	SB-444	2
2	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	2
3	60Ni-22Cr-9Mo-3.5Cb	Smls. & wld. ftgs.	SB-366	...
4	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	1
(25) 5	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1
6	60Ni-22Cr-9Mo-3.5Cb	Plate	SB-443	1
7	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet	SB-443	1
8	60Ni-22Cr-9Mo-3.5Cb	Sheet, strip	SB-443	1
9	60Ni-22Cr-9Mo-3.5Cb	Smls. pipe	SB-444	1
10	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	1
(25) 11	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1
12	60Ni-22Cr-9Mo-3.5Cb	Wld. tube	SB-704	...
13	60Ni-22Cr-9Mo-3.5Cb	Wld. pipe	SB-705	...
14	Ni-Cr-Mo-W	Forgings	SB-564	...
15	Ni-Cr-Mo-W	Rod	SB-574	...
16	Ni-Cr-Mo-W	Plate, sheet, strip	SB-575	...
17	Ni-Cr-Mo-W	Wld. pipe	SB-619	...
18	Ni-Cr-Mo-W	Smls. pipe & tube	SB-622	...
19	Ni-Cr-Mo-W	Wld. tube	SB-626	...
20	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...
21	58Ni-29Cr-9Fe	Smls. tube	SB-163	...
22	58Ni-29Cr-9Fe	Bar, rod	SB-166	...
23	58Ni-29Cr-9Fe	Plate, sheet, strip	SB-168	...
24	58Ni-29Cr-9Fe	Forgings	SB-564	...
25	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...
26	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...
27	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...
28	49Ni-25Cr-18Fe-6Mo	Plate, sheet, strip	SB-582	...
29	49Ni-25Cr-18Fe-6Mo	Wld. pipe	SB-619	...
30	49Ni-25Cr-18Fe-6Mo	Smls. pipe & tube	SB-622	...
31	49Ni-25Cr-18Fe-6Mo	Wld. tube	SB-626	...
32	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...
33	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...
34	47Ni-22Cr-20Fe-7Mo	Smls. & wld. ftgs.	SB-366	...
35	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...
36	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...
37	47Ni-22Cr-20Fe-7Mo	Wld. pipe	SB-619	...
38	47Ni-22Cr-20Fe-7Mo	Smls. pipe & tube	SB-622	...
39	47Ni-22Cr-20Fe-7Mo	Wld. tube	SB-626	...
40	35Ni-35Fe-20Cr-Cb	Forgings	SB-462	...
41	35Ni-35Fe-20Cr-Cb	Plate	SB-463	...
42	35Ni-35Fe-20Cr-Cb	Bar	SB-473	...
43	35Ni-35Fe-20Cr-Cb	Smls. pipe & tube	SB-729	...
44	35Ni-35Fe-20Cr-Cb	Wld. pipe	SB-464	...
45	35Ni-35Fe-20Cr-Cb	Wld. tube	SB-468	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N06625	Solution ann.	...	690
2	N06625	Solution ann.	...	690
3	N06625	Annealed	...	690
4	N06625	Annealed	$100 < t \leq 250$	760
5	N06625	Annealed	$100 < t \leq 250$	760
6	N06625	Cold rolled/ann.	≤ 9.5	758
7	N06625	Hot rolled/ann.	≤ 70	758
8	N06625	Cold rolled/ann.	...	827
9	N06625	Annealed	...	825
10	N06625	Annealed	≤ 100	825
11	N06625	Annealed	≤ 100	825
12	N06625	Annealed	...	825
13	N06625	Annealed	...	825
14	N06686	Solution ann.	...	689
15	N06686	Solution ann.	...	689
16	N06686	Solution ann.	...	689
17	N06686	Solution ann.	...	689
18	N06686	Solution ann.	...	689
19	N06686	Solution ann.	...	689
20	N06690	Hot worked/ann.	>127 O.D.	515
21	N06690	Annealed	...	585
22	N06690	Annealed	...	585
23	N06690	Annealed	...	585
24	N06690	Annealed	...	585
25	N06690	Cold worked/ann.	≤ 127 O.D.	586
26	N06690	Cold worked/ann.	>127 O.D.	586
27	N06690	Hot worked/ann.	≤ 127 O.D.	586
28	N06975	Solution ann.	...	585
29	N06975	Solution ann.	...	585
30	N06975	Solution ann.	...	585
31	N06975	Solution ann.	...	585
32	N06985	Annealed	>19	585
33	N06985	Annealed	>19	585
34	N06985	Annealed	...	620
35	N06985	Annealed	≤ 19	620
36	N06985	Annealed	≤ 19	620
37	N06985	Annealed	...	620
38	N06985	Annealed	...	620
39	N06985	Annealed	...	620
40	N08020	Annealed	...	550
41	N08020	Annealed	...	550
42	N08020	Annealed	...	550
43	N08020	Annealed	...	550
44	N08020	Wld. ann.	...	550
45	N08020	Wld. ann.	...	550

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	690	690	690	690	687	685	685	685	685	685	685	685	685	682	675
2	690	690	690	690	687	685	685	685	685	685	685	685	685	682	675
3	690	690	677	677	677	677	677	677	677	677	677	677	677	676	670
4	760	760	745	745	745	745	745	745	745	745	745	745	746	744	738
5	760	760	745	745	745	745	745	745	745	745	745	745	746	744	738
6	758	758	758	744	730	719	714	708	702	696	691	685	679	672	665
7	760	760	745	745	745	745	745	745	745	745	745	745	746	744	738
8	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
9	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
10	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
11	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
12	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
13	825	825	809	809	809	809	809	809	809	809	809	809	809	808	801
14	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
15	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
16	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
17	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
18	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
19	689	689	680	659	642	629	624	619	613	608	601	594	585	575	564
20	517	516	509	501	494	489	487	486	485	484	482	480	476	471	463
21	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
22	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
23	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
24	586	586	579	566	558	554	552	551	550	549	547	543	539	533	524
25	586	585	577	567	560	554	552	551	550	548	547	544	540	534	525
26	586	585	577	567	560	554	552	551	549	548	547	544	540	534	525
27	586	585	577	567	560	554	552	551	550	548	547	544	540	534	525
28	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
29	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
30	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
31	586	586	586	577	565	556	552	549	545	541	538	534	529	524	517
32	586	586	577	556	540	528	524	520	517	513	509	504	499	492	484
33	586	586	577	556	540	528	524	520	517	513	509	504	499	492	484
34	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
35	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
36	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
37	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
38	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
39	621	620	611	589	571	560	555	551	547	543	539	534	528	521	512
40	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
41	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
42	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
43	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
44	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...
45	552	551	546	536	533	533	533	530	528	526	526	526	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding														
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875 900
	Nonferrous Materials (Cont'd)													
1	666	654	639	620	597	570	539	505	467	426	383	337	291	245 ...
2	666	654	639	620	597	570	539	505	467	426	383	337	291	245 ...
3	662	650	634	614	589	561	528	491	450	407	360	312	263	214 ...
4	729	716	698	676	649	618	581	541	496	448	397	344	290	236 ...
5	729	716	698	676	649	618	581	541	496	448	397	344	290	236 ... (25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	729	716	698	676	649	618	581	541	496	448	397	344	290	236 ...
8	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ...
9	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ...
10	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ...
11	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ... (25)
12	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ...
13	791	777	758	734	705	670	631	587	539	486	431	373	315	256 ...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	35Ni-35Fe-20Cr-Cb	Smls. & wld. ftgs.	SB-366	...
2	37Ni-33Fe-23Cr-4Mo-Cu	Wld. pipe	SB-464	...
3	37Ni-33Fe-23Cr-4Mo-Cu	Wld. tube	SB-468	...
4	35Ni-30Fe-24Cr-6Mo-Cu	Wld. pipe	SB-464	...
5	35Ni-30Fe-24Cr-6Mo-Cu	Wld. tube	SB-468	...
6	31Ni-31Fe-29Cr-Mo	Smls. tube	SB-668	...
7	31Ni-31Fe-29Cr-Mo	Plate, sheet, strip	SB-709	...
8	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. & wld. ftgs.	SB-366	...
9	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forgings	SB-564	...
10	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Rod	SB-581	...
11	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. pipe	SB-619	...
12	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. pipe & tube	SB-622	...
13	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Plate, sheet, strip	SB-625	...
14	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. tube	SB-626	...
15	37Ni-33Fe-25Cr	Condenser tubes	SB-163	...
16	37Ni-33Fe-25Cr	Smls. & wld. ftgs.	SB-366	...
17	37Ni-33Fe-25Cr	Smls. pipe & tube	SB-407	...
18	37Ni-33Fe-25Cr	Bar, rod	SB-408	...
19	37Ni-33Fe-25Cr	Plate, sheet, strip	SB-409	...
20	37Ni-33Fe-25Cr	Wld. pipe	SB-514	...
21	37Ni-33Fe-25Cr	Wld. tube	SB-515	...
22	37Ni-33Fe-25Cr	Forgings	SB-564	...
23	26Ni-43Fe-22Cr-5Mo	Wld. pipe	SB-619	...
24	26Ni-43Fe-22Cr-5Mo	Plate, sheet, strip	SB-620	...
25	26Ni-43Fe-22Cr-5Mo	Rod	SB-621	...
26	26Ni-43Fe-22Cr-5Mo	Smls. pipe & tube	SB-622	...
27	26Ni-43Fe-22Cr-5Mo	Wld. tube	SB-626	...
28	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...
29	35Ni-19Cr-1 $\frac{1}{4}$ Si	Pipe	SB-535	...
30	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate	SB-536	...
31	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. ftgs.	SB-366	...
32	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. pipe	SB-535	...
33	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate, sheet, strip	SB-536	...
34	35Ni-19Cr-1 $\frac{1}{4}$ Si	Wld. pipe	SB-710	...
35	35Ni-23Cr-7.5Mo-N	Plate, sheet, strip	SB-625	...
36	35Ni-23Cr-7.5Mo-N	Bar, wire	SB-649	...
37	35Ni-23Cr-7.5Mo-N	Wld. pipe	SB-673	...
38	35Ni-23Cr-7.5Mo-N	Wld. tube	SB-674	...
39	35Ni-23Cr-7.5Mo-N	Smls. pipe & tube	SB-677	...
40	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-462	...
41	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-564	...
42	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...
43	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...
44	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...
45	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N08020	Annealed	...	585
2	N08024	Wld. ann.	...	550
3	N08024	Wld. ann.	...	550
4	N08026	Wld. ann.	...	550
5	N08026	Wld. ann.	...	550
6	N08028	Annealed	...	505
7	N08028	Annealed	...	505
8	N08031	...	...	650
9	N08031	...	...	650
10	N08031	...	...	650
11	N08031	...	...	650
12	N08031	...	...	650
13	N08031	...	...	650
14	N08031	...	...	650
15	N08120	Solution ann.	...	621
16	N08120	Solution ann.	...	621
17	N08120	Solution ann.	...	621
18	N08120	Solution ann.	...	621
19	N08120	Solution ann.	...	621
20	N08120	Solution ann.	...	621
21	N08120	Solution ann.	...	621
22	N08120	Solution ann.	...	621
23	N08320	Solution ann.	...	515
24	N08320	Solution ann.	...	515
25	N08320	Solution ann.	...	515
26	N08320	Solution ann.	...	515
27	N08320	Solution ann.	...	515
28	N08330	...	...	485
29	N08330	...	...	485
30	N08330	...	...	485
31	N08330	Annealed	...	485
32	N08330	Annealed	...	485
33	N08330	Annealed	...	485
34	N08330	Annealed	...	485
35	N08354	Solution ann.	...	640
36	N08354	Solution ann.	...	640
37	N08354	Solution ann.	...	640
38	N08354	Solution ann.	...	640
39	N08354	Solution ann.	...	640
40	N08367	Solution ann.	...	655
41	N08367	Solution ann.	...	655
42	N08367	Solution ann.	>5	655
43	N08367	Solution ann.	>5	655
44	N08367	Solution ann.	>5	655
45	N08367	Solution ann.	>5	655

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	586	586	580	569	567	566	566	564	561	559	559	559	...	...	...
2	552	551	544	531	518	506	501	496	492	488	485	482	480	478	475
3	552	551	544	531	518	506	501	496	492	488	485	482	480	478	475
4	552	551	542	527	513	501	495	489	482	476	470	464	459	455	450
5	552	551	542	527	513	501	495	489	482	476	470	464	459	455	450
6	503	503	485	467	453	442	437	432	427	423	419	414	408	403	397
7	503	503	485	467	453	442	437	432	427	423	419	414	408	403	397
8	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
9	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
10	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
11	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
12	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
13	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
14	648	647	623	594	567	545	535	527	520	515	510	506	500	493	...
15	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
16	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
17	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
18	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
19	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
20	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
21	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
22	621	621	604	586	574	568	566	565	564	563	561	559	555	551	544
23	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
24	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
25	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
26	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
27	517	517	511	496	486	483	482	482	482	481	479	477	...	...	...
28	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
29	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
30	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
31	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
32	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
33	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
34	483	483	483	474	469	469	469	469	469	469	469	469	468	464	453
35	640	637	602	577	559	546	542	537	533	529	524	519	...	...	...
36	640	637	602	577	559	546	542	537	533	529	524	519	...	...	...
37	640	637	602	577	559	546	542	537	533	529	524	519	...	...	...
38	640	637	602	577	559	546	542	537	533	529	524	519	...	...	...
39	640	637	602	577	559	546	542	537	533	529	524	519	...	...	...
40	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
41	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
42	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
43	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
44	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...
45	655	654	618	594	577	565	560	556	552	549	546	543	539	535	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
29	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
30	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
31	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
32	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
33	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
34	440	425	407	388	366	342	316	288	260	232	203	176	157	132	111
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	46Fe-24Ni-21Cr-6Mo-N	Bar, rod, wire	SB-691	...
2	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...
3	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...
4	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...
5	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...
6	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...
7	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...
8	46Fe-24Ni-21Cr-6Mo-N	Castings	SA-351	CN3MN
9	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SB-599	...
10	25Ni-47Fe-21Cr-5Mo	Bar, wire	SB-672	...
11	32Ni-45Fe-20Cr-Cb	Castings	SA-351	CT15C
12	33Ni-42Fe-21Cr	Smls. tube	SB-163	...
13	33Ni-42Fe-21Cr	Smls. & wld. ftgs.	SB-366	...
14	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...
15	33Ni-42Fe-21Cr	Bar	SB-408	...
16	33Ni-42Fe-21Cr	Plate	SB-409	...
17	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...
18	33Ni-42Fe-21Cr	Wld. tube	SB-515	...
19	33Ni-42Fe-21Cr	Forgings	SB-564	...
20	33Ni-42Fe-21Cr	Smls. tube	SB-163	...
21	32Ni-44Fe-21Cr	Smls. tube	SB-163	...
22	32Ni-44Fe-21Cr	Smls. pipe & tube	SB-407	...
23	33Ni-42Fe-21Cr	Smls. tube	SB-163	...
24	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...
25	33Ni-42Fe-21Cr	Bar	SB-408	...
26	33Ni-42Fe-21Cr	Plate	SB-409	...
27	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...
28	33Ni-42Fe-21Cr	Wld. tube	SB-515	...
29	33Ni-42Fe-21Cr	Forgings	SB-564	...
30	33Ni-42Fe-21Cr	Smls. tube	SB-163	...
31	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...
32	33Ni-42Fe-21Cr	Bar	SB-408	...
33	33Ni-42Fe-21Cr	Plate	SB-409	...
34	33Ni-42Fe-21Cr	Wld. tube	SB-515	...
35	33Ni-42Fe-21Cr	Forgings	SB-564	...
(25) 36	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10
(25) 37	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H
(25) 38	42Fe-33Ni-21Cr	Plate	SA-240	800H
(25) 39	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H
(25) 40	42Fe-33Ni-21Cr	Bar	SA-276	800H
(25) 41	42Fe-33Ni-21Cr	Smls. pipe	SA-312	800H
(25) 42	42Fe-33Ni-21Cr	Wld. pipe	SA-312	800H
(25) 43	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H
(25) 44	42Fe-33Ni-21Cr	Bar	SA-479	800H
(25) 45	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N08367	Solution ann.	...	655
2	N08367	Solution ann.	>5	655
3	N08367	Solution ann.	≤5	690
4	N08367	Solution ann.	≤5	690
5	N08367	Solution ann.	≤5	690
6	N08367	Solution ann.	≤5	690
7	N08367	Solution ann.	≤5	690
8	J94651	Solution ann.	...	550
9	N08700	Solution ann.	...	550
10	N08700	Solution ann.	...	550
11	...	As cast	...	435
12	N08800	Annealed	...	515
13	N08800	Annealed	...	515
14	N08800	Annealed	...	515
15	N08800	Annealed	...	515
16	N08800	Annealed	...	515
17	N08800	Annealed	...	515
18	N08800	Annealed	...	515
19	N08800	Annealed	...	515
20	N08800	Cold worked	...	570
21	N08801	Ann./stabilized	...	450
22	N08801	Ann./stabilized	...	450
23	N08810	Annealed	...	450
24	N08810	Annealed	...	450
25	N08810	Annealed	...	450
26	N08810	Annealed	...	450
27	N08810	Annealed	...	450
28	N08810	Annealed	...	450
29	N08810	Annealed	...	450
30	N08811	Annealed	...	450
31	N08811	Annealed	...	450
32	N08811	Annealed	...	450
33	N08811	Annealed	...	450
34	N08811	Annealed	...	450
35	N08811	Annealed	...	450
36	N08810	...	...	450
37	N08810	...	...	450
38	N08810	...	...	450
39	N08810	...	...	450
40	N08810	...	...	450
41	N08810	...	...	450
42	N08810	...	...	450
43	N08810	...	...	450
44	N08810	...	...	450
45	N08810	...	...	450

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
4	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
5	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
6	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
7	689	688	651	626	608	595	590	586	581	578	575	572	568	564	...
8	552	516	479	455	437	423	417	411	405	400	395	390	386	383	379
9	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
10	552	551	546	534	520	517	517	515	...	...	...	...	...	...	...
11	434	434	434	434	434	434	434	434	434	434	434	434	434	...	...
12	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
13	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
14	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
15	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
16	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
17	517	517	517	517	515	514	514	514	513	512	510	506	501	495	487
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	572	572	572	570	558	552	551	551	...	...	...	...	...	...	...
21	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
22	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
23	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
24	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
25	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
26	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
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	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
37	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
38	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
39	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
40	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
41	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
42	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
43	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
44	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
45	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
13	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
14	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
15	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
16	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
17	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
18	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
19	465	445	421	393	363	330	296	263	231	204	184	173	175	194	...
20	515	492	466	485	401	365	328	291	256	226	203	191	193	214	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
24	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
25	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
26	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
27	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
28	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
29	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
30	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
31	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
32	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
33	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
34	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
35	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131
36	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
37	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
38	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
39	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
40	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
41	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
42	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
43	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
44	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
45	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
(25) 1	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10
(25) 2	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11
(25) 3	42Fe-33Ni-21Cr	Smls. tube	SA-213	...
(25) 4	42Fe-33Ni-21Cr	Plate	SA-240	...
(25) 5	42Fe-33Ni-21Cr	Wld. tube	SA-249	...
(25) 6	42Fe-33Ni-21Cr	Bar	SA-276	...
(25) 7	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...
(25) 8	42Fe-33Ni-21Cr	Bar	SA-479	...
(25) 9	42Fe-33Ni-21Cr	Wld. tube	SA-688	...
(25) 10	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11
11	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...
12	42Ni-21.5Cr-3Mo-2.3Cu	Smls. & wld. ftgs.	SB-366	...
13	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...
14	42Ni-21.5Cr-3Mo-2.3Cu	Plate	SB-424	...
15	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...
16	42Ni-21.5Cr-3Mo-2.3Cu	Forgings	SB-564	...
17	42Ni-21.5Cr-3Mo-2.3Cu	Wld. tube	SB-704	...
18	42Ni-21.5Cr-3Mo-2.3Cu	Wld. pipe	SB-705	...
19	44Fe-25Ni-21Cr-Mo	Forgings	SA-182	...
20	44Fe-25Ni-21Cr-Mo	Smls. tube	SA-213	...
21	44Fe-25Ni-21Cr-Mo	Plate, sheet, strip	SA-240	...
22	44Fe-25Ni-21Cr-Mo	Wld. tube	SA-249	...
23	44Fe-25Ni-21Cr-Mo	Smls. & wld. pipe	SA-312	...
24	44Fe-25Ni-21Cr-Mo	Fittings	SA-403	...
25	44Fe-25Ni-21Cr-Mo	Bar	SA-479	...
26	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SB-625	...
27	25Ni-20Cr-6Mo-Cu-N	Bar, wire	SB-649	...
28	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SB-673	...
29	25Ni-20Cr-6Mo-Cu-N	Wld. tube	SB-674	...
30	25Ni-20Cr-6Mo-Cu-N	Smls. pipe & tube	SB-677	...
(25) 31	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SA-240	...
(25) 32	25Ni-20Cr-6Mo-Cu-N	Bar	SA-276	...
(25) 33	25Ni-20Cr-6Mo-Cu-N	Bar	SA-479	...
(25) 34	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SA-312	...
(25) 35	25Ni-20Cr-6Mo-Cu-N	Smls. pipe	SA-312	...
(25) 36	25Ni-20Cr-6Mo-Cu-N	Smls. tube	SA-213	...
37	62Ni-28Mo-5Fe	Plate	SB-333	...
38	62Ni-28Mo-5Fe	Smls. & wld. ftgs.	SB-366	...
39	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...
40	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...
41	62Ni-28Mo-5Fe	Wld. tube	SB-626	...
42	62Ni-28Mo-5Fe	Rod	SB-335	...
43	62Ni-28Mo-5Fe	Sheet, strip	SB-333	...
44	70Ni-16Mo-7Cr-5Fe	Smls. & wld. ftgs.	SB-366	...
45	70Ni-16Mo-7Cr-5Fe	Plate, sheet, strip	SB-434	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N08810	...	...	450
2	N08811	...	...	450
3	N08811	...	...	450
4	N08811	...	...	450
5	N08811	...	...	450
6	N08811	...	...	450
7	N08811	...	...	450
8	N08811	...	...	450
9	N08811	...	...	450
10	N08811	...	...	450
11	N08825	Annealed	...	585
12	N08825	Annealed	...	585
13	N08825	Cold worked/ann.	...	585
14	N08825	Annealed	...	585
15	N08825	Annealed	...	585
16	N08825	Annealed	...	585
17	N08825	Annealed	...	585
18	N08825	Annealed	...	585
19	N08904	Annealed	...	490
20	N08904	Annealed	...	490
21	N08904	Annealed	...	490
22	N08904	Annealed	...	490
23	N08904	Annealed	...	490
24	N08904	Annealed	...	490
25	N08904	Annealed	...	490
26	N08925	Annealed	...	600
27	N08925	Annealed	...	600
28	N08925	Annealed	...	600
29	N08925	Annealed	...	600
30	N08925	Annealed	...	600
31	N08925	...	...	600
32	N08925	...	...	600
33	N08925	...	...	600
34	N08925	...	...	600
35	N08925	...	...	600
36	N08925	...	...	600
37	N10001	Annealed	...	690
38	N10001	Annealed	...	690
39	N10001	Solution ann.	...	690
40	N10001	Solution ann.	...	690
41	N10001	Solution ann.	...	690
42	N10001	Annealed	...	690
43	N10001	Annealed	...	795
44	N10003	Annealed	...	690
45	N10003	Annealed	...	690

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
2	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
3	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
4	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
5	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
6	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
7	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
8	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
9	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
10	448	448	448	446	442	440	440	440	440	440	440	440	439	437	432
11	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
12	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
13	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
14	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
15	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
16	585	585	585	585	585	585	...	582	579	576	572	568	563	557	549
17	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
18	586	586	586	586	586	586	585	583	580	577	573	569	564	557	549
19	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
20	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
21	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
22	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
23	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
24	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
25	490	489	467	452	441	431	427	424	420	417	...	...	...	...	...
26	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
27	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
28	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
29	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
30	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
31	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
32	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
33	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
34	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
35	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
36	600	599	577	556	537	521	514	507	500	493	485	476	...	...	...
37	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
38	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
39	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
40	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
41	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
42	689	689	689	679	672	669	667	664	662	659	657	654	...	...	...
43	793	793	793	781	773	769	767	764	761	758	755	753	...	...	...
44	689	689	689	689	689	689	689	689	689	689	689	689	680	668	654
45	689	689	689	689	689	689	689	689	689	689	689	689	680	668	654

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
2	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
3	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
4	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
5	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
6	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
7	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
8	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
9	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
10	423	410	395	379	360	340	319	296	273	249	224	200	176	153	131 (25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	638	620	600	578	554	529	502	473	443	413	381	350	...	...	...
45	638	620	600	578	554	529	502	473	443	413	381	350	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	70Ni-16Mo-7Cr-5Fe	Rod	SB-573	...
2	62Ni-25Mo-8Cr-2Fe	Smls. & wld. ftgs.	SB-366	...
3	62Ni-25Mo-8Cr-2Fe	Plate, sheet, strip	SB-434	...
4	62Ni-25Mo-8Cr-2Fe	Forgings	SB-564	...
5	62Ni-25Mo-8Cr-2Fe	Rod	SB-573	...
6	62Ni-25Mo-8Cr-2Fe	Wld. pipe	SB-619	...
7	62Ni-25Mo-8Cr-2Fe	Smls. pipe & tube	SB-622	...
8	62Ni-25Mo-8Cr-2Fe	Wld. tube	SB-626	...
9	54Ni-16Mo-15Cr	Smls. & wld. ftgs.	SB-366	...
10	54Ni-16Mo-15Cr	Forgings	SB-462	...
11	54Ni-16Mo-15Cr	Forgings	SB-564	...
12	54Ni-16Mo-15Cr	Rod	SB-574	...
13	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...
14	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...
15	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...
16	54Ni-16Mo-15Cr	Wld. tube	SB-626	...
17	62Ni-22Mo-15Cr	Smls. & wld. fittings	SB-366	...
18	62Ni-22Mo-15Cr	Forgings	SB-462	...
19	62Ni-22Mo-15Cr	Forgings	SB-564	...
20	62Ni-22Mo-15Cr	Rod	SB-574	...
21	62Ni-22Mo-15Cr	Plate, sheet, strip	SB-575	...
22	62Ni-22Mo-15Cr	Wld. pipe	SB-619	...
23	62Ni-22Mo-15Cr	Smls. pipe & tube	SB-622	...
24	62Ni-22Mo-15Cr	Wld. tube	SB-626	...
25	Ni-28Mo-3Fe-1.3Cr-0.25Al	Plate, sheet, strip	SB-333	...
26	Ni-28Mo-3Fe-1.3Cr-0.25Al	Rod	SB-335	...
27	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. & wld. ftgs.	SB-366	...
28	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forgings	SB-564	...
29	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. pipe	SB-619	...
30	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. pipe & tube	SB-622	...
31	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. tube	SB-626	...
32	65Ni-28Mo-2Fe	Smls. & wld. ftgs.	SB-366	...
33	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...
34	65Ni-28Mo-2Fe	Wld. tube	SB-626	...
35	65Ni-28Mo-2Fe	Plate, sheet, strip	SB-333	...
36	65Ni-28Mo-2Fe	Rod	SB-335	...
37	65Ni-28Mo-2Fe	Forgings	SB-462	...
38	65Ni-28Mo-2Fe	Forgings	SB-564	...
39	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...
40	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...
41	65Ni-28Mo-2Fe	Wld. tube	SB-626	...
42	65Ni-29.5Mo-2Fe-2Cr	Plate, sheet, strip	SB-333	...
43	65Ni-29.5Mo-2Fe-2Cr	Rod	SB-335	...
44	65Ni-29.5Mo-2Fe-2Cr	Smls. & wld. ftgs.	SB-366	...
45	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-462	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N10003	Annealed	...	690
2	N10242	Annealed	...	725
3	N10242	Annealed	...	725
4	N10242	Annealed	...	725
5	N10242	Annealed	...	725
6	N10242	Solution ann.	...	725
7	N10242	Solution ann.	...	725
8	N10242	Solution ann.	...	725
9	N10276	Solution ann.	...	690
10	N10276	Solution ann.	...	690
11	N10276	Solution ann.	...	690
12	N10276	Solution ann.	...	690
13	N10276	Solution ann.	...	690
14	N10276	Solution ann.	...	690
15	N10276	Solution ann.	...	690
16	N10276	Solution ann.	...	690
17	N10362	Solution ann.	...	725
18	N10362	Solution ann.	...	725
19	N10362	Solution ann.	...	725
20	N10362	Solution ann.	...	725
21	N10362	Solution ann.	...	725
22	N10362	Solution ann.	...	725
23	N10362	Solution ann.	...	725
24	N10362	Solution ann.	...	725
25	N10629	...	...	760
26	N10629	...	...	760
27	N10629	...	...	760
28	N10629	...	...	760
29	N10629	...	...	760
30	N10629	...	...	760
31	N10629	...	...	760
32	N10665	Annealed	...	760
33	N10665	Annealed	...	760
34	N10665	Annealed	...	760
35	N10665	Solution ann.	...	760
36	N10665	Solution ann.	...	760
37	N10665	Solution ann.	...	760
38	N10665	Solution ann.	...	760
39	N10665	Solution ann.	...	760
40	N10665	Solution ann.	...	760
41	N10665	Solution ann.	...	760
42	N10675	Solution ann.	...	760
43	N10675	Solution ann.	...	760
44	N10675	Solution ann.	...	760
45	N10675	Solution ann.	...	760

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	689	689	689	689	689	689	689	689	689	689	689	689	680	668	654
2	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
3	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
4	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
5	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
6	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
7	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
8	724	724	724	724	724	721	719	718	716	715	713	712	711	711	711
9	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
10	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
11	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
12	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
13	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
14	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
15	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
16	689	689	689	675	662	651	645	641	636	632	627	623	618	612	607
17	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
18	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
19	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
20	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
21	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
22	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
23	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
24	724	724	724	715	698	688	685	684	682	681	678	674	...	...	...
25	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
26	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
27	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
28	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
29	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
30	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
31	758	758	758	758	752	741	737	733	729	725	722	719	717	712	707
32	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
33	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
34	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
35	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
36	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
37	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
38	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
39	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
40	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
41	758	758	758	758	758	755	752	748	745	742	738	735	731	728	727
42	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
43	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
44	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
45	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	638	620	600	578	554	529	502	473	443	413	381	350	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
10	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
11	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
12	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
13	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
14	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
15	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
16	600	591	581	570	557	543	528	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-564	...
2	65Ni-29.5Mo-2Fe-2Cr	Wld. pipe	SB-619	...
3	65Ni-29.5Mo-2Fe-2Cr	Smls. pipe & tube	SB-622	...
4	65Ni-29.5Mo-2Fe-2Cr	Wld. tube	SB-626	...
5	37Ni-30Co-28Cr-2.7Si	Plate, sheet, strip	SB-435	...
6	37Ni-30Co-28Cr-2.7Si	Forgings	SB-564	...
7	37Ni-30Co-28Cr-2.7Si	Rod	SB-572	...
8	37Ni-30Co-28Cr-2.7Si	Wld. pipe	SB-619	...
9	37Ni-30Co-28Cr-2.7Si	Smls. pipe & tube	SB-622	...
10	37Ni-30Co-28Cr-2.7Si	Wld. tube	SB-626	...
11	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. & wld. ftgs.	SB-366	...
12	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Forgings	SB-564	...
13	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. pipe	SB-619	...
14	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. pipe & tube	SB-622	...
15	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Plate, sheet, strip	SB-625	...
16	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. tube	SB-626	...
17	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Rod	SB-649	...
18	21Ni-30Fe-22Cr-18Co-3Mo-3W	Plate, sheet, strip	SB-435	...
19	21Ni-30Fe-22Cr-18Co-3Mo-3W	Rod	SB-572	...
20	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. pipe	SB-619	...
21	21Ni-30Fe-22Cr-18Co-3Mo-3W	Smls. pipe & tube	SB-622	...
22	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. tube	SB-626	...
23	Co-26Cr-9Ni-5Mo-3Fe-2W	Rod	SB-815	...
24	Co-26Cr-9Ni-5Mo-3Fe-2W	Plate, sheet, strip	SB-818	...
25	Ti	Plate, sheet, strip	SB-265	1
26	Ti	Smls. & wld. tube	SB-338	1
27	Ti	Bar, billet	SB-348	1
28	Ti	Smls. & wld. ftgs.	SB-363	WPT1
29	Ti	Forgings	SB-381	F-1
30	Ti	Smls. pipe	SB-861	1
31	Ti	Wld. pipe	SB-862	1
32	Ti	Castings	SB-367	C-2
33	Ti	Forgings	SB-381	F-2
34	Ti	Plate, sheet, strip	SB-265	2H
35	Ti	Smls. & wld. tube	SB-338	2H
36	Ti	Bar, billet	SB-348	2H
37	Ti	Smls. fittings	SB-363	WPT2H
38	Ti	Wld. fittings	SB-363	WPT2HW
39	Ti	Forgings	SB-381	F-2H
40	Ti	Smls. pipe	SB-861	2H
41	Ti	Wld. pipe	SB-862	2H
42	Ti	Castings	SB-367	C-3
43	Ti	Plate, sheet, strip	SB-265	3
44	Ti	Smls. & wld. tube	SB-338	3
45	Ti	Bar, billet	SB-348	3

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	N10675	Solution ann.	...	760
2	N10675	Solution ann.	...	760
3	N10675	Solution ann.	...	760
4	N10675	Solution ann.	...	760
5	N12160	Solution ann.	...	620
6	N12160	Solution ann.	...	620
7	N12160	Solution ann.	...	620
8	N12160	Solution ann.	...	620
9	N12160	Solution ann.	...	620
10	N12160	Solution ann.	...	620
11	R20033	...	...	750
12	R20033	...	...	750
13	R20033	...	...	750
14	R20033	...	...	750
15	R20033	...	...	750
16	R20033	...	...	750
17	R20033	...	...	750
18	R30556	Annealed	...	690
19	R30556	Annealed	...	690
20	R30556	Annealed	...	690
21	R30556	Annealed	...	690
22	R30556	Annealed	...	690
23	R31233	Solution ann.	...	896
24	R31233	Solution ann.	...	896
25	R50250	Annealed	...	240
26	R50250	Annealed	...	240
27	R50250	Annealed	...	240
28	R50250	Annealed	...	240
29	R50250	Annealed	...	240
30	R50250	Annealed	...	240
31	R50250	Annealed	...	240
32	R50400	...	...	345
33	R50400	Annealed	...	345
34	R50400	Annealed	...	400
35	R50400	Annealed	...	400
36	R50400	Annealed	...	400
37	R50400	Annealed	...	400
38	R50400	Annealed	...	400
39	R50400	Annealed	...	400
40	R50400	Annealed	...	400
41	R50400	Annealed	...	400
42	R50550	...	...	450
43	R50550	Annealed	...	450
44	R50550	Annealed	...	450
45	R50550	Annealed	...	450

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
2	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
3	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
4	758	758	758	758	752	741	737	733	729	725	722	719	716	714	710
5	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
6	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
7	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
8	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
9	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
10	621	621	620	607	592	579	572	565	558	551	544	538	530	523	515
11	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
12	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
13	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
14	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
15	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
16	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
17	752	749	711	677	651	630	621	614	607	600	593	587	578	569	...
18	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
19	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
20	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
21	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
22	689	689	675	655	640	631	627	623	621	618	616	613	609	605	600
23	896	896	896	896	896	896	896	894	883	872	864	856	850	843	835
24	896	896	896	896	896	896	896	894	883	872	864	856	850	843	835
25	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
26	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
27	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
28	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
29	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
30	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
31	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
32	345	278	234	199	170	...	...	...	...	...	...	...	...	...	...
33	345	295	249	216	188	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	...	...	...	...	...	...	...
42	448	372	306	254	212	...	...	...	...	...	...	...	...	...	...
43	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
44	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
45	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
Nonferrous Materials (Cont'd)				
1	Ti	Smls. & wld. ftgs.	SB-363	WPT3
2	Ti	Forgings	SB-381	F-3
3	Ti	Smls. pipe	SB-861	3
4	Ti	Wld. pipe	SB-862	3
5	Ti-Pd	Plate, sheet, strip	SB-265	11
6	Ti-Pd	Plate, sheet, strip	SB-265	17
7	Ti-Ru	Plate, sheet, strip	SB-265	27
8	Ti-Pd	Plate, sheet, strip	SB-265	7
9	Ti-0.15Pd	Plate, sheet, strip	SB-265	7H
10	Ti-0.15Pd	Smls. & wld. tube	SB-338	7H
11	Ti-0.15Pd	Bar, billet	SB-348	7H
12	Ti-0.15Pd	Smls. fittings	SB-363	WPT7H
13	Ti-0.15Pd	Wld. fittings	SB-363	WPT7HW
14	Ti-0.15Pd	Forgings	SB-381	F-7H
15	Ti-0.15Pd	Smls. pipe	SB-861	7H
16	Ti-0.15Pd	Wld. pipe	SB-862	7H
17	Ti-Pd	Plate, sheet, strip	SB-265	16
18	Ti-Pd	Bar, billet	SB-348	16
19	Ti-Pd	Forgings	SB-381	F-16
20	Ti-0.05Pd	Plate, sheet, strip	SB-265	16H
21	Ti-0.05Pd	Smls. & wld. tube	SB-338	16H
22	Ti-0.05Pd	Bar, billet	SB-348	16H
23	Ti-0.05Pd	Smls. fittings	SB-363	WPT16H
24	Ti-0.05Pd	Wld. fittings	SB-363	WPT16HW
25	Ti-0.05Pd	Forgings	SB-381	F-16H
26	Ti-0.05Pd	Smls. pipe	SB-861	16H
27	Ti-0.05Pd	Wld. pipe	SB-862	16H
28	Ti-Ru	Plate, sheet, strip	SB-265	26
29	Ti-Ru	Smls. & wld. tube	SB-338	26
30	Ti-Ru	Bar, billet	SB-348	26
31	Ti-Ru	Smls. fittings	SB-363	WPT26
32	Ti-Ru	Wld. fittings	SB-363	WPT26W
33	Ti-Ru	Forgings	SB-381	F-26
34	Ti-Ru	Smls. pipe	SB-861	26
35	Ti-Ru	Wld. pipe	SB-862	26
36	Ti-0.10Ru	Plate, sheet, strip	SB-265	26H
37	Ti-0.10Ru	Smls. & wld. tube	SB-338	26H
38	Ti-0.10Ru	Bar, billet	SB-348	26H
39	Ti-0.10Ru	Smls. fittings	SB-363	WPT26H
40	Ti-0.10Ru	Wld. fittings	SB-363	WPT26HW
41	Ti-0.10Ru	Forgings	SB-381	F-26H
42	Ti-0.10Ru	Smls. pipe	SB-861	26H
43	Ti-0.10Ru	Wld. pipe	SB-862	26H
44	Ti-0.3Mo-0.8Ni	Forgings	SB-381	F-12
45	Ti-4Al-2.5V-1.5Fe	Plate, sheet, strip	SB-265	38

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	R50550	Annealed	...	450
2	R50550	Annealed	...	450
3	R50550	Annealed	...	450
4	R50550	Annealed	...	450
5	R52250	Annealed	...	240
6	R52252	Annealed	...	240
7	R52254	Annealed	...	240
8	R52400	Annealed	...	345
9	R52400	Annealed	...	400
10	R52400	Annealed	...	400
11	R52400	Annealed	...	400
12	R52400	Annealed	...	400
13	R52400	Annealed	...	400
14	R52400	Annealed	...	400
15	R52400	Annealed	...	400
16	R52400	Annealed	...	400
17	R52402	Annealed	...	345
18	R52402	Annealed	...	345
19	R52402	Annealed	...	345
20	R52402	Annealed	...	400
21	R52402	Annealed	...	400
22	R52402	Annealed	...	400
23	R52402	Annealed	...	400
24	R52402	Annealed	...	400
25	R52402	Annealed	...	400
26	R52402	Annealed	...	400
27	R52402	Annealed	...	400
28	R52404	Annealed	...	345
29	R52404	Annealed	...	345
30	R52404	Annealed	...	345
31	R52404	Annealed	...	345
32	R52404	Annealed	...	345
33	R52404	Annealed	...	345
34	R52404	Annealed	...	345
35	R52404	Annealed	...	345
36	R52404	Annealed	...	400
37	R52404	Annealed	...	400
38	R52404	Annealed	...	400
39	R52404	Annealed	...	400
40	R52404	Annealed	...	400
41	R52404	Annealed	...	400
42	R52404	Annealed	...	400
43	R52404	Annealed	...	400
44	R53400	Annealed	...	485
45	R54250	Annealed	...	895

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
2	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
3	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
4	448	372	306	254	212	185	173	...	...	...	...	...	...	...	...
5	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
6	241	196	159	134	117	93.6	80.7	...	...	...	...	...	...	...	...
7	241	194	159	135	116	93.8	81.7	...	...	...	...	...	...	...	...
8	345	295	249	216	188	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	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
18	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
19	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
20	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
21	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
22	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
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	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
29	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
30	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
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	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
35	345	294	247	215	187	164	153	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...
42	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
43	400	340	289	250	219	190	178	170	...	...	...	...	...	...	...
44	483	445	390	348	319	302	295	...	...	...	...	...	...	...	...
45	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade
	Nonferrous Materials (Cont'd)			
1	Ti-4Al-2.5V-1.5Fe	Smls. tube	SB-338	38
2	Ti-4Al-2.5V-1.5Fe	Wld. tube	SB-338	38
3	Ti-4Al-2.5V-1.5Fe	Bar, billet	SB-348	38
4	Ti-4Al-2.5V-1.5Fe	Smls. fittings	SB-363	WPT38
5	Ti-4Al-2.5V-1.5Fe	Wld. fittings	SB-363	WPT38W
6	Ti-4Al-2.5V-1.5Fe	Forgings	SB-381	F-38
7	Ti-4Al-2.5V-1.5Fe	Smls. pipe	SB-861	38
8	Ti-4Al-2.5V-1.5Fe	Wld. pipe	SB-862	38
9	Ti-3Al-2.5V	Plate, sheet, strip	SB-265	9
10	Ti-3Al-2.5V	Smls. & wld. tube	SB-338	9
11	Ti-3Al-2.5V	Bar, billet	SB-348	9
12	Ti-3Al-2.5V	Smls. fittings	SB-363	WPT9
13	Ti-3Al-2.5V	Wld. fittings	SB-363	WPT9W
14	Ti-3Al-2.5V	Forgings	SB-381	F-9
15	Ti-3Al-2.5V	Smls. pipe	SB-861	9
16	Ti-3Al-2.5V	Wld. pipe	SB-862	9
17	Ti-3Al-2.5V-0.1Ru	Plate, sheet, strip	SB-265	28
18	Ti-3Al-2.5V-0.1Ru	Smls. & wld. tube	SB-338	28
19	Ti-3Al-2.5V-0.1Ru	Bar, billet	SB-348	28
20	Ti-3Al-2.5V-0.1Ru	Smls. fittings	SB-363	WPT28
21	Ti-3Al-2.5V-0.1Ru	Wld. fittings	SB-363	WPT28W
22	Ti-3Al-2.5V-0.1Ru	Forgings	SB-381	F-28
23	Ti-3Al-2.5V-0.1Ru	Smls. pipe	SB-861	28
24	Ti-3Al-2.5V-0.1Ru	Wld. pipe	SB-862	28
25	99.2Zr	Forgings	SB-493	...
26	99.2Zr	Smls. & wld. tube	SB-523	...
27	99.2Zr	Bar, wire	SB-550	...
28	99.2Zr	Plate, sheet, strip	SB-551	...
29	99.2Zr	Smls. fittings	SB-653	PZ-2
30	99.2Zr	Wld. fittings	SB-653	PZ-2W
31	99.2Zr	Smls. & wld. pipe	SB-658	...
(25) 32	99.2Zr	Castings	SB-752	...
33	95.5Zr + 2.5Nb	Forgings	SB-493	...
34	95.5Zr + 2.5Nb	Smls. & wld. tube	SB-523	...
35	95.5Zr + 2.5Nb	Bar, wire	SB-550	...
36	95.5Zr + 2.5Nb	Plate, sheet, strip	SB-551	...
37	95.5Zr + 2.5Nb	Smls. fittings	SB-653	PZ-5
38	95.5Zr + 2.5Nb	Wld. fittings	SB-653	PZ-5W
39	95.5Zr + 2.5Nb	Smls. & wld. pipe	SB-658	...
(25) 40	95.5Zr + 2.5Nb	Castings	SB-752	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Line No.	Alloy Desig./UNS No.	Class/Condition/ Temper	Size/Thickness, mm	Min. Tensile Strength, MPa
Nonferrous Materials (Cont'd)				
1	R54250	Annealed	...	895
2	R54250	Annealed	...	895
3	R54250	Annealed	...	895
4	R54250	Annealed	...	895
5	R54250	Annealed	...	895
6	R54250	Annealed	...	895
7	R54250	Annealed	...	895
8	R54250	Annealed	...	895
9	R56320	Annealed	...	620
10	R56320	Annealed	...	620
11	R56320	Annealed	...	620
12	R56320	Annealed	...	620
13	R56320	Annealed	...	620
14	R56320	Annealed	...	620
15	R56320	Annealed	...	620
16	R56320	Annealed	...	620
17	R56323	Annealed	...	620
18	R56323	Annealed	...	620
19	R56323	Annealed	...	620
20	R56323	Annealed	...	620
21	R56323	Annealed	...	620
22	R56323	Annealed	...	620
23	R56323	Annealed	...	620
24	R56323	Annealed	...	620
25	R60702	Annealed	...	380
26	R60702	Annealed	...	380
27	R60702	Annealed	...	380
28	R60702	Annealed	...	380
29	R60702	Annealed	...	380
30	R60702	Annealed	...	380
31	R60702	Annealed	...	380
32	R61702	...	...	380
33	R60705	Annealed	...	485
34	R60705	Annealed	...	550
35	R60705	Annealed	...	550
36	R60705	Annealed	...	550
37	R60705	Annealed	...	550
38	R60705	Annealed	...	550
39	R60705	Annealed	...	550
40	R61705	...	...	483

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	40	100	150	200	250	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)														
1	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
2	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
3	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
4	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
5	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
6	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
7	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
8	896	881	813	753	707	675	664	656	...	...	...	...	...	...	...
9	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
10	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
11	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
12	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
13	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
14	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
15	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
16	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
17	621	592	544	491	444	421	412	...	...	...	...	...	...	...	...
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	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
26	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
27	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
28	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
29	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
30	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
31	379	323	268	223	189	165	156	149	142	137	133	128	...	...	...
32	379	337	282	234	195	162	149	...	...	...	...	...	...	...	...
33	483	391	336	302	284	276	272	267	259	247	229	203	...	...	...
34	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
35	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
36	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
37	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
38	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
39	552	446	384	345	325	315	311	305	296	282	262	232	...	...	...
40	483	434	379	329	286	253	241	...	...	...	...	...	...	...	...

Table U (Cont'd)
Tensile Strength Values, S_u , for Ferrous and Nonferrous Materials

Tensile Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	... (25)

NOTES TO TABLE U**GENERAL NOTES**

- (a) The following abbreviations are used: ann., annealed; cond., condenser; CW, cold worked; fin., finished; fr., from; fgs., fittings; HW, hot worked; N, Normalized; NT, Normalized and tempered; QT, Quenched and tempered; 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, VIII, or XII 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.
- (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.

INTENTIONALLY LEFT BLANK

Table Y-1
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Line No.	Nominal Composition	Product Form	Spec. No.	Type/Grade	Alloy Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials					
	1 Carbon steel	Sheet	SA-1008	CS-A	...	...
	2 Carbon steel	Sheet	SA-1008	CS-B	...	...
(25)	3 Carbon steel	Wld. tube	SA-513	1/1008	...	...
	4 Carbon steel	Bar	SA-675	45	...	...
	5 Carbon steel	Wld. pipe	SA-134	A283A	...	...
	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	...
(25)	9 Carbon steel	Wld. tube	SA-513	1/1010	...	...
	10 Carbon steel	Wld. tube	SA-178	A	K01200	...
	11 Carbon steel	Smls. tube	SA-179	...	K01200	...
	12 Carbon steel	Smls. tube	SA-192	...	K01201	...
	13 Carbon steel	Wld. tube	SA-214	...	K01807	...
	14 Carbon steel	Smls. tube	SA-556	A2	K01807	...
(25)	15 ...	...	...	...	...	...
	16 Carbon steel	Wld. pipe	SA-53	E/A	K02504	...
(25)	17 Carbon steel	Butt-wld. pipe	SA-53	F/A	...	...
	18 Carbon steel	Smls. pipe	SA-53	S/A	K02504	...
	19 Carbon steel	Smls. pipe	SA-106	A	K02501	...
	20 Carbon steel	Wld. pipe	SA-135	A	...	...
	21 Carbon steel	Forged pipe	SA-369	FPA	K02501	...
	22 Carbon steel	Wld. pipe	SA-587	...	K11500	...
(25)	23 Carbon steel	Wld. tube	SA-513	1/1015	...	...
	24 Carbon steel	Bar	SA-675	50	...	...
	25 Carbon steel	Wld. pipe	SA-134	A283B	...	...
	26 Carbon steel	Plate	SA-285	B	K02200	...
	27 Carbon steel	Wld. pipe	SA-672	A50	K02200	...
	28 Carbon steel	Sheet	SA-414	B	K02201	...
	29 Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
(25)	30 Carbon steel	Plate	SA/EN 10025-2	S235JR	...	...
	31 Carbon steel	Plate	SA/EN 10028-2	P235GH	...	...
	32 Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...
	33 Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
(25)	34 Carbon steel	Wld. pipe & tube	SA/EN 10217-1	P235TR2	...	...
	35 Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...
	36 Carbon steel	Smls. tube	SA/EN 10216-2	P235GH	...	...
	37 Carbon steel	Sheet, strip	SA-1011	36	SS	Type 1
	38 Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
	39 Carbon steel	Bar	SA-675	55	...	...
	40 Carbon steel	Wld. pipe	SA-134	A283C	K02401	...
	41 Carbon steel	Plate	SA-283	C	K02401	...
	42 Carbon steel	Plate	SA-285	C	K02801	...
	43 Carbon steel	Smls. & wld. pipe	SA-333	1	K03008	...
	44 Carbon steel	Smls. & wld. tube	SA-334	1	K03008	...
	45 Carbon steel	Plate	SA-516	55	K01800	...

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	...	290	207	...
4	...	310	155	...
5	...	310	165	...
6	...	310	165	...
7	...	310	165	...
8	...	310	170	...
9	...	310	221	...
10	...	325	180	...
11	...	325	180	...
12	...	325	180	...
13	...	325	180	...
14	...	325	180	...
15	...	...	...	...
16	...	330	205	...
17	...	330	205	...
18	...	330	205	...
19	...	330	205	...
20	...	330	205	...
21	...	330	205	...
22	...	330	205	...
23	...	330	241	...
24	...	345	170	...
25	...	345	185	...
26	...	345	185	...
27	...	345	185	...
28	...	345	205	...
29	$150 < t \leq 250$	350	215	...
30	$t \leq 100$	360	215	...
31	≤ 60	360	215	...
32	$40 < t \leq 60$	360	215	...
33	$100 < t \leq 150$	360	225	...
34	$t \leq 40$	360	225	...
35	$16 < t \leq 40$	360	225	...
36	$t \leq 16$	360	235	...
37	$t \leq 6$	365	250	...
38	$60 < t \leq 100$	370	235	...
39	...	380	190	...
40	...	380	205	...
41	...	380	205	...
42	...	380	205	...
43	...	380	205	...
44	...	380	205	...
45	...	380	205	...

Table Y-1
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	207	194	188	186	183	180	178	175	171	166
4	155	146	141	139	137	135	133	130	127	124
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	221	207	201	198	195	192	190	186	182	178
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	...	...	...	...	...	...	...	...	...	...
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	207	195	189	186	183	180	177	174	170	166
22	207	195	189	186	183	180	177	174	170	166
23	241	227	220	217	213	210	208	204	200	194
24	172	162	157	155	152	150	148	145	142	139
25	186	175	170	167	165	162	160	157	153	149
26	186	175	170	167	165	162	160	157	153	149
27	186	175	170	167	165	162	160	157	153	149
28	207	195	189	186	183	180	177	174	170	166
29	215	202	196	193	190	187	184	181	177	172
30	214	214	195	191	189	187	184	180	176	172
31	215	202	196	193	190	187	184	181	177	173
32	215	202	196	193	190	187	184	181	177	173
33	225	212	205	202	199	196	193	189	185	181
34	228	214	207	204	202	198	195	191	188	183
35	225	212	205	202	199	196	193	189	185	181
36	235	221	214	211	208	205	201	198	193	189
37	248	233	227	223	219	216	213	209	204	199
38	234	221	213	210	207	204	201	198	193	188
39	190	178	173	170	167	165	163	159	156	152
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
44	207	195	189	186	183	180	177	174	170	166
45	207	195	189	186	183	180	177	174	170	166

Table Y-1
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	162	157	153	148	143	139	135	132	128	126
4	121	117	114	110	107	104	101	98.6	96.2	93.7
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	173	168	163	158	153	148	144	141	137	134
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	...	...	...	...	...	...	...	...	...	...
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	161	157	152	148	143	139	135	132	128	125
22	161	157	152	148	143	139	135	132	128	125
23	189	183	178	173	167	162	158	154	150	147
24	135	131	127	123	119	116	113	110	107	104
25	145	141	137	132	129	125	122	119	116	112
26	145	141	137	132	129	125	122	119	116	112
27	145	141	137	132	129	125	122	119	116	112
28	161	157	152	148	143	139	135	132	128	125
29	168	163	158	153	149	144	141	137	133	130
30	167	162	157	153	148	144	140	136	133	129
31	168	163	158	153	149	144	141	137	133	130
32	168	163	158	153	149	144	141	137	133	130
33	176	171	165	160	156	151	147	143	140	136
34	177	173	167	163	157	153	149	145	141	137
35	176	171	165	160	156	151	147	143	140	136
36	183	178	173	167	162	158	154	150	146	142
37	194	188	183	...	...	...	...	...	...	...
38	183	178	173	168	163	158	154	150	146	142
39	148	144	139	135	131	127	124	121	118	114
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
44	161	157	152	148	143	139	135	132	128	125
45	161	157	152	148	143	139	135	132	128	125

Table Y-1
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

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

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	Carbon steel	Smls. pipe	SA-524	II	K02104	...
2	Carbon steel	Wld. pipe	SA-671	CA55	K02801	...
3	Carbon steel	Wld. pipe	SA-671	CE55	K02202	...
4	Carbon steel	Wld. pipe	SA-672	A55	K02801	...
5	Carbon steel	Wld. pipe	SA-672	B55	K02001	...
6	Carbon steel	Wld. pipe	SA-672	C55	K01800	...
7	Carbon steel	Wld. pipe	SA-672	E55	K02202	...
8	Carbon steel	Sheet	SA-414	C	K02503	...
9	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
10	Carbon steel	Sheet, strip	SA-1011	40	SS	...
11	Carbon steel	Sheet, strip	SA-1011	45	HSLAS	2
12	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
13	Carbon steel	Plate	SA/EN 10028-3	P275NH	...	...
14	Carbon steel	Plate, sheet, bar	SA-36	...	K02600	...
15	Carbon steel	Plate, sheet	SA-662	A	K01701	...
16	Carbon steel	Sheet, strip	SA-1011	36	SS	Type 2
17	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
18	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...
19	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...
20	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
21	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
22	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...
23	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...
24	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
25	Carbon steel	Plate	SA/EN 10028-2	P265GH	...	...
26	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...
27	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250A	...	...
28	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250BR	...	...
29	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250 B0	...	...
30	Carbon steel	Plate, bar, shapes	SA/IS 2062	E250C	...	...
31	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...
32	Carbon steel	Smls. tube	SA/EN 10216-2	P265GH	...	...
33	Carbon steel	Forgings	SA-181	...	K03502	60
34	Carbon steel	Castings	SA-216	WCA	J02502	...
35	Carbon steel	Forgings	SA-266	1	K03506	...
36	Carbon steel	Forgings	SA-350	LF1	K03009	1
37	Carbon steel	Castings	SA-352	LCA	J02504	...
38	Carbon steel	Cast pipe	SA-660	WCA	J02504	...
39	Carbon steel	Bar	SA-675	60	...	...
40	Carbon steel	Forgings	SA-765	I	K03046	...
41	Carbon steel	Plate	SA-515	60	K02401	...
42	Carbon steel	Plate	SA-516	60	K02100	...
43	Carbon steel	Wld. pipe	SA-671	CB60	K02401	...
44	Carbon steel	Wld. pipe	SA-671	CC60	K02100	...
45	Carbon steel	Wld. pipe	SA-671	CE60	K02402	...

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	205	...
6	...	380	205	...
7	...	380	205	...
8	...	380	230	...
9	$40 < t \leq 60$	390	255	...
10	$t \leq 6$	380	275	...
11	...	380	310	...
12	$16 < t \leq 40$	390	265	...
13	≤ 16	390	275	...
14	...	400	250	...
15	...	400	275	...
16	$t \leq 6$	400	250	...
17	$t > 40$	410	230	...
18	$t > 40$	410	230	...
19	$t > 40$	410	230	...
20	$t > 40$	410	230	...
21	$20 < t \leq 40$	410	240	...
22	$20 < t \leq 40$	410	240	...
23	$20 < t \leq 40$	410	240	...
24	$20 < t \leq 40$	410	240	...
25	≤ 60	410	245	...
26	$40 < t \leq 60$	410	245	...
27	$t \leq 20$	410	250	...
28	$t \leq 20$	410	250	...
29	$t \leq 20$	410	250	...
30	$t \leq 20$	410	250	...
31	$16 < t \leq 40$	410	255	...
32	$t \leq 16$	410	265	...
33	...	415	205	...
34	...	415	205	...
35	...	415	205	...
36	...	415	205	...
37	...	415	205	...
38	...	415	205	...
39	...	415	205	...
40	...	415	205	...
41	...	415	220	...
42	...	415	220	...
43	...	415	220	...
44	...	415	220	...
45	...	415	220	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	207	195	189	186	183	180	177	174	170	166
6	207	195	189	186	183	180	177	174	170	166
7	207	195	189	186	183	180	177	174	170	166
8	228	214	207	204	201	198	195	191	187	183
9	255	240	232	229	225	222	218	214	210	204
10	276	259	251	248	244	240	237	232	227	221
11	310	292	283	279	274	270	266	261	255	249
12	265	250	242	239	235	231	227	224	218	213
13	275	258	251	247	243	239	236	231	226	221
14	248	233	227	223	219	216	213	209	204	199
15	276	259	251	248	244	240	237	232	227	221
16	248	233	227	223	219	216	213	209	204	199
17	230	215	209	206	203	201	197	194	189	185
18	230	215	209	206	203	201	197	194	189	185
19	230	215	209	206	203	201	197	194	189	185
20	230	215	209	206	203	201	197	194	189	185
21	240	225	218	215	212	209	206	202	198	193
22	240	225	218	215	212	209	206	202	198	193
23	240	225	218	215	212	209	206	202	198	193
24	240	225	218	215	212	209	206	202	198	193
25	245	230	223	220	217	213	210	206	202	197
26	245	230	223	220	217	213	210	206	202	197
27	250	234	227	224	221	218	215	211	206	201
28	250	234	227	224	221	218	215	211	206	201
29	250	234	227	224	221	218	215	211	206	201
30	250	234	227	224	221	218	215	211	206	201
31	255	240	232	229	225	222	219	214	210	205
32	265	249	242	238	234	231	227	223	218	213
33	207	195	189	186	183	180	177	174	170	166
34	207	195	189	186	183	180	177	174	170	166
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	221	208	201	198	195	192	189	185	182	177
42	221	208	201	198	195	192	189	185	182	177
43	221	208	201	198	195	192	189	185	182	177
44	221	208	201	198	195	192	189	185	182	177
45	221	208	201	198	195	192	189	185	182	177

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	161	157	152	148	143	139	135	132	128	125
6	161	157	152	148	143	139	135	132	128	125
7	161	157	152	148	143	139	135	132	128	125
8	178	173	167	162	157	153	149	145	142	137
9	199	193	187	182	176	171	167	162	158	154
10	216	209	202	...	...	...	...	...	...	...
11	242	235	228	...	...	...	...	...	...	...
12	207	201	195	189	183	178	173	169	164	160
13	215	208	202	196	190	185	180	175	171	166
14	194	188	183	177	171	166	162	158	154	150
15	216	209	202	196	191	185	180	176	171	167
16	194	188	183	...	...	...	...	...	...	...
17	180	174	169	...	...	...	...	...	...	...
18	180	174	169	...	...	...	...	...	...	...
19	180	174	169	...	...	...	...	...	...	...
20	180	174	169	...	...	...	...	...	...	...
21	187	182	176	...	...	...	...	...	...	...
22	187	182	176	...	...	...	...	...	...	...
23	187	182	176	...	...	...	...	...	...	...
24	187	182	176	...	...	...	...	...	...	...
25	191	186	180	175	169	165	160	156	152	148
26	191	186	180	175	169	165	160	156	152	148
27	195	189	183	...	...	...	...	...	...	...
28	195	189	183	...	...	...	...	...	...	...
29	195	189	183	...	...	...	...	...	...	...
30	195	189	183	...	...	...	...	...	...	...
31	199	193	187	182	176	171	167	162	158	154
32	207	201	195	189	183	178	173	169	164	160
33	161	157	152	148	143	139	135	132	128	125
34	161	157	152	148	143	139	135	132	128	125
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	172	167	162	157	153	149	144	140	137	133
42	172	167	162	157	153	149	144	140	137	133
43	172	167	162	157	153	149	144	140	137	133
44	172	167	162	157	153	149	144	140	137	133
45	172	167	162	157	153	149	144	140	137	133

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	Carbon steel	Wld. pipe	SA-672	B60	K02401	...
2	Carbon steel	Wld. pipe	SA-672	C60	K02100	...
3	Carbon steel	Wld. pipe	SA-672	E60	K02402	...
4	Carbon steel	Wld. pipe	SA-134	A283D	K02702	...
5	Carbon steel	Plate	SA-283	D	K02702	...
6	Carbon steel	Wld. pipe	SA-53	E/B	K03005	...
7	Carbon steel	Smls. pipe	SA-53	S/B	K03005	...
8	Carbon steel	Smls. pipe	SA-106	B	K03006	...
9	Carbon steel	Wld. pipe	SA-135	B	...	...
10	Carbon steel	Smls. & wld. fittings	SA-234	WPB	K03006	...
11	Carbon steel	Smls. & wld. pipe	SA-333	6	K03006	...
12	Carbon steel	Smls. & wld. tube	SA-334	6	K03006	...
13	Carbon steel	Forged pipe	SA-369	FPB	K03006	...
14	Carbon steel	Forgings	SA-372	A	K03002	...
15	Carbon steel	Sheet	SA-414	D	K02505	...
16	Carbon steel	Smls. & wld. fittings	SA-420	WPL6	...	...
17	Carbon steel	Smls. pipe	SA-524	I	K02104	...
18	Carbon steel	Bar	SA-696	B	K03200	...
19	Carbon steel	Bolting	SA-307	A	...	...
20	Carbon steel	Bolting	SA-307	B	...	...
21	Carbon steel	Forgings	SA-727	...	K02506	...
22	Carbon steel	Wld. tube	SA-178	C	K03503	...
23	Carbon steel	Smls. tube	SA-210	A-1	K02707	...
24	Carbon steel	Smls. tube	SA-556	B2	K02707	...
(25)	...	...	...	...	...	...
26	Carbon steel	Plate, bar	SA/CSA-G40.21	38W	...	...
27	Carbon steel	Plate, sheet, bar	SA-572	42	...	...
28	Carbon steel	Sheet, strip	SA-1011	45	HSLAS	1
29	Carbon steel	Sheet, strip	SA-1011	45	SS	...
30	Carbon steel	Sheet, strip	SA-1011	50	HSLAS	2
31	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
32	Carbon steel	Plate	SA/AS 1548	PT430	...	...
33	Carbon steel	Plate	SA/AS 1548	PT430	...	...
34	Carbon steel	Plate	SA/AS 1548	PT430	...	...
35	Carbon steel	Plate	SA/AS 1548	PT430	...	...
36	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
37	Carbon steel	Bar	SA-675	65	...	...
38	Carbon steel	Castings	SA-352	LCB	J03003	...
39	Carbon steel	Plate	SA-515	65	K02800	...
40	Carbon steel	Plate	SA-516	65	K02403	...
41	Carbon steel	Wld. pipe	SA-671	CB65	K02800	...
42	Carbon steel	Wld. pipe	SA-671	CC65	K02403	...
43	Carbon steel	Wld. pipe	SA-672	B65	K02800	...
44	Carbon steel	Wld. pipe	SA-672	C65	K02403	...
45	Carbon steel	Sheet	SA-414	E	K02704	...

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	220	...
2	...	415	220	...
3	...	415	220	...
4	...	415	230	...
5	...	415	230	...
6	...	415	240	...
7	...	415	240	...
8	...	415	240	...
9	...	415	240	...
10	...	415	240	...
11	...	415	240	...
12	...	415	240	...
13	...	415	240	...
14	...	415	240	...
15	...	415	240	...
16	...	415	240	...
17	...	415	240	...
18	...	415	240	...
19	$6 \leq t \leq 100$	415	250	...
20	...	415	250	...
21	...	415	250	...
22	...	415	255	...
23	...	415	255	...
24	...	415	255	...
25	...	...	...	...
26	...	415	260	...
27	$t \leq 150$	415	290	...
28	...	410	310	...
29	$t \leq 6$	410	310	...
30	...	410	340	...
31	$150 < t \leq 250$	430	220	...
32	$80 < t \leq 150$	430	250	...
33	$40 < t \leq 80$	430	270	...
34	$16 < t \leq 40$	430	280	...
35	≤ 16	430	300	...
36	$100 < t \leq 150$	440	235	...
37	...	450	225	...
38	...	450	240	...
39	...	450	240	...
40	...	450	240	...
41	...	450	240	...
42	...	450	240	...
43	...	450	240	...
44	...	450	240	...
45	...	450	260	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	221	208	201	198	195	192	189	185	182	177
2	221	208	201	198	195	192	189	185	182	177
3	221	208	201	198	195	192	189	185	182	177
4	228	214	207	204	201	198	195	191	187	183
5	228	214	207	204	201	198	195	191	187	183
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	241	227	220	217	214	210	207	203	198	194
14	241	227	220	217	214	210	207	203	198	194
15	241	227	220	217	214	210	207	203	198	194
16	241	227	220	217	214	210	207	203	198	194
17	241	227	220	217	214	210	207	203	198	194
18	241	227	220	217	214	210	207	203	198	194
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	255	240	233	229	225	222	219	215	210	205
23	255	240	233	229	225	222	219	215	210	205
24	255	240	233	229	225	222	219	215	210	205
25	...	...	...	...	...	...	...	...	...	...
26	262	246	239	235	232	228	225	221	216	210
27	290	273	264	260	256	253	248	243	238	232
28	310	292	283	279	274	270	266	261	255	249
29	310	292	283	279	274	270	266	261	255	249
30	345	328	313	306	300	293	287	281	276	271
31	220	220	201	197	195	192	189	185	181	177
32	252	240	229	225	223	220	216	212	207	202
33	269	256	244	240	238	234	230	226	221	216
34	279	266	254	250	247	243	239	235	230	224
35	300	286	273	268	265	262	257	252	247	240
36	234	221	214	211	207	204	201	197	193	188
37	224	210	205	201	198	196	192	189	184	180
38	241	227	220	217	214	210	207	203	198	194
39	241	227	220	217	214	210	207	203	198	194
40	241	227	220	217	214	210	207	203	198	194
41	241	227	220	217	214	210	207	203	198	194
42	241	227	220	217	214	210	207	203	198	194
43	241	227	220	217	214	210	207	203	198	194
44	241	227	220	217	214	210	207	203	198	194
45	262	246	239	235	232	228	225	221	216	210

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	172	167	162	157	153	149	144	140	137	133
2	172	167	162	157	153	149	144	140	137	133
3	172	167	162	157	153	149	144	140	137	133
4	178	173	167	162	157	153	149	145	142	137
5	178	173	167	162	157	153	149	145	142	137
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	188	183	177	172	167	162	158	154	150	146
14	188	183	177	172	167	162	158	154	150	146
15	188	183	177	172	167	162	158	154	150	146
16	188	183	177	172	167	162	158	154	150	146
17	188	183	177	172	167	162	158	154	150	146
18	188	183	177	172	167	162	158	154	150	146
19	194	188	183	177	171	...	...	...	...	...
20	194	188	183	177	171	...	...	...	...	...
21	194	188	183	177	171	166	162	158	154	150
22	200	193	187	182	176	171	167	163	158	154
23	200	193	187	182	176	171	167	163	158	154
24	200	193	187	182	176	171	167	163	158	154
25	...	...	...	...	...	...	...	...	...	...
26	204	199	193	187	181	176	171	167	163	154
27	226	219	213	...	...	...	...	...	...	...
28	242	235	228	...	...	...	...	...	...	...
29	242	235	228	...	...	...	...	...	...	...
30	266	262	259	...	...	...	...	...	...	...
31	172	167	162	157	152	148	144	140	137	133
32	196	191	185	179	174	169	164	160	156	152
33	210	204	198	191	186	180	176	172	167	163
34	218	211	205	199	193	187	182	178	173	169
35	234	227	220	213	207	202	196	191	186	181
36	183	178	172	167	162	157	153	149	146	142
37	175	170	165	160	155	151	146	142	139	135
38	188	183	177	172	167	162	158	154	150	146
39	188	183	177	172	167	162	158	154	150	146
40	188	183	177	172	167	162	158	154	150	146
41	188	183	177	172	167	162	158	154	150	146
42	188	183	177	172	167	162	158	154	150	146
43	188	183	177	172	167	162	158	154	150	146
44	188	183	177	172	167	162	158	154	150	146
45	204	199	193	187	181	176	171	167	162	158

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials (Cont'd)					
1	Carbon steel	Plate	SA-662	B	K02203	...
2	Carbon steel	Plate, bar	SA/CSA-G40.21	44W	...	...
3	Carbon steel	Plate, bar	SA/CSA-G40.21	44W	...	...
4	Carbon steel	Plate	SA-537	...	K12437	1
5	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...
6	Carbon steel	Plate, bar	SA/CSA-G40.21	50W	...	...
7	Carbon steel	Plate, bar	SA/CSA-G40.21	50W	...	...
8	Carbon steel	Plate, sheet, bar	SA-572	50	...	...
9	Carbon steel	Round bar	SA-572	50	...	...
10	Carbon steel	Sheet, strip	SA-1011	50	SS	...
11	Carbon steel	Sheet, strip	SA-1011	50	HSLAS	1
(25) 12	Carbon steel	Bolting	SA-311	1018	G10180	A
13	Carbon steel	Sheet, strip	SA-1011	55	HSLAS	2
(25) 14	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT
15	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
16	Carbon steel	Plate	SA/AS 1548	PT460	...	...
17	Carbon steel	Plate	SA/AS 1548	PT460	...	...
(25) 18	Carbon steel	Forgings	SA/EN 10222-2	P280GH	...	N, NT, or QT
19	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
20	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
21	Carbon steel	Plate	SA/AS 1548	PT460	...	...
22	Carbon steel	Plate	SA/EN 10028-2	P295GH	...	...
23	Carbon steel	Plate	SA/AS 1548	PT460	...	...
24	Carbon steel	Plate	SA/GB 713	Q345R	...	...
25	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...
26	Carbon steel	Plate	SA/EN 10025-2	S355J2+N	...	...
27	Carbon steel	Plate	SA/EN 10025-2	S355J2+N	...	...
28	Carbon steel	Plate	SA/EN 10025-2	S355J2+N	...	...
29	Carbon steel	Plate	SA/EN 10025-2	S355J2+N	...	...
30	Carbon steel	Plate	SA/GB 713	Q345R	...	...
31	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...
32	Carbon steel	Plate	SA-455	...	K03300	...
33	Carbon steel	Bar	SA-675	70	...	...
34	Carbon steel	Forgings	SA-105	...	K03504	...
35	Carbon steel	Forgings	SA-181	...	K03502	70
36	Carbon steel	Castings	SA-216	WCB	J03002	...
37	Carbon steel	Forgings	SA-266	2	K03506	...
38	Carbon steel	Forgings	SA-266	4	K03017	...
39	Carbon steel	Forgings	SA-350	LF2	K03011	...
40	Carbon steel	Forgings	SA-508	1	K13502	...
41	Carbon steel	Forgings	SA-508	1A	K13502	...
42	Carbon steel	Forgings	SA-541	1	K03506	...
43	Carbon steel	Forgings	SA-541	1A	K03020	...
44	Carbon steel	Cast pipe	SA-660	WCB	J03003	...
45	Carbon steel	Forgings	SA-765	II	K03047	...

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	...	450	275	...
2	$64 < t \leq 200$	450	275	...
3	$t \leq 64$	450	305	...
4	$65 < t \leq 100$	450	310	...
5	$65 < t \leq 100$	450	310	...
6	$64 < t \leq 150$	450	315	...
7	$t \leq 64$	450	345	...
8	$t \leq 100$	450	345	...
9	$t \leq 275$	450	345	...
10	$t \leq 6$	450	340	...
11	...	450	340	...
12	$20 < t \leq 30$	450	380	...
13	...	450	380	...
14	$35 < t \leq 160$	460	255	...
15	$60 < t \leq 100$	460	260	...
16	$80 < t \leq 150$	460	265	...
17	$40 < t \leq 80$	460	275	...
18	$t \leq 35$	460	280	...
19	$40 < t \leq 60$	460	285	...
20	$16 < t \leq 40$	460	290	...
21	$16 < t \leq 40$	460	295	...
22	≤ 16	460	295	...
23	≤ 16	460	305	...
24	$150 < t \leq 250$	470	265	...
25	$150 < t \leq 250$	470	280	...
26	$63 < t \leq 80$	470	325	...
27	$40 < t \leq 63$	470	335	...
28	$16 < t \leq 40$	470	345	...
29	$3 \leq t \leq 16$	470	355	...
30	$100 < t \leq 150$	480	285	...
31	$100 < t \leq 150$	480	295	...
32	$15 < t \leq 20$	485	240	...
33	...	485	240	...
34	...	485	250	...
35	...	485	250	...
36	...	485	250	...
37	...	485	250	...
38	...	485	250	...
39	...	485	250	...
40	...	485	250	...
41	...	485	250	...
42	...	485	250	...
43	...	485	250	...
44	...	485	250	...
45	...	485	250	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	276	259	251	248	244	240	237	232	227	221
2	276	261	253	248	244	240	236	231	226	221
3	303	287	278	273	268	264	259	254	249	243
4	310	292	283	279	274	270	266	261	255	249
5	310	292	283	279	274	270	266	261	255	249
6	317	300	291	285	281	276	271	266	260	254
7	345	326	316	310	305	300	295	289	283	276
8	345	328	313	306	300	293	287	281	276	271
9	345	328	313	306	300	293	287	281	276	271
10	345	328	313	306	300	293	287	281	276	271
11	345	328	313	306	300	293	287	281	276	271
12	379	356	347	341	335	330	326	320	312	304
13	379	352	331	318	306	296	286	278	271	265
14	255	239	231	227	224	221	217	213	208	203
15	259	243	236	232	229	225	221	217	213	208
16	265	253	242	238	235	232	228	223	219	213
17	276	263	251	247	244	241	237	232	227	221
18	280	262	254	250	246	242	238	234	229	223
19	286	269	261	257	253	249	246	241	235	229
20	290	273	264	260	256	253	248	243	238	232
21	296	283	270	265	262	258	254	249	244	238
22	296	279	271	266	262	258	254	249	244	238
23	303	289	276	271	268	264	260	255	250	244
24	265	249	242	238	235	231	227	223	218	213
25	280	262	255	251	248	244	240	236	231	225
26	325	...	...	...	...	...	...	...	...	...
27	335	...	...	...	...	...	...	...	...	...
28	345	...	...	...	...	...	...	...	...	...
29	355	...	...	...	...	...	...	...	...	...
30	285	268	260	256	252	249	245	240	235	229
31	295	276	268	264	261	257	253	248	243	237
32	241	227	220	217	214	210	207	203	198	194
33	241	227	220	217	214	210	207	203	198	194
34	248	233	227	223	219	216	213	209	204	199
35	248	233	227	223	219	216	213	209	204	199
36	248	233	227	223	219	216	213	209	204	199
37	248	233	227	223	219	216	213	209	204	199
38	248	233	227	223	219	216	213	209	204	199
39	248	233	227	223	219	216	213	209	204	199
40	248	233	227	223	219	216	213	209	204	199
41	248	233	227	223	219	216	213	209	204	199
42	248	233	227	223	219	216	213	209	204	199
43	248	233	227	223	219	216	213	209	204	199
44	248	233	227	223	219	216	213	209	204	199
45	248	233	227	223	219	216	213	209	204	199

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	216	209	202	196	191	185	180	176	171	167
2	215	209	203	197	191	185	180	175	171	166
3	237	230	223	217	210	204	198	193	188	183
4	242	235	228	221	215	209	203	197	192	187
5	242	235	228	221	215	209	203	197	192	187
6	247	241	234	227	220	213	207	201	196	191
7	269	261	254	246	239	232	225	219	213	208
8	266	262	259	...	...	...	...	...	...	...
9	266	262	259	...	...	...	...	...	...	...
10	266	262	259	...	...	...	...	...	...	...
11	266	262	259	...	...	...	...	...	...	...
12	297	288	280	271	262	...	...	...	...	...
13	259	254	249	...	...	...	...	...	...	...
14	198	192	186	180	175	170	165	161	157	153
15	202	196	190	185	179	173	169	165	160	156
16	207	201	195	189	184	178	173	169	164	160
17	216	209	202	196	191	185	180	176	171	167
18	217	211	204	198	192	186	181	177	172	168
19	223	217	211	204	198	192	187	182	178	173
20	226	219	213	207	200	195	189	184	180	175
21	232	225	218	211	205	199	194	189	184	179
22	232	225	218	211	205	199	194	189	184	179
23	237	230	223	216	210	204	198	193	188	183
24	207	201	195	189	183	178	173	169	164	160
25	219	212	205	199	193	188	183	178	174	169
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	223	216	210	203	197	191	186	181	177	172
31	230	223	216	210	204	198	193	188	183	178
32	188	183	177	172	167	162	158	154	150	146
33	188	183	177	172	167	162	158	154	150	146
34	194	188	183	177	171	166	162	158	154	150
35	194	188	183	177	171	166	162	158	154	150
36	194	188	183	177	171	166	162	158	154	150
37	194	188	183	177	171	166	162	158	154	150
38	194	188	183	177	171	166	162	158	154	150
39	194	188	183	177	171	166	162	158	154	150
40	194	188	183	177	171	166	162	158	154	150
41	194	188	183	177	171	166	162	158	154	150
42	194	188	183	177	171	166	162	158	154	150
43	194	188	183	177	171	166	162	158	154	150
44	194	188	183	177	171	166	162	158	154	150
45	194	188	183	177	171	166	162	158	154	150

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials (Cont'd)					
1	Carbon steel	Plate	SA-515	70	K03101	...
2	Carbon steel	Plate	SA-516	70	K02700	...
3	Carbon steel	Wld. pipe	SA-671	CB70	K03101	...
4	Carbon steel	Wld. pipe	SA-671	CC70	K02700	...
5	Carbon steel	Wld. pipe	SA-672	B70	K03101	...
6	Carbon steel	Wld. pipe	SA-672	C70	K02700	...
7	Carbon steel	Smls. pipe	SA-106	C	K03501	...
8	Carbon steel	Wld. tube	SA-178	D	...	...
9	Carbon steel	Smls. tube	SA-210	C	K03501	...
10	Carbon steel	Castings	SA-216	WCC	J02503	...
11	Carbon steel	Smls. & wld. fittings	SA-234	WPC	K03501	...
12	Carbon steel	Castings	SA-352	LCC	J02505	...
13	Carbon steel	Castings	SA-487	16	...	A
14	Carbon steel	Plate	SA-537	...	K12437	3
15	Carbon steel	Smls. tube	SA-556	C2	K03006	...
(25) 16	...	...	...	...	...	...
17	Carbon steel	Cast pipe	SA-660	WCC	J02505	...
18	Carbon steel	Bar	SA-696	C	K03200	...
19	Carbon steel	Sheet	SA-414	F	K03102	...
20	Carbon steel	Plate	SA-662	C	K02007	...
21	Carbon steel	Plate	SA-537	...	K12437	2
22	Carbon steel	Plate	SA-738	C	K02008	...
23	Carbon steel	Plate	SA-537	...	K12437	1
24	Carbon steel	Wld. pipe	SA-671	CD70	K12437	...
25	Carbon steel	Wld. pipe	SA-672	D70	K12437	...
26	Carbon steel	Wld. pipe	SA-691	CMSH-70	K12437	...
27	Carbon steel	Plate	SA-841	A	...	1
28	Carbon steel	Plate, sheet, bar	SA-572	55	...	...
29	Carbon steel	Round bar	SA-572	55	...	...
30	Carbon steel	Sheet, strip	SA-1011	55	HSLAS	1
(25) 31	Carbon steel	Bolting	SA-311	1018	G10180	A
32	Carbon steel	Sheet, strip	SA-1011	60	HSLAS	2
(25) 33	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT
(25) 34	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT
35	Carbon steel	Plate	SA/GB 713	Q345R	...	...
36	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...
37	Carbon steel	Plate	SA/GB 713	Q345R	...	...
38	Carbon steel	Plate	SA/GB 713	Q345R	...	...
39	Carbon steel	Plate	SA-455	...	K03300	...
(25) 40	Carbon steel	Forgings	SA/EN 10222-2	P305GH	...	N, NT, or QT
41	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...
42	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...
43	Carbon steel	Plate	SA/GB 713	Q345R	...	...
44	Carbon steel	Plate	SA/EN 10025-2	S355J2+N	...	...
45	Carbon steel	Plate	SA/EN 10028-2	P355GH	...	...

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	260	...
2	...	485	260	...
3	...	485	260	...
4	...	485	260	...
5	...	485	260	...
6	...	485	260	...
7	...	485	275	...
8	...	485	275	...
9	...	485	275	...
10	...	485	275	...
11	...	485	275	...
12	...	485	275	...
13	...	485	275	...
14	$100 < t \leq 150$	485	275	...
15	...	485	275	...
16	...	...	...	...
17	...	485	275	...
18	...	485	275	...
19	...	485	290	...
20	...	485	295	...
21	$100 < t \leq 150$	485	315	...
22	$100 < t \leq 150$	485	315	...
23	≤ 65	485	345	...
24	≤ 65	485	345	...
25	≤ 65	485	345	...
26	≤ 65	485	345	...
27	≤ 100	485	345	...
28	$t \leq 50$	485	380	...
29	$t \leq 90$	485	380	...
30	...	480	380	...
31	$t \leq 20$	485	415	...
32	...	480	410	...
33	$70 < t \leq 160$	490	280	...
34	$35 < t \leq 70$	510	285	...
35	$60 < t \leq 100$	490	305	...
36	$60 < t \leq 100$	490	315	...
37	$36 < t \leq 60$	490	315	...
38	$16 < t \leq 36$	500	325	...
39	$9.5 < t \leq 15$	505	255	...
40	$t \leq 35$	510	305	...
41	$40 < t \leq 60$	510	335	...
42	$16 < t \leq 40$	510	345	...
43	$3 \leq t \leq 16$	510	345	...
44	$t < 3$	510	355	...
45	≤ 16	510	355	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	262	246	239	235	232	228	225	221	216	210
2	262	246	239	235	232	228	225	221	216	210
3	262	246	239	235	232	228	225	221	216	210
4	262	246	239	235	232	228	225	221	216	210
5	262	246	239	235	232	228	225	221	216	210
6	262	246	239	235	232	228	225	221	216	210
7	276	259	251	248	244	240	237	232	227	221
8	276	259	251	248	244	240	237	232	227	221
9	276	259	251	248	244	240	237	232	227	221
10	276	259	251	248	244	240	237	232	227	221
11	276	259	251	248	244	240	237	232	227	221
12	276	259	251	248	244	240	237	232	227	221
13	276	257	244	236	230	225	220	216	212	208
14	276	256	241	232	223	215	208	202	197	193
15	276	259	251	248	244	240	237	232	227	221
16	...	...	...	...	...	...	...	...	...	...
17	276	259	251	248	244	240	237	232	227	221
18	276	259	251	248	244	240	237	232	227	221
19	290	273	264	260	256	253	248	243	238	232
20	296	279	271	266	262	258	254	249	244	238
21	317	294	277	266	256	248	240	233	226	221
22	317	294	277	266	256	248	240	233	226	221
23	345	320	302	289	279	269	261	253	247	241
24	345	320	302	289	279	269	261	253	247	241
25	345	320	302	289	279	269	261	253	247	241
26	345	320	302	289	279	269	261	253	247	241
27	345	328	316	308	301	296	292	289	286	283
28	379	352	331	318	306	296	286	278	271	265
29	379	352	331	318	306	296	286	278	271	265
30	379	352	331	318	306	296	286	278	271	265
31	414	389	379	372	365	360	355	349	340	332
32	414	394	379	369	362	355	351	347	343	339
33	280	262	254	250	246	242	238	234	229	223
34	285	267	258	254	250	246	242	238	233	227
35	305	287	278	274	270	266	262	257	251	245
36	315	295	286	282	279	275	270	265	259	253
37	315	296	287	283	279	275	270	265	259	253
38	325	305	297	292	288	284	279	274	268	261
39	255	240	233	229	225	222	219	215	210	205
40	305	285	276	272	268	264	259	255	249	243
41	335	314	305	300	296	292	288	282	276	269
42	345	323	314	309	305	301	296	291	284	277
43	345	324	315	310	306	301	296	291	284	277
44	355	...	...	...	...	...	...	...	...	...
45	355	332	323	318	314	310	305	299	292	285

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	204	199	193	187	181	176	171	167	162	158
2	204	199	193	187	181	176	171	167	162	158
3	204	199	193	187	181	176	171	167	162	158
4	204	199	193	187	181	176	171	167	162	158
5	204	199	193	187	181	176	171	167	162	158
6	204	199	193	187	181	176	171	167	162	158
7	216	209	202	196	191	185	180	176	171	167
8	216	209	202	196	191	185	180	176	171	167
9	216	209	202	196	191	185	180	176	171	167
10	216	209	202	196	191	185	180	176	171	167
11	216	209	202	196	191	185	180	176	171	167
12	216	209	202	196	191	185	180	176	171	167
13	204	201	197	192	187	181	175	...	...	...
14	189	185	181	177	174	169	164	...	...	...
15	216	209	202	196	191	185	180	176	171	167
16	...	...	...	...	...	...	...	...	...	...
17	216	209	202	196	191	185	180	176	171	167
18	216	209	202	196	191	185	180	176	171	167
19	226	219	213	207	200	195	189	184	180	175
20	232	225	218	211	205	199	194	189	184	179
21	216	212	208	204	199	194	189	...	...	...
22	216	212	208	204	199	194	189	...	...	...
23	235	231	226	222	217	211	204	...	...	...
24	235	231	226	222	217	211	204	...	...	...
25	235	231	226	222	217	211	204	...	...	...
26	235	231	226	222	217	211	204	...	...	...
27	279	275	269	261	252	...	...	...	...	...
28	259	254	249	...	...	...	...	...	...	...
29	259	254	249	...	...	...	...	...	...	...
30	259	254	249	...	...	...	...	...	...	...
31	324	314	305	295	285	...	...	...	...	...
32	335	330	323	...	...	...	...	...	...	...
33	217	211	204	198	192	186	181	177	172	168
34	221	215	208	202	195	190	185	180	175	171
35	238	231	224	217	211	205	199	194	189	184
36	246	239	231	224	217	211	206	201	196	190
37	246	239	232	225	218	212	206	200	195	190
38	254	247	239	232	225	218	212	207	201	196
39	200	193	187	182	176	171	167	163	158	154
40	236	230	223	216	209	203	197	192	188	183
41	261	254	246	238	231	225	219	213	208	203
42	269	261	253	245	238	231	225	220	214	209
43	270	262	254	246	239	232	225	219	214	208
44	...	...	...	...	...	...	...	...	...	...
45	277	269	261	252	245	238	232	226	220	215

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

(25)

(25)

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials (Cont'd)					
1	Carbon steel	Forgings	SA-266	3	K05001	...
2	Carbon steel	Plate	SA-455	...	K03300	...
3	Carbon steel	Plate	SA-299	A	K02803	...
4	Carbon steel	Wld. pipe	SA-671	CK75	K02803	...
5	Carbon steel	Wld. pipe	SA-672	N75	K02803	...
6	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...
7	Carbon steel	Plate	SA-299	A	K02803	...
8	Carbon steel	Wld. pipe	SA-691	CMS-75	K02803	...
9	Carbon steel	Forgings	SA-372	B	K04001	...
10	Carbon steel	Sheet	SA-414	G	K03103	...
11	Carbon steel	Plate	SA-738	A	K12447	...
12	Carbon steel	Plate	SA-537	...	K12437	3
13	Carbon steel	Plate	SA-537	...	K12437	2
14	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...
15	Carbon steel	Plate	SA-738	C	K02008	...
16	Carbon steel	Plate, sheet, bar	SA-572	60	...	...
17	Carbon steel	Round bar	SA-572	60	...	...
18	Carbon steel	Sheet, strip	SA-1011	60	HSLAS	1
19	Carbon steel	Plate	SA-299	B	K02803	...
20	Carbon steel	Plate	SA-299	B	K02803	...
21	Carbon steel	Forgings	SA-765	IV	K02009	...
22	Carbon steel	Plate	SA-537	...	K12437	3
23	Carbon steel	Plate	SA-537	...	K12437	2
24	Carbon steel	Wld. pipe	SA-671	CD80	K12437	...
25	Carbon steel	Wld. pipe	SA-672	D80	K12437	...
26	Carbon steel	Wld. pipe	SA-691	CMSH-80	K12437	...
27	Carbon steel	Plate	SA-738	C	K02008	...
28	Carbon steel	Plate	SA-841	B	...	2
29	Carbon steel	Plate, sheet, bar	SA-572	65	...	...
(25) 30	Carbon steel	Bolting	SA-311	1035	G10350	A
31	Carbon steel	Plate	SA-612	...	K02900	...
32	Carbon steel	Plate	SA-841	F	...	6
33	Carbon steel	Plate	SA-612	...	K02900	...
34	Carbon steel	Plate	SA-738	B	K12007	...
(25) 35	Carbon steel	Bolting	SA-311	1035	G10350	A
36	Carbon steel	Plate	SA-841	F	...	7
37	Carbon steel	Forgings	SA-372	C	K04801	...
38	Carbon steel	Bolting	SA-449	...	K04200	...
39	Carbon steel	Plate	SA-724	A	K11831	...
40	Carbon steel	Plate	SA-724	C	K12037	...
(25) 41	Carbon steel	Bolting	SA-311	1045	G10450	A
42	Carbon steel	Plate	SA-724	B	K12031	...
(25) 43	Carbon steel	Bolting	SA-311	1045	G10450	A
(25) 44	Carbon steel	Bolting	SA-311	1050	G10500	A
(25) 45	Carbon steel	Bolting	SA-311	1050	G10500	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	...	515	260	...
2	≤ 9.5	515	260	...
3	> 25	515	275	...
4	> 25	515	275	...
5	> 25	515	275	...
6	> 25	515	275	...
7	≤ 25	515	290	...
8	≤ 25	515	290	...
9	...	515	310	...
10	...	515	310	...
11	...	515	310	...
12	$65 < t \leq 100$	515	345	...
13	$65 < t \leq 100$	515	380	...
14	$65 < t \leq 100$	515	380	...
15	$65 < t \leq 100$	515	380	...
16	$t \leq 32$	520	415	...
17	$t \leq 90$	520	415	...
18	...	520	410	...
19	> 25	550	310	...
20	≤ 25	550	325	...
21	...	550	345	...
22	≤ 65	550	380	...
23	≤ 65	550	415	...
24	≤ 65	550	415	...
25	≤ 65	550	415	...
26	≤ 65	550	415	...
27	≤ 65	550	415	...
28	≤ 65	550	415	...
29	$t \leq 32$	550	450	...
30	$20 < t \leq 30$	550	485	...
31	$12.5 < t \leq 25$	560	345	...
32	$t \leq 32$	565	485	...
33	≤ 12.5	570	345	...
34	...	585	415	...
35	$t \leq 20$	590	520	...
36	$t \leq 25$	590	515	...
37	...	620	380	...
38	$38 < t \leq 75$	620	400	...
39	...	620	485	...
40	...	620	485	...
41	$20 < t \leq 30$	620	550	...
42	...	655	515	...
43	$t \leq 20$	655	585	...
44	$20 < t \leq 30$	655	585	...
45	$t \leq 20$	690	620	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	262	246	239	235	232	228	225	221	216	210
3	276	259	251	248	244	240	237	232	227	221
4	276	259	251	248	244	240	237	232	227	221
5	276	259	251	248	244	240	237	232	227	221
6	276	259	251	248	244	240	237	232	227	221
7	290	273	264	260	256	253	248	243	238	232
8	290	273	264	260	256	253	248	243	238	232
9	310	292	283	279	274	270	266	261	255	249
10	310	292	283	279	274	270	266	261	255	249
11	310	292	283	279	274	270	266	261	255	249
12	345	320	302	289	279	269	261	253	247	241
13	379	352	331	318	306	296	286	278	271	265
14	379	352	331	318	306	296	286	278	271	265
15	379	352	331	318	306	296	286	278	271	265
16	414	394	379	369	362	355	351	347	343	339
17	414	394	379	369	362	355	351	347	343	339
18	414	394	379	369	362	355	351	347	343	339
19	310	292	283	278	274	270	266	261	255	249
20	324	305	295	291	287	282	278	273	267	260
21	345	328	313	306	300	293	287	281	276	271
22	379	352	331	318	306	296	286	278	271	265
23	414	384	362	347	335	323	313	303	295	288
24	414	384	362	347	335	323	313	303	295	288
25	414	384	362	347	335	323	313	303	295	288
26	414	384	362	347	335	323	313	303	295	288
27	414	384	362	347	335	323	313	303	295	288
28	414	394	379	369	362	355	351	347	343	339
29	448	427	413	398	372	340	321	305	292	281
30	483	453	442	434	426	420	415	407	397	387
31	345	323	300	289	279	270	260	252	245	241
32	483	463	443	431	422	415	410	406	402	397
33	345	323	300	289	279	270	260	252	245	241
34	414	393	378	368	360	353	345	339	333	328
35	517	486	473	465	457	450	444	436	425	415
36	517	496	475	462	452	444	439	435	430	425
37	379	357	346	340	336	331	325	319	312	304
38	400	381	364	357	354	349	343	337	329	321
39	483	448	422	405	390	377	365	354	345	337
40	483	448	422	405	390	377	365	354	345	337
41	552	518	505	496	487	480	474	465	454	443
42	517	480	452	434	418	403	390	379	370	361
43	586	551	536	527	518	510	503	494	482	470
44	586	551	536	527	518	510	503	494	482	470
45	621	583	568	558	548	541	533	523	510	498

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	204	199	193	187	181	176	171	167	162	158
3	216	209	202	196	191	185	180	176	171	167
4	216	209	202	196	191	185	180	176	171	167
5	216	209	202	196	191	185	180	176	171	167
6	216	209	202	196	191	185	180	176	171	167
7	226	219	213	207	200	195	189	184	180	175
8	226	219	213	207	200	195	189	184	180	175
9	242	235	228	221	215	209	203	197	192	187
10	242	235	228	221	215	209	203	197	192	187
11	242	235	228	221	215	209	203	197	192	187
12	235	231	226	222	217	211	204	...	...	...
13	259	254	249	244	238	231	225	...	...	...
14	259	254	249	244	238	231	225	...	...	...
15	259	254	249	244	238	231	225	...	...	...
16	335	330	323	...	...	...	...	...	...	...
17	335	330	323	...	...	...	...	...	...	...
18	335	330	323	...	...	...	...	...	...	...
19	242	235	228	221	215	208	203	198	193	187
20	253	246	238	231	224	218	212	206	201	196
21	266	262	259	255	...	...	...	...	...	...
22	259	254	249	244	238	231	225	...	...	...
23	283	277	272	266	260	253	246	...	...	...
24	283	277	272	266	260	253	246	...	...	...
25	283	277	272	266	260	253	246	...	...	...
26	283	277	272	266	260	253	246	...	...	...
27	283	277	272	266	260	253	246	...	...	...
28	335	330	323	314	303	...	...	...	...	...
29	270	259	246	...	...	...	...	...	...	...
30	378	366	356	345	333	...	...	...	...	...
31	237	232	226	220	...	...	...	...	...	...
32	391	384	378	...	...	...	...	...	...	...
33	237	232	226	220	...	...	...	...	...	...
34	323	317	312	306	300	293	286	...	...	...
35	405	392	382	369	357	...	...	...	...	...
36	419	411	405	...	...	...	...	...	...	...
37	296	288	279	270	262	255	248	242	236	229
38	312	303	294	285	277	269	261	255	249	...
39	330	323	317	311	303	295	287	...	...	...
40	330	323	317	311	303	295	287	...	...	...
41	432	418	407	394	380	...	...	...	...	...
42	353	346	339	333	325	316	306	...	...	...
43	458	444	433	418	404	...	...	...	...	...
44	458	444	433	418	404	...	...	...	...	...
45	485	470	458	443	428	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
(25) 1	...	...	...	...	...	...
(25) 2	Carbon steel	Bolting	SA-325	1	K02706	...
3	Carbon steel	Bolting	SA-449	...	K04200	...
4	Carbon steel	Bolting	SA-354	BC	K04100	...
(25) 5	Carbon steel	Bolting	SA-311	1045	G10450	B
6	Carbon steel	Bolting	SA-325	1	K02706	...
7	Carbon steel	Bolting	SA-449	...	K04200	...
8	Carbon steel	Bolting	SA-354	BC	K04100	...
9	Carbon steel	Bolting	SA-354	BD	K04100	...
10	Carbon steel	Bolting	SA-354	BD	K04100	...
11	Carbon steel	Flat wire	SA-905	...	...	2
12	Carbon steel	Flat wire	SA-905	...	...	2
13	Carbon steel	Flat wire	SA-905	...	...	2
14	Carbon steel	Flat wire	SA-905	...	...	2
15	Carbon steel	Flat wire	SA-905	...	...	2
16	Carbon steel	Flat wire	SA-905	...	...	1
17	Carbon steel	Flat wire	SA-905	...	...	1
18	Carbon steel	Flat wire	SA-905	...	...	1
19	Carbon steel	Flat wire	SA-905	...	...	1
20	Carbon steel	Flat wire	SA-905	...	...	1
21	Ductile cast iron	Castings	SA-874	...	...	...
22	Ductile cast iron	Castings	SA/JIS G5504	FCD 300 LT	...	...
23	C-Mn-Si-Cb	Plate	SA-737	B	K12001	...
24	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490	...	...
25	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490	...	...
26	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490	...	...
27	C-Mn-Si-Cb	Plate	SA/AS 1548	PT490	...	...
28	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized
29	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized
30	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized
31	C-Mn-Si-Cb	Plate	SA/GB 713	Q370R	...	Normalized
32	C-Mn-Si-V	Plate	SA-737	C	K12202	...
33	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...
34	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...
35	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...
36	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...
37	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...
38	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...
39	C-Mn-Si-V-Cb	Plate	SA-656	T3	...	...
40	C-Mn-Si-V-Cb	Plate	SA-656	T7	...	...
41	C-Mn-Ti	Plate, sheet	SA-562	...	K11224	...
42	C-Si-Ti	Forgings	SA-836	...	...	1
43	C- $\frac{1}{4}$ Mo	Bolting	SA-320	L7A	G40370	...
(25) 44	Alloy steel	Bolting	SA/ISO 898-1	9.8	...	...
45	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037	G40370	...

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	...	...	...	...
2	$25 < t \leq 38$	725	560	...
3	$25 < t \leq 38$	725	560	...
4	$64 < t \leq 100$	795	685	...
5	$t \leq 75$	795	690	...
6	$13 \leq t \leq 25$	825	635	...
7	≤ 25	825	635	...
8	$6 < t \leq 64$	860	750	...
9	$64 < t \leq 100$	965	795	...
10	$6 < t \leq 64$	1035	895	...
11	1.5	1695	1450	(1)
12	1.3	1725	1475	(1)
13	1.02	1765	1525	(1)
14	0.76	1805	1560	(1)
15	0.51	1850	1600	(1)
16	1.5	1895	1650	(1)
17	1.3	1930	1675	(1)
18	1.02	1965	1725	(1)
19	0.76	2000	1760	(1)
20	0.51	2040	1795	(1)
21	$300 < t < 530$	300	200	...
22	$300 < t < 530$	300	200	...
23	...	485	345	...
24	$80 < t \leq 150$	490	320	...
25	$40 < t \leq 80$	490	330	...
26	$16 < t \leq 40$	490	340	...
27	≤ 16	490	360	...
28	$60 < t \leq 100$	510	330	...
29	$36 < t \leq 60$	520	340	...
30	$16 < t \leq 36$	530	360	...
31	$10 \leq t \leq 16$	530	370	...
32	...	550	415	...
33	≤ 50	415	345	...
34	≤ 50	415	345	...
35	≤ 40	485	415	...
36	≤ 40	485	415	...
37	≤ 25	550	485	...
38	≤ 25	550	485	...
39	≤ 20	620	550	...
40	≤ 20	620	550	...
41	...	380	205	...
42	...	380	170	...
43	≤ 65	860	725	...
44	$d \leq 16$	900	720	...
45	≥ 16	1170	930	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
Ferrous Materials (Cont'd)										
1	...	...	...	...	...	...	...	...	...	...
2	558	525	488	468	452	436	422	409	399	390
3	558	525	488	468	452	436	422	409	399	390
4	683	651	621	611	604	595	585	574	562	548
5	690	648	631	620	609	601	592	581	567	553
6	634	596	554	531	513	495	479	465	453	443
7	634	596	554	531	513	495	479	465	453	443
8	752	717	684	672	664	655	644	632	618	603
9	793	757	722	709	701	691	680	667	652	636
10	896	855	816	802	792	781	768	753	737	719
11	1450	...	...	...	...	...	...	...	...	...
12	1480	...	...	...	...	...	...	...	...	...
13	1520	...	...	...	...	...	...	...	...	...
14	1560	...	...	...	...	...	...	...	...	...
15	1600	...	...	...	...	...	...	...	...	...
16	1650	1600	1530	...	...	...	...	...	...	...
17	1680	1620	1560	...	...	...	...	...	...	...
18	1720	1670	1600	...	...	...	...	...	...	...
19	1760	1700	1630	...	...	...	...	...	...	...
20	1790	1740	1670	...	...	...	...	...	...	...
21	200	182	174	...	166	...	162	...	160	...
22	200	182	174	...	166	...	162	...	160	...
23	345	331	312	298	285	272	262	253	246	240
24	321	308	290	278	265	253	243	235	228	223
25	331	318	300	286	273	261	251	243	236	231
26	341	328	309	296	282	270	259	250	243	238
27	359	344	325	310	296	283	272	263	256	250
28	330	317	300	285	272	260	249	242	235	230
29	340	327	309	294	280	268	257	249	242	237
30	360	346	327	311	297	284	272	263	257	251
31	370	356	336	320	305	291	280	271	264	258
32	414	397	375	358	342	327	314	303	294	288
33	345	324	314	309	305	300	295	290	284	277
34	345	324	314	309	305	300	295	290	284	277
35	414	389	377	371	366	360	355	348	340	332
36	414	389	377	371	366	360	355	348	340	332
37	483	454	440	433	427	421	414	406	397	387
38	483	454	440	433	427	421	414	406	397	387
39	552	519	503	495	488	481	473	464	454	443
40	552	519	503	495	488	481	473	464	454	443
41	207	189	176	169	165	163	161	161	161	161
42	172	157	147	141	138	136	134	134	134	134
43	724	690	659	648	640	631	620	609	596	581
44	720	686	655	644	636	...	...	...	...	...
45	931	902	870	853	838	825	813	801	790	779

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	...	...	...	...	...	...	...	...	...	...
2	381	374	366	359	351	341	329	314	295	269
3	381	374	366	359	351	341	329	314	295	269
4	533	517	502	486	472	459	446	435	424	412
5	539	523	509	492	475	...	...	...	...	...
6	433	424	416	408	399	388	374	357	335	306
7	433	424	416	408	399	388	374	357	335	306
8	587	570	553	536	520	505	491	479	466	453
9	619	601	583	565	548	533	518	505	492	479
10	700	679	658	638	618	601	584	569	554	539
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	157	154	151	...	...	...	...	...	...	...
22	157	154	151	...	...	...	...	...	...	...
23	236	233	230	226	222	216	208	198	182	179
24	220	217	214	210	206	200	193	183	171	157
25	227	224	221	217	213	207	199	190	177	162
26	234	230	227	224	220	214	206	195	183	164
27	246	242	239	235	231	225	216	205	192	175
28	227	223	220	216	212	206	198	188	179	169
29	234	230	227	223	218	212	204	194	184	174
30	247	244	240	236	231	224	216	206	195	184
31	254	251	247	243	237	230	222	212	200	189
32	283	279	276	272	266	259	249	237	218	214
33	269	261	253	...	...	...	...	...	...	...
34	269	261	253	...	...	...	...	...	...	...
35	323	314	304	...	...	...	...	...	...	...
36	323	314	304	...	...	...	...	...	...	...
37	377	366	355	...	...	...	...	...	...	...
38	377	366	355	...	...	...	...	...	...	...
39	431	418	405	...	...	...	...	...	...	...
40	431	418	405	...	...	...	...	...	...	...
41	161	161	161	160	158	...	...	...	...	...
42	134	134	134	134	132	...	...	...	...	...
43	565	549	532	516	501	486	473	461	450	437
44	...	...	...	...	...	...	...	...	...	...
45	768	757	744	730	714	697	677	656	631	604

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042	G40420	...
2	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4140	G41400	...
3	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4037	G40370	...
4	C- $\frac{1}{4}$ Mo	Bolting	SA-574	4042	G40420	...
5	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...
6	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...
7	C-0.3Mo	Smls. tube	SA/EN 10216-2	16Mo3	...	...
8	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1b	K11422	...
9	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1b	K11422	...
10	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1	K11522	...
11	C- $\frac{1}{2}$ Mo	Smls. & wld. fittings	SA-234	WP1	K12821	...
12	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1	K11522	...
13	C- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P1	K11522	...
14	C- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP1	K11522	...
15	C- $\frac{1}{2}$ Mo	Smls. tube	SA-209	T1a	K12023	...
16	C- $\frac{1}{2}$ Mo	Wld. tube	SA-250	T1a	K12023	...
17	C- $\frac{1}{2}$ Mo	Castings	SA-217	WC1	J12524	...
18	C- $\frac{1}{2}$ Mo	Castings	SA-352	LC1	J12522	...
19	C- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP1	J12521	...
20	C- $\frac{1}{2}$ Mo	Plate	SA-204	A	K11820	...
21	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L65	K11820	...
22	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-65	K11820	...
23	C- $\frac{1}{2}$ Mo	Forgings	SA-182	F1	K12822	...
24	C- $\frac{1}{2}$ Mo	Plate	SA-204	B	K12020	...
25	C- $\frac{1}{2}$ Mo	Forgings	SA-336	F1	K12520	...
26	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L70	K12020	...
27	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-70	K12020	...
28	C- $\frac{1}{2}$ Mo	Plate	SA-204	C	K12320	...
29	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	L75	K12320	...
30	C- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	CM-75	K12320	...
31	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	55
32	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	55
33	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	65
34	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	65
35	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	G	K13049	70
36	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo	Forgings	SA-372	H	K13547	70
37	$\frac{1}{2}$ Cr- $\frac{1}{5}$ Mo-V	Plate	SA-517	B	K11630	...
38	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Plate	SA-517	A	K11856	...
39	$\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-Si	Forgings	SA-592	A	K11856	...
40	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P2	K11547	...
41	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP2	K11547	...
42	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-387	2	K12143	1
43	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	$\frac{1}{2}$ CR	K12143	...
44	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T2	K11547	...
45	$\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP2	J11547	...

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	≥ 16	1170	930	...
2	≥ 16	1170	930	...
3	≤ 13	1240	965	...
4	≤ 13	1240	965	...
5	$40 < t \leq 60$	450	260	...
6	$16 < t \leq 40$	450	270	...
7	$t \leq 16$	450	280	...
8	...	365	195	...
9	...	365	195	...
10	...	380	205	...
11	...	380	205	...
12	...	380	205	...
13	...	380	205	...
14	...	380	205	...
15	...	415	220	...
16	...	415	220	...
17	...	450	240	...
18	...	450	240	...
19	...	450	240	...
20	...	450	255	...
21	...	450	255	...
22	...	450	255	...
23	...	485	275	...
24	...	485	275	...
25	...	485	275	...
26	...	485	275	...
27	...	485	275	...
28	...	515	295	...
29	...	515	295	...
30	...	515	295	...
31	...	585	380	...
32	...	585	380	...
33	...	725	450	...
34	...	725	450	...
35	...	825	485	...
36	...	825	485	...
37	≤ 32	795	690	...
38	≤ 32	795	690	...
39	≤ 65	795	690	...
40	...	380	205	...
41	...	380	205	...
42	...	380	230	...
43	...	380	230	...
44	...	415	205	...
45	...	415	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	931	902	870	853	838	825	813	801	790	779
2	931	902	870	853	838	825	813	801	790	779
3	965	935	902	884	869	856	843	831	819	808
4	965	935	902	884	869	856	843	831	819	808
5	260	250	243	238	234	230	227	224	221	218
6	270	260	252	248	243	239	236	232	229	226
7	280	270	262	257	252	248	244	241	238	234
8	193	186	181	177	174	171	169	166	164	161
9	193	186	181	177	174	171	169	166	164	161
10	207	199	193	190	187	184	180	178	175	173
11	207	199	193	190	187	184	180	178	175	173
12	207	199	193	190	187	184	180	178	175	173
13	207	199	193	190	187	184	180	178	175	173
14	207	199	193	190	187	184	180	178	175	173
15	221	212	206	202	199	196	193	190	187	185
16	221	212	206	202	199	196	193	190	187	185
17	241	232	226	221	218	214	211	208	205	202
18	241	232	226	221	218	214	211	208	205	202
19	241	232	226	221	218	214	211	208	205	202
20	255	246	239	234	230	226	223	219	216	213
21	255	246	239	234	230	226	223	219	216	213
22	255	246	239	234	230	226	223	219	216	213
23	276	266	258	253	249	245	241	237	234	231
24	276	266	258	253	249	245	241	237	234	231
25	276	266	258	253	249	245	241	237	234	231
26	276	266	258	253	249	245	241	237	234	231
27	276	266	258	253	249	245	241	237	234	231
28	296	286	277	272	267	263	259	255	252	248
29	296	286	277	272	267	263	259	255	252	248
30	296	286	277	272	267	263	259	255	252	248
31	372	364	353	346	340	335	330	326	321	317
32	372	364	353	346	340	335	330	326	321	317
33	440	430	417	409	402	396	390	385	380	374
34	440	430	417	409	402	396	390	385	380	374
35	483	462	447	439	433	427	421	415	410	404
36	483	462	447	439	433	427	421	415	410	404
37	689	670	656	646	637	629	621	614	607	600
38	689	670	656	646	637	629	621	614	607	600
39	689	670	656	646	637	629	621	614	607	600
40	207	199	193	190	187	184	180	178	175	173
41	207	199	193	190	187	184	180	178	175	173
42	228	219	213	209	205	202	198	196	193	191
43	228	219	213	209	205	202	198	196	193	191
44	207	199	193	190	187	184	180	178	175	173
45	207	199	193	190	187	184	180	178	175	173

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	768	757	744	730	714	697	677	656	631	604
2	768	757	744	730	714	697	677	656	631	604
3	797	785	771	757	741	722	702	679	654	626
4	797	785	771	757	741	722	702	679	654	626
5	215	211	208	204	200	195	189	183	176	169
6	223	219	216	212	207	202	196	190	183	175
7	231	228	224	220	215	210	204	197	190	182
8	159	157	154	151	148	144	141	136	131	125
9	159	157	154	151	148	144	141	136	131	125
10	170	168	165	162	159	155	150	146	140	134
11	170	168	165	162	159	155	150	146	140	134
12	170	168	165	162	159	155	150	146	140	134
13	170	168	165	162	159	155	150	146	140	134
14	170	168	165	162	159	155	150	146	140	134
15	182	180	176	173	169	165	161	155	149	143
16	182	180	176	173	169	165	161	155	149	143
17	199	196	193	189	185	181	175	170	163	157
18	199	196	193	189	185	181	175	170	163	157
19	199	196	193	189	185	181	175	170	163	157
20	210	207	204	200	196	191	186	180	173	166
21	210	207	204	200	196	191	186	180	173	166
22	210	207	204	200	196	191	186	180	173	166
23	228	224	220	216	211	207	200	194	187	179
24	228	224	220	216	211	207	200	194	187	179
25	228	224	220	216	211	207	200	194	187	179
26	228	224	220	216	211	207	200	194	187	179
27	228	224	220	216	211	207	200	194	187	179
28	245	241	237	232	227	222	216	209	201	192
29	245	241	237	232	227	222	216	209	201	192
30	245	241	237	232	227	222	216	209	201	192
31	312	306	298	290	280	268	253	237	218	196
32	312	306	298	290	280	268	253	237	218	196
33	368	361	353	343	331	316	299	280	257	231
34	368	361	353	343	331	316	299	280	257	231
35	396	389	379	368	356	340	323	302	278	249
36	396	389	379	368	356	340	323	302	278	249
37	594	587	579	571	561	549	534	517	496	470
38	594	587	579	571	561	549	534	517	496	470
39	594	587	579	571	561	549	534	517	496	470
40	170	168	165	162	159	155	150	146	140	134
41	170	168	165	162	159	155	150	146	140	134
42	188	185	182	179	175	171	166	160	154	148
43	188	185	182	179	175	171	166	160	154	148
44	170	168	165	162	159	155	150	146	140	134
45	170	168	165	162	159	155	150	146	140	134

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F2	K12122	...
2	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	2	K12143	2
3	$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	$\frac{1}{2}\text{CR}$	K12143	...
4	$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	Wld. tube	SA-423	1	K11535	...
5	$\frac{3}{4}\text{Cr}-\frac{3}{4}\text{Ni}-\text{Cu}-\text{Al}$	Pipe	SA-333	4	K11267	...
6	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	55
7	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	55
8	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	55
9	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7	G41400	...
(25) 10	Alloy steel	Bolting	SA/ISO 898-1	8.8	...	...
(25) 11	Alloy steel	Bolting	SA/ISO 898-1	8.8	...	...
12	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7M	G41400	...
13	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-320	L7M	G41400	...
14	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	65
15	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7	G41400	...
16	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	E	K13047	70
17	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	F	G41350	70
18	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	K13548	70
19	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-193	B7	G41400	...
20	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-320	L7	G41400	...
21	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Forgings	SA-372	J	G41370	110
22	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-574	4137	G41370	...
23	$1\text{Cr}-\frac{1}{5}\text{Mo}$	Bolting	SA-574	4137	G41370	...
(25) 24	$1\text{Cr}-\frac{1}{5}\text{Mo}-\text{B}$	Forgings	SA-372	R	G41371	110
25	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	12	K11757	1
26	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	1CR	K11757	...
27	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Cast pipe	SA-426	CP12	J11562	...
28	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-182	F12	K11562	1
29	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA-213	T12	K11562	...
30	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. & wld. fittings	SA-234	WP12	K12062	1
31	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. pipe	SA-335	P12	K11562	...
32	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forged pipe	SA-369	FP12	K11562	...
33	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT
34	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...
35	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...
36	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/GB 713	15CrMoR	...	NT
37	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT
38	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA/EN 10028-2	13CrMo4-5	...	...
39	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT
40	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA/EN 10216-2	13CrMo4-5	...	...
(25) 41	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT
42	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Smls. tube	SA/EN 10216-2	13CrMo4-5	...	...
(25) 43	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA/EN 10222-2	13CrMo4-5	...	NT or QT
44	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-387	12	K11757	2
45	$1\text{Cr}-\frac{1}{2}\text{Mo}$	Wld. pipe	SA-691	1CR	K11757	...

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	275	...
2	...	485	310	...
3	...	485	310	...
4	...	415	255	...
5	...	415	240	...
6	...	585	380	...
7	...	585	380	...
8	...	585	380	...
9	$100 < t \leq 180$	690	515	...
10	$d \leq 16$	800	640	...
11	$d > 16$	830	660	...
12	≤ 100	690	550	...
13	≤ 65	690	550	...
14	...	725	450	...
15	$64 < t \leq 100$	795	655	...
16	...	825	485	...
17	...	825	485	...
18	...	825	485	...
19	≤ 64	860	725	...
20	≤ 65	860	725	...
21	...	930	760	...
22	≥ 16	1170	930	...
23	≤ 13	1240	1035	...
24	...	930	760	...
25	...	380	230	...
26	...	380	230	...
27	...	415	205	...
28	...	415	220	...
29	...	415	220	...
30	...	415	220	...
31	...	415	220	...
32	...	415	220	...
33	$250 < t \leq 500$	420	240	...
34	$150 < t \leq 250$	420	245	...
35	$100 < t \leq 150$	430	255	...
36	$100 < t \leq 200$	440	255	...
37	$100 < t \leq 250$	440	265	...
38	$60 < t \leq 100$	440	270	...
39	$70 < t \leq 100$	440	275	...
40	$40 < t \leq 60$	440	280	...
41	$35 < t \leq 70$	440	285	...
42	$t \leq 40$	440	290	...
43	$t \leq 35$	440	295	...
44	...	450	275	...
45	...	450	275	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	276	266	258	253	249	245	241	237	234	231
2	310	299	290	285	280	275	271	267	263	260
3	310	299	290	285	280	275	271	267	263	260
4	255	242	234	230	227	225	223	221	219	217
5	241	228	222	218	216	214	211	209	207	205
6	372	364	353	346	340	335	330	326	321	317
7	372	364	353	346	340	335	330	326	321	317
8	372	364	353	346	340	335	330	326	321	317
9	517	498	479	470	463	457	451	445	438	432
10	640	616	592	581	573	...	...	...	...	...
11	660	636	611	599	591	...	...	...	...	...
12	552	532	511	501	494	488	482	475	467	461
13	552	532	511	501	494	488	482	475	467	461
14	440	430	417	409	402	396	390	385	380	374
15	655	631	606	595	586	579	572	564	556	547
16	483	462	447	439	433	427	421	415	410	404
17	483	462	447	439	433	427	421	415	410	404
18	483	462	447	439	433	427	421	415	410	404
19	724	698	671	658	648	640	632	623	614	605
20	724	698	671	658	648	640	632	623	614	605
21	758	725	703	690	679	670	661	652	644	634
22	930	890	863	847	833	822	811	800	790	778
23	1035	990	960	942	927	915	903	890	879	866
24	758	725	703	690	679	670	661	652	644	634
25	228	214	204	198	194	189	185	182	180	177
26	228	214	204	198	194	189	185	182	180	177
27	207	194	185	180	176	172	169	166	163	161
28	221	207	198	192	187	183	180	177	174	172
29	221	207	198	192	187	183	180	177	174	172
30	221	207	198	192	187	183	180	177	174	172
31	221	207	198	192	187	183	180	177	174	172
32	221	207	198	192	187	183	180	177	174	172
33	240	226	216	210	205	200	196	193	190	187
34	245	230	220	214	208	204	200	196	193	191
35	255	239	229	222	217	212	208	204	201	198
36	225	211	202	196	191	187	183	180	177	175
37	265	250	239	232	226	221	216	213	210	207
38	270	253	242	235	230	224	220	216	213	210
39	275	259	248	241	235	229	225	221	217	215
40	280	266	257	251	246	241	236	233	229	225
41	285	269	257	250	243	237	233	229	225	222
42	290	276	266	260	254	249	245	241	237	233
43	295	278	266	258	252	246	241	237	233	230
44	276	259	248	240	234	229	225	221	218	215
45	276	259	248	240	234	229	225	221	218	215

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	228	224	220	216	211	207	200	194	187	179
2	256	252	248	243	238	232	226	219	210	201
3	256	252	248	243	238	232	226	219	210	201
4	214	212	209	206	203	199	194	188	180	170
5	203	200	198	195	192	189	184	178	170	160
6	312	306	298	290	280	268	253	237	218	196
7	312	306	298	290	280	268	253	237	218	196
8	312	306	298	290	280	268	253	237	218	196
9	425	416	406	395	381	365	346	323	297	268
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...
12	454	444	433	421	407	389	369	344	317	285
13	454	444	433	421	407	389	369	344	317	285
14	368	361	353	343	331	316	299	280	257	231
15	538	527	514	501	483	463	439	409	376	339
16	396	389	379	368	356	340	323	302	278	249
17	396	389	379	368	356	340	323	302	278	249
18	396	389	379	368	356	340	323	302	278	249
19	595	583	568	553	534	511	485	452	416	374
20	595	583	568	553	534	511	485	452	416	374
21	623	611	596	579	559	535	507	474	436	392
22	764	750	731	710	686	656	622	582	535	481
23	851	834	814	791	763	731	692	647	595	535
24	623	611	596	579	559	535	507	474	436	392
25	174	172	170	168	165	163	160	156	152	147
26	174	172	170	168	165	163	160	156	152	147
27	159	157	155	153	151	148	145	142	138	134
28	170	167	165	163	161	158	155	151	147	142
29	170	167	165	163	161	158	155	151	147	142
30	170	167	165	163	161	158	155	151	147	142
31	170	167	165	163	161	158	155	151	147	142
32	170	167	165	163	161	158	155	151	147	142
33	185	183	181	178	176	172	169	165	160	156
34	188	186	184	181	178	175	172	168	163	158
35	196	193	191	188	186	182	179	175	170	165
36	173	171	169	166	164	161	158	154	150	145
37	204	202	199	197	194	190	186	182	177	172
38	207	205	202	200	197	193	189	185	180	174
39	212	210	207	204	201	198	193	189	184	178
40	222	218	215	211	207	202	197	192	186	179
41	220	217	215	212	208	205	200	196	190	185
42	230	226	222	218	214	209	204	199	192	185
43	227	225	222	219	216	212	207	203	197	191
44	212	209	207	204	201	197	194	189	184	178
45	212	209	207	204	201	197	194	189	184	178

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR	...	NT
2	1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...
3	1Cr- $\frac{1}{2}$ Mo	Plate	SA/GB 713	15CrMoR	...	NT
4	1Cr- $\frac{1}{2}$ Mo	Plate	SA/EN 10028-2	13CrMo4-5	...	...
5	1Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F12	K11564	2
6	1Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F12	K11564	...
7	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...
8	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...
9	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	5
10	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	5
11	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-193	B16	K14072	...
12	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	4
13	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	3
14	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	2
15	1Cr- $\frac{1}{2}$ Mo-V	Bolting	SA-540	B21	K14073	1
16	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	5
17	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	5
18	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	4
19	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	3
20	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	2
21	1Cr-1Mn- $\frac{1}{4}$ Mo	Bolting	SA-540	B22	K41420	1
22	1Cr-V	Smls. tube	SA-213	T17	K12047	...
23	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC6	J12072	...
24	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP11	J12072	...
25	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo	Bar	SA-739	B11	K11797	...
26	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11597	1
27	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T11	K11597	...
28	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. & wld. fittings	SA-234	WP11	...	1
29	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P11	K11597	...
30	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11597	1
31	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forged pipe	SA-369	FP11	K11597	...
32	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	1
33	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	$1\frac{1}{4}$ CR	K11789	...
34	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-182	F11	K11572	2
35	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	2
36	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT
37	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT
38	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA/EN 10028-2	13CrMoSi5-5	...	QT
39	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Forgings	SA-336	F11	K11572	3
40	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Plate	SA-387	11	K11789	2
41	$1\frac{1}{4}$ Cr- $\frac{1}{2}$ Mo-Si	Wld. pipe	SA-691	$1\frac{1}{4}$ CR	K11789	...
42	$1\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...
43	$1\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Cu	Forgings	SA-592	E	K11695	...
44	$1\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...
45	$1\frac{3}{4}$ Cr- $\frac{1}{2}$ Mo-Ti	Plate	SA-517	E	K21604	...

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	$60 < t \leq 100$	450	275	...
2	$16 < t \leq 60$	450	290	...
3	$6 \leq t \leq 60$	450	295	...
4	$t \leq 16$	450	300	...
5	...	485	275	...
6	...	485	275	...
7	$100 < t \leq 200$	690	585	...
8	$64 < t \leq 100$	760	655	...
9	$50 < t \leq 205$	795	690	...
10	≤ 50	825	725	...
11	≤ 64	860	725	...
12	≤ 150	930	825	...
13	≤ 150	1000	895	...
14	≤ 100	1070	965	...
15	≤ 100	1140	1035	...
16	$50 < t \leq 100$	795	690	...
17	≤ 50	825	725	...
18	≤ 100	930	825	...
19	≤ 100	1000	895	...
20	≤ 75	1070	965	...
21	≤ 38	1140	1035	...
22	...	415	205	...
23	...	485	275	...
24	...	485	275	...
25	...	485	310	...
26	...	415	205	...
27	...	415	205	...
28	...	415	205	...
29	...	415	205	...
30	...	415	205	...
31	...	415	205	...
32	...	415	240	...
33	...	415	240	...
34	...	485	275	...
35	...	485	275	...
36	$100 < t \leq 250$	490	380	...
37	$60 < t \leq 100$	500	390	...
38	≤ 60	510	400	...
39	...	515	310	...
40	...	515	310	...
41	...	515	310	...
42	$65 < t \leq 100$	725	620	...
43	≤ 65	795	690	...
44	$65 < t \leq 150$	725	620	...
45	≤ 65	795	690	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	275	258	247	240	234	229	224	220	217	214
2	290	272	260	253	247	241	236	232	229	226
3	295	277	265	257	251	245	240	236	233	229
4	300	282	269	262	255	249	244	240	237	233
5	276	259	248	240	234	229	225	221	218	215
6	276	259	248	240	234	229	225	221	218	215
7	586	575	563	557	551	544	538	531	525	518
8	655	643	630	622	615	608	600	593	586	579
9	689	678	664	655	646	639	632	625	617	609
10	724	711	696	688	680	672	664	656	648	640
11	724	711	696	688	680	672	664	656	648	640
12	827	814	797	786	776	767	759	750	740	731
13	896	882	863	851	840	831	822	812	802	792
14	965	950	930	917	905	895	885	875	864	852
15	1030	1020	996	982	970	959	949	937	925	913
16	688	673	657	646	637	628	619	610	601	591
17	722	707	689	678	668	659	650	641	631	620
18	825	808	787	775	764	753	743	733	722	709
19	894	876	854	840	828	817	806	794	782	769
20	963	943	919	904	891	879	867	855	842	827
21	1032	1009	983	968	955	943	931	918	903	886
22	207	197	190	185	181	178	175	172	169	166
23	276	262	253	247	242	237	233	229	225	222
24	276	262	253	247	242	237	233	229	225	222
25	310	295	284	278	272	267	262	258	253	249
26	207	197	190	185	181	178	175	172	169	166
27	207	197	190	185	181	178	175	172	169	166
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	241	230	221	216	211	207	204	201	197	194
33	241	230	221	216	211	207	204	201	197	194
34	276	262	253	247	242	237	233	229	225	222
35	276	262	253	247	242	237	233	229	225	222
36	380	372	365	360	355	349	343	338	332	327
37	390	382	375	369	364	358	353	347	341	335
38	400	391	384	379	373	367	362	356	350	344
39	310	295	284	278	272	267	262	258	253	249
40	310	295	284	278	272	267	262	258	253	249
41	310	295	284	278	272	267	262	258	253	249
42	621	604	591	581	573	566	560	554	548	543
43	689	670	656	646	637	629	622	615	609	603
44	621	604	591	581	573	566	560	554	548	543
45	689	670	656	646	637	629	622	615	609	603

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	211	209	206	203	200	197	193	188	183	177
2	223	220	217	214	211	208	203	199	193	187
3	227	224	221	218	215	211	207	202	197	190
4	230	228	225	222	218	215	210	206	200	194
5	212	209	207	204	201	197	194	189	184	178
6	212	209	207	204	201	197	194	189	184	178
7	511	504	496	488	479	469	457	443	427	407
8	571	563	555	546	535	524	511	495	477	455
9	601	594	585	575	564	551	536	520	502	480
10	631	623	613	603	592	579	565	547	528	503
11	631	623	613	603	592	579	565	547	528	503
12	721	712	702	690	677	662	644	624	602	576
13	782	772	761	747	734	716	697	676	653	624
14	842	831	819	805	790	771	751	728	702	672
15	902	891	877	862	847	827	805	780	753	720
16	579	565	550	532	...	...	...	...	...	...
17	608	594	578	559	...	...	...	...	...	...
18	695	679	660	638	...	...	...	...	...	...
19	753	736	715	691	...	...	...	...	...	...
20	811	792	770	745	...	...	...	...	...	...
21	866	842	813	778	...	...	...	...	...	...
22	164	161	158	155	153	149	145	142	137	132
23	219	215	211	208	204	199	195	189	183	176
24	219	215	211	208	204	199	195	189	183	176
25	246	242	238	234	229	224	219	213	206	198
26	164	161	158	155	153	149	145	142	137	132
27	164	161	158	155	153	149	145	142	137	132
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	191	188	185	182	178	174	170	165	160	154
33	191	188	185	182	178	174	170	165	160	154
34	219	215	211	208	204	199	195	189	183	176
35	219	215	211	208	204	199	195	189	183	176
36	321	315	309	303	297	291	283	276	267	258
37	329	324	318	311	305	298	291	283	274	265
38	338	332	326	319	313	306	298	290	281	272
39	246	242	238	234	229	224	219	213	206	198
40	246	242	238	234	229	224	219	213	206	198
41	246	242	238	234	229	224	219	213	206	198
42	538	534	530	525	521	515	509	502	494	483
43	598	593	589	584	579	573	566	558	548	536
44	538	534	530	525	521	515	509	502	494	483
45	598	593	589	584	579	573	566	558	548	536

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	1
2	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA-213	T22	K21590	...
3	2 $\frac{1}{4}$ Cr-1Mo	Smls. & wld. fittings	SA-234	WP22	K21590	1
4	2 $\frac{1}{4}$ Cr-1Mo	Smls. pipe	SA-335	P22	K21590	...
5	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	1
6	2 $\frac{1}{4}$ Cr-1Mo	Forged pipe	SA-369	FP22	K21590	...
7	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	1
8	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR	K21590	...
9	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
10	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT
11	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
12	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
13	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA/EN 10216-2	10CrMo9-10	...	...
14	2 $\frac{1}{4}$ Cr-1Mo	Smls. tube	SA/EN 10216-2	10CrMo9-10	...	...
15	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
16	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
17	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA/EN 10028-2	10CrMo9-10	...	...
18	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-217	WC9	J21890	...
19	2 $\frac{1}{4}$ Cr-1Mo	Cast pipe	SA-426	CP22	J21890	...
20	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-182	F22	K21590	3
21	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-336	F22	K21590	3
22	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-387	22	K21590	2
23	2 $\frac{1}{4}$ Cr-1Mo	Wld. pipe	SA-691	2 $\frac{1}{4}$ CR	K21590	...
24	2 $\frac{1}{4}$ Cr-1Mo	Bar	SA-739	B22	K21390	...
(25) 25	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA/EN 10222-2	11CrMo9-10	...	NT or QT
26	2 $\frac{1}{4}$ Cr-1Mo	Castings	SA-487	8	J22091	A
27	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-508	22	K21590	3
28	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	3
29	2 $\frac{1}{4}$ Cr-1Mo	Plate	SA-542	B	K21590	4
30	2 $\frac{1}{4}$ Cr-1Mo	Forgings	SA-541	22	K21390	4
31	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-182	F22V	K31835	...
32	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-336	F22V	K31835	...
33	2 $\frac{1}{4}$ Cr-1Mo-V	Forgings	SA-541	22V	K31835	...
34	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-542	D	K31835	4a
35	2 $\frac{1}{4}$ Cr-1Mo-V	Plate	SA-832	22V	K31835	...
36	3Cr-1Mo	Smls. tube	SA-213	T21	K31545	...
37	3Cr-1Mo	Smls. pipe	SA-335	P21	K31545	...
38	3Cr-1Mo	Forgings	SA-336	F21	K31545	1
39	3Cr-1Mo	Forged pipe	SA-369	FP21	K31545	...
40	3Cr-1Mo	Plate	SA-387	21	K31545	1
41	3Cr-1Mo	Cast pipe	SA-426	CP21	J31545	...
42	3Cr-1Mo	Forgings	SA-182	F21	K31545	...
43	3Cr-1Mo	Forgings	SA-336	F21	K31545	3
44	3Cr-1Mo	Plate	SA-387	21	K31545	2
45	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-182	F3V	K31830	...

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	205	...
2	...	415	205	...
3	...	415	205	...
4	...	415	205	...
5	...	415	205	...
6	...	415	205	...
7	...	415	205	...
8	...	415	205	...
9	$150 < t \leq 250$	450	250	...
10	$200 < t \leq 500$	450	265	...
11	$100 < t \leq 150$	460	260	...
12	$60 < t \leq 100$	470	280	...
13	$40 < t \leq 60$	480	270	...
14	$t \leq 40$	480	280	...
15	$40 < t \leq 60$	480	290	...
16	$16 < t \leq 40$	480	300	...
17	$t \leq 16$	480	310	...
18	...	485	275	...
19	...	485	275	...
20	...	515	310	...
21	...	515	310	...
22	...	515	310	...
23	...	515	310	...
24	...	515	310	...
25	$t \leq 200$	520	310	...
26	...	585	380	...
27	...	585	380	...
28	...	585	380	...
29	...	585	380	...
30	...	725	585	...
31	...	585	415	...
32	...	585	415	...
33	...	585	415	...
34	...	585	415	...
35	...	585	415	...
36	...	415	205	...
37	...	415	205	...
38	...	415	205	...
39	...	415	205	...
40	...	415	205	...
41	...	415	205	...
42	...	515	310	...
43	...	515	310	...
44	...	515	310	...
45	...	585	415	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	197	192	190	187	186	185	185	185	185
2	207	197	192	190	187	186	185	185	185	185
3	207	197	192	190	187	186	185	185	185	185
4	207	197	192	190	187	186	185	185	185	185
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	250	236	227	223	218	215	212	210	208	206
10	265	251	242	236	232	228	225	222	220	218
11	260	246	237	231	227	224	221	218	216	214
12	280	264	255	249	245	241	238	235	233	231
13	270	256	248	245	242	239	237	235	233	231
14	280	266	258	254	251	248	246	244	242	240
15	290	274	264	258	253	249	246	244	241	239
16	300	283	273	267	262	258	255	252	249	247
17	310	293	282	276	271	267	263	260	258	255
18	276	262	254	250	247	244	242	240	238	236
19	276	262	254	250	247	244	242	240	238	236
20	310	293	282	276	271	267	263	260	258	256
21	310	293	282	276	271	267	263	260	258	256
22	310	293	282	276	271	267	263	260	258	256
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	283	276	271	267	263	260	258	255
26	379	360	349	343	339	336	333	330	328	325
27	379	372	365	361	357	353	350	346	343	339
28	379	372	365	361	357	353	350	346	343	339
29	379	372	365	361	357	353	350	346	343	339
30	586	574	560	554	549	543	539	534	530	526
31	414	412	410	407	404	400	396	392	388	383
32	414	412	410	407	404	400	396	392	388	383
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	207	197	192	190	187	186	185	185	185	185
37	207	197	192	190	187	186	185	185	185	185
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	310	293	282	276	271	267	263	260	258	256
43	310	293	282	276	271	267	263	260	258	256
44	310	293	282	276	271	267	263	260	258	256
45	414	396	384	377	371	366	363	361	359	358

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	185	185	185	185	185	184	181	178	173	167
2	185	185	185	185	185	184	181	178	173	167
3	185	185	185	185	185	184	181	178	173	167
4	185	185	185	185	185	184	181	178	173	167
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	204	202	200	198	195	191	187	182	176	169
10	217	215	212	210	206	202	198	192	186	180
11	212	210	208	205	202	199	194	189	183	176
12	229	227	224	221	218	214	209	204	197	190
13	229	227	224	222	219	215	211	206	199	191
14	238	235	233	230	227	223	219	213	207	198
15	237	235	232	229	226	222	217	211	204	196
16	245	243	240	237	233	229	224	218	211	203
17	253	251	248	245	241	237	232	225	218	210
18	234	231	229	226	223	220	215	210	204	195
19	234	231	229	226	223	220	215	210	204	195
20	253	251	248	245	241	237	232	225	218	210
21	253	251	248	245	241	237	232	225	218	210
22	253	251	248	245	241	237	232	225	218	210
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	231	225	218	210
26	322	319	316	312	307	302	296	289	280	269
27	335	331	326	322	317	312	306	300	...	...
28	335	331	326	322	317	312	306	300	...	...
29	335	331	326	322	317	312	306	300	...	...
30	521	517	511	505	498	490	480	470	457	442
31	377	372	366	360	353	346	339	332	324	...
32	377	372	366	360	353	346	339	332	324	...
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	185	185	185	185	185	184	181	178	173	167
37	185	185	185	185	185	184	181	178	173	167
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	253	251	248	245	241	237	232	225	218	210
43	253	251	248	245	241	237	232	225	218	210
44	253	251	248	245	241	237	232	225	218	210
45	357	356	354	353	350	347	342	336	330	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-336	F3V	K31830	...
2	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-508	3V	K31830	...
3	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Forgings	SA-541	3V	K31830	...
4	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-542	C	K31830	4a
5	3Cr-1Mo- $\frac{1}{4}$ V-Ti-B	Plate	SA-832	21V	K31830	...
6	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-182	F3VCb	...	...
7	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-336	F3VCb	...	...
8	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-508	3VCb	...	...
9	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Forgings	SA-541	3VCb	...	...
10	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-542	E	...	4a
11	3Cr-1Mo- $\frac{1}{4}$ V-Cb-Ca	Plate	SA-832	23V	...	...
12	5Cr- $\frac{1}{2}$ Mo	Smls. tube	SA-213	T5	K41545	...
13	5Cr- $\frac{1}{2}$ Mo	Smls. & wld. fittings	SA-234	WP5	K41545	...
14	5Cr- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P5	K41545	...
15	5Cr- $\frac{1}{2}$ Mo	Forged pipe	SA-369	FP5	K41545	...
16	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	1
17	5Cr- $\frac{1}{2}$ Mo	Wld. pipe	SA-691	5CR	K41545	...
18	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5	K41545	...
19	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5	K41545	...
20	5Cr- $\frac{1}{2}$ Mo	Plate	SA-387	5	K41545	2
21	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-336	F5A	K42544	...
22	5Cr- $\frac{1}{2}$ Mo	Castings	SA-217	C5	J42045	...
23	5Cr- $\frac{1}{2}$ Mo	Cast pipe	SA-426	CP5	J42045	...
24	5Cr- $\frac{1}{2}$ Mo	Forgings	SA-182	F5a	K42544	...
25	5Cr- $\frac{1}{2}$ Mo	Bolting	SA-193	B5	K50100	...
26	5Cr- $\frac{1}{2}$ Mo-Si	Smls. tube	SA-213	T5b	K51545	...
27	5Cr- $\frac{1}{2}$ Mo-Si	Smls. pipe	SA-335	P5b	K51545	...
28	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. tube	SA-213	T5c	K41245	...
29	5Cr- $\frac{1}{2}$ Mo-Ti	Smls. pipe	SA-335	P5c	K41245	...
30	9Cr-1Mo	Smls. tube	SA-213	T9	K90941	...
31	9Cr-1Mo	Fittings	SA-234	WP9	K90941	...
32	9Cr-1Mo	Smls. pipe	SA-335	P9	K90941	...
33	9Cr-1Mo	Forged pipe	SA-369	FP9	K90941	...
34	9Cr-1Mo	Forgings	SA-182	F9	K90941	...
35	9Cr-1Mo	Forgings	SA-336	F9	K90941	...
36	9Cr-1Mo	Castings	SA-217	C12	J82090	...
37	9Cr-1Mo	Cast pipe	SA-426	CP9	J82090	...
38	9Cr-1Mo-V	Smls. tube	SA-213	T91 Types 1 & 2	K90901	...
39	9Cr-1Mo-V	Fittings	SA-234	WP91 Types 1 & 2	K90901	...
40	9Cr-1Mo-V	Smls. pipe	SA-335	P91 Types 1 & 2	K90901	...
41	9Cr-1Mo-V	Forged pipe	SA-369	FP91 Types 1 & 2	K90901	...
42	9Cr-1Mo-V	Plate	SA-387	91 Types 1 & 2	K90901	2
43	9Cr-1Mo-V	Forgings	SA-182	F91 Types 1 & 2	K90901	...
44	9Cr-1Mo-V	Forgings	SA-336	F91 Types 1 & 2	K90901	...
45	11Cr-Ti	Plate	SA-240	...	S40910	...

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	...	585	415	...
9	...	585	415	...
10	...	585	415	...
11	...	585	415	...
12	...	415	205	...
13	...	415	205	...
14	...	415	205	...
15	...	415	205	...
16	...	415	205	...
17	...	415	205	...
18	...	415	250	...
19	...	485	275	...
20	...	515	310	...
21	...	550	345	...
22	...	620	415	...
23	...	620	415	...
24	...	620	450	...
25	≤100	690	550	...
26	...	415	205	...
27	...	415	205	...
28	...	415	205	...
29	...	415	205	...
30	...	415	205	...
31	...	415	205	...
32	...	415	205	...
33	...	415	205	...
34	...	585	380	...
35	...	585	380	...
36	...	620	415	...
37	...	620	415	...
38	...	585	415	...
39	...	620	415	...
40	...	585	415	...
41	...	585	415	...
42	...	585	415	...
43	...	620	415	...
44	...	620	415	...
45	...	380	170	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	414	396	384	377	371	366	363	361	359	358
2	414	396	384	377	371	366	363	361	359	358
3	414	396	384	377	371	366	363	361	359	358
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	207	193	186	182	180	179	178	177	177	176
13	207	193	186	182	180	179	178	177	177	176
14	207	193	186	182	180	179	178	177	177	176
15	207	193	186	182	180	179	178	177	177	176
16	207	193	186	182	180	179	178	177	177	176
17	207	193	186	182	180	179	178	177	177	176
18	248	232	223	219	216	215	213	212	212	211
19	276	257	248	243	240	238	237	237	236	234
20	310	290	279	274	270	268	267	266	265	264
21	345	322	310	304	300	298	296	295	294	293
22	414	387	372	365	360	357	355	354	353	352
23	414	387	372	365	360	357	355	354	353	352
24	448	419	403	395	390	387	385	384	382	381
25	552	517	486	477	475	474	474	474	474	473
26	207	193	186	182	180	179	178	177	177	176
27	207	193	186	182	180	179	178	177	177	176
28	207	193	186	182	180	179	178	177	177	176
29	207	193	186	182	180	179	178	177	177	176
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	379	354	341	334	330	327	326	325	324	322
35	379	354	341	334	330	327	326	325	324	322
36	414	387	372	365	360	357	355	354	353	352
37	414	387	372	365	360	357	355	354	353	352
38	414	394	384	380	378	378	377	377	377	377
39	414	394	384	380	378	378	377	377	377	377
40	414	394	384	380	378	378	377	377	377	377
41	414	394	384	380	378	378	377	377	377	377
42	414	394	384	380	378	378	377	377	377	377
43	414	394	384	380	378	378	377	377	377	377
44	414	394	384	380	378	378	377	377	377	377
45	172	159	148	141	135	130	125	122	120	118

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	357	356	354	353	350	347	342	336	330	...
2	357	356	354	353	350	347	342	336	330	...
3	357	356	354	353	350	347	342	336	330	...
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	175	173	171	168	165	160	154	148	140	132
13	175	173	171	168	165	160	154	148	140	132
14	175	173	171	168	165	160	154	148	140	132
15	175	173	171	168	165	160	154	148	140	132
16	175	173	171	168	165	160	154	148	140	132
17	175	173	171	168	165	160	154	148	140	132
18	210	208	205	201	197	191	185	177	168	158
19	233	231	228	224	219	213	206	197	187	176
20	262	260	257	252	247	239	231	221	210	198
21	291	289	285	280	274	266	256	245	233	220
22	350	347	342	336	329	319	308	295	280	263
23	350	347	342	336	329	319	308	295	280	263
24	379	376	371	364	356	346	333	319	303	285
25	473	472	466	459	448	435	419	400	379	355
26	175	173	171	168	165	160	154	148	140	132
27	175	173	171	168	165	160	154	148	140	132
28	175	173	171	168	165	160	154	148	140	132
29	175	173	171	168	165	160	154	148	140	132
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	320	318	314	308	301	292	282	270	257	242
35	320	318	314	308	301	292	282	270	257	242
36	350	347	342	336	329	319	308	295	280	263
37	350	347	342	336	329	319	308	295	280	263
38	377	375	371	366	358	348	337	322	306	288
39	377	375	371	366	358	348	337	322	306	288
40	377	375	371	366	358	348	337	322	306	288
41	377	375	371	366	358	348	337	322	306	288
42	377	375	371	366	358	348	337	322	306	288
43	377	375	371	366	358	348	337	322	306	288
44	377	375	371	366	358	348	337	322	306	288
45	118	117	117	116	116	115	113	110	107	103

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	11Cr-Ti	Plate	SA-240	...	S40920	...
2	11Cr-Ti	Plate	SA-240	...	S40930	...
3	11Cr-Ti	Smls. & wld. tube	SA-268	TP409	S40900	...
4	12Cr	Plate	SA-1010	40	S41003	...
5	12Cr	Bar	SA-479	403	S40300	A
6	12Cr	Bar	SA-479	403	S40300	1
7	12Cr	Plate	SA-1010	50	S41003	...
8	12Cr-Al	Bar	SA/JIS G4303	SUS405	...	...
9	12Cr-Al	Plate	SA-240	405	S40500	...
10	12Cr-Al	Bar	SA-479	405	S40500	...
11	12Cr-Al	Smls. & wld. tube	SA-268	TP405	S40500	...
12	12Cr-1Mo-V-W	Bolting	SA-437	B4C	K91352	...
13	12Cr-1Mo-V-W	Bolting	SA-437	B4B	K91352	...
14	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16	S45500	H1000
15	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16	S45500	H1000
16	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16	S45500	H950
17	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16	S45500	H950
18	12Cr-9Ni-2Cu-1Ti	Bar	SA-564	XM-16	S45500	H900
19	12Cr-9Ni-2Cu-1Ti	Forgings	SA-705	XM-16	S45500	H900
20	12Cr-Ti	Smls. & wld. tube	SA-268	...	S40800	...
21	13Cr	Plate	SA-240	410S	S41008	...
22	13Cr	Smls. & wld. tube	SA-268	TP410	S41000	...
23	13Cr	Plate	SA-240	410	S41000	...
24	13Cr	Forgings	SA-182	F6a	S41000	1
25	13Cr	Bar	SA-479	410	S41000	...
26	13Cr	Bar	SA-479	410	S41000	A
27	13Cr	Bar	SA-479	410	S41000	1
28	13Cr	Forgings	SA-182	F6a	S41000	2
29	13Cr	Castings	SA-217	CA15	J91150	...
30	13Cr	Cast pipe	SA-426	CPCA15	J91150	...
31	13Cr	Bar	SA/EN 10088-3	X12Cr13	...	QT650
32	13Cr	Bolting	SA-193	B6	S41000	...
33	13Cr-4Ni	Castings	SA-487	CA6NM	J91540	A
34	13Cr-4Ni	Forgings	SA-182	F6NM	S41500	...
35	13Cr-4Ni	Bar	SA-479	...	S41500	...
36	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1150M
37	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1150M
38	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1150
39	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1150
40	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1100
41	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1100
42	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1050
43	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1050
44	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1025
45	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1025

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	170	...
2	...	380	170	...
3	...	380	170	...
4	≤19	455	275	...
5	...	485	275	...
6	...	485	275	...
7	≤19	485	345	...
8	...	410	174	...
9	...	415	170	...
10	...	415	170	...
11	...	415	205	...
12	...	790	585	...
13	...	1000	720	...
14	...	1410	1280	...
15	≥13	1410	1280	...
16	...	1520	1410	...
17	≥13	1520	1410	...
18	...	1620	1520	...
19	≥13	1620	1520	...
20	...	380	205	...
21	...	415	205	...
22	...	415	205	...
23	...	450	205	...
24	...	485	275	...
25	...	485	275	...
26	...	485	275	...
27	...	485	275	...
28	...	585	380	...
29	...	620	450	...
30	...	620	450	...
31	$t \leq 160$	650	450	...
32	≤100	760	585	...
33	...	760	550	...
34	...	795	620	...
35	...	795	620	...
36	...	860	585	...
37	...	860	585	...
38	...	930	620	...
39	...	930	620	...
40	...	1035	930	...
41	...	1035	930	...
42	...	1205	1140	...
43	...	1205	1140	...
44	...	1275	1205	...
45	...	1275	1205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	172	159	148	141	135	130	125	122	120	118
2	172	159	148	141	135	130	125	122	120	118
3	172	159	148	141	135	130	125	122	120	118
4	276	276	274	263	253	248	235	229	224	220
5	276	261	252	248	245	243	241	239	238	236
6	276	261	252	248	245	243	241	239	238	236
7	345	345	342	329	316	304	294	286	280	275
8	172	163	158	155	153	152	150	150	149	147
9	172	163	158	155	153	152	150	150	149	147
10	172	163	158	155	153	152	150	150	149	147
11	207	196	189	186	183	182	181	180	178	177
12	585	574	560	551	544	537	531	525	520	515
13	722	708	691	680	670	662	654	647	641	635
14	1276	...	...	...	...	...	...	...	...	...
15	1276	...	...	...	...	...	...	...	...	...
16	1413	...	...	...	...	...	...	...	...	...
17	1413	...	...	...	...	...	...	...	...	...
18	1517	...	...	...	...	...	...	...	...	...
19	1517	...	...	...	...	...	...	...	...	...
20	207	196	189	186	183	182	181	180	178	177
21	207	196	189	186	183	182	181	180	178	177
22	207	196	189	186	183	182	181	180	178	177
23	207	196	189	186	183	182	181	180	178	177
24	276	261	252	248	245	243	241	239	238	236
25	276	261	252	248	245	243	241	239	238	236
26	276	261	252	248	245	243	241	239	238	236
27	276	261	252	248	245	243	241	239	238	236
28	379	359	347	341	336	333	331	329	327	325
29	448	424	410	403	398	394	391	389	387	384
30	448	424	410	403	398	394	391	389	387	384
31	450	428	414	406	400	396	392	390	387	385
32	586	555	535	524	517	511	508	505	503	500
33	552	531	517	508	502	497	492	489	486	483
34	621	605	595	589	583	578	572	566	560	553
35	621	605	595	589	583	578	572	566	560	553
36	586	...	...	...	...	...	...	...	...	...
37	586	...	...	...	...	...	...	...	...	...
38	621	...	...	...	...	...	...	...	...	...
39	621	...	...	...	...	...	...	...	...	...
40	931	...	...	...	...	...	...	...	...	...
41	931	...	...	...	...	...	...	...	...	...
42	1140	...	...	...	...	...	...	...	...	...
43	1140	...	...	...	...	...	...	...	...	...
44	1210	...	...	...	...	...	...	...	...	...
45	1210	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	118	117	117	116	116	115	113	110	107	103
2	118	117	117	116	116	115	113	110	107	103
3	118	117	117	116	116	115	113	110	107	103
4	217	213	208	202	193	183	172	161	151	146
5	234	231	227	223	216	209	200	190	179	166
6	234	231	227	223	216	209	200	190	179	166
7	271	266	260	252	242	229	215	201	189	182
8	146	144	142	139	135	131	125	119	111	103
9	146	144	142	139	135	131	125	119	111	103
10	146	144	142	139	135	131	125	119	111	103
11	176	173	170	167	162	157	150	142	134	124
12	511	506	501	496	...	...	...	...	...	...
13	629	624	618	612	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	176	173	170	167	162	157	150	142	134	124
21	176	173	170	167	162	157	150	142	134	124
22	176	173	170	167	162	157	150	142	134	124
23	176	173	170	167	162	157	150	142	134	124
24	234	231	227	223	216	209	200	190	179	166
25	234	231	227	223	216	209	200	190	179	166
26	234	231	227	223	...	...	...	...	...	...
27	234	231	227	223	...	...	...	...	...	...
28	322	318	312	306	297	288	275	262	246	227
29	380	375	369	361	351	339	325	309	290	269
30	380	375	369	361	...	...	...	...	...	...
31	382	378	372	364	354	342	327	310	291	271
32	497	492	486	477	465	451	433	412	387	359
33	479	475	468	461	450	438	426	...	...	...
34	546	538	530	520	...	...	...	...	...	...
35	546	538	530	520	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials (Cont'd)					
1	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H1000
2	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H1000
3	13Cr-8Ni-2Mo	Bar	SA-564	XM-13	S13800	H950
4	13Cr-8Ni-2Mo	Forgings	SA-705	XM-13	S13800	H950
5	15Cr	Smls. & wld. tube	SA-268	TP429	S42900	...
6	15Cr	Plate	SA-240	429	S42900	...
(25) 7	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H1150M
(25) 8	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H1150M
(25) 9	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H1150
(25) 10	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H1150
(25) 11	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H1100
(25) 12	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H1100
(25) 13	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H1075
(25) 14	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H1075
(25) 15	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H1025
(25) 16	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H1025
(25) 17	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H925
(25) 18	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H925
(25) 19	15Cr-5Ni-3Cu	Bar	SA-564	XM-12	S15500	H900
(25) 20	15Cr-5Ni-3Cu	Forgings	SA-705	XM-12	S15500	H900
21	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H1150
22	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H1150
23	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H1100
24	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H1100
25	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H1050
26	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H1050
27	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H1025
28	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H1025
29	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H1000
30	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H1000
31	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H950
32	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H950
33	15Cr-6Ni-Cu-Mo	Bar	SA-564	XM-25	S45000	H900
34	15Cr-6Ni-Cu-Mo	Forgings	SA-705	XM-25	S45000	H900
35	17Cr	Smls. & wld. tube	SA-268	TP430	S43000	...
36	17Cr	Plate	SA-240	430	S43000	...
37	17Cr	Bar	SA-479	430	S43000	...
(25) 38	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1150M
(25) 39	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1150M
(25) 40	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1150
(25) 41	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1150
(25) 42	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1150
(25) 43	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1100
(25) 44	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1100
(25) 45	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1100

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	...	1415	1310	...
2	...	1415	1310	...
3	...	1515	1415	...
4	...	1515	1415	...
5	...	415	240	...
6	...	450	205	...
7	...	795	515	...
8	...	795	515	...
9	...	930	725	...
10	...	930	725	...
11	...	965	795	...
12	...	965	795	...
13	...	1000	860	...
14	...	1000	860	...
15	...	1070	1000	...
16	...	1070	1000	...
17	...	1170	1070	...
18	...	1170	1070	...
19	...	1310	1170	...
20	...	1310	1170	...
21	≥13	860	515	...
22	≥13	860	515	...
23	≥13	895	725	...
24	≥13	895	725	...
25	≥13	1000	930	...
26	≥13	1000	930	...
27	≥13	1035	965	...
28	≥13	1035	965	...
29	≥13	1105	1035	...
30	≥13	1105	1035	...
31	≥13	1170	1105	...
32	≥13	1170	1105	...
33	≥13	1240	1170	...
34	≥13	1240	1170	...
35	...	415	240	...
36	...	450	205	...
37	...	485	275	...
38	...	795	515	...
39	...	795	515	...
40	...	930	725	...
41	...	930	725	...
42	...	930	725	...
43	...	965	795	...
44	...	965	795	...
45	...	965	795	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	1310	...	...	...	...	...	...	...	...	...
2	1310	...	...	...	...	...	...	...	...	...
3	1410	...	...	...	...	...	...	...	...	...
4	1410	...	...	...	...	...	...	...	...	...
5	241	228	221	217	214	212	211	209	208	207
6	207	196	189	186	183	182	181	180	178	177
7	517	493	477	468	461	454	448	442	436	431
8	517	493	477	468	461	454	448	442	436	431
9	724	690	668	656	645	636	627	619	611	604
10	724	690	668	656	645	636	627	619	611	604
11	793	756	732	718	707	696	687	678	669	662
12	793	756	732	718	707	696	687	678	669	662
13	862	822	795	780	768	757	747	737	728	719
14	862	822	795	780	768	757	747	737	728	719
15	1000	953	923	905	891	878	866	855	844	834
16	1000	953	923	905	891	878	866	855	844	834
17	1069	1019	987	968	952	939	926	914	902	892
18	1069	1019	987	968	952	939	926	914	902	892
19	1172	1117	1082	1061	1044	1029	1015	1002	989	978
20	1172	1117	1082	1061	1044	1029	1015	1002	989	978
21	517	...	...	...	...	...	...	...	...	...
22	517	...	...	...	...	...	...	...	...	...
23	724	...	...	...	...	...	...	...	...	...
24	724	...	...	...	...	...	...	...	...	...
25	931	...	...	...	...	...	...	...	...	...
26	931	...	...	...	...	...	...	...	...	...
27	965	...	...	...	...	...	...	...	...	...
28	965	...	...	...	...	...	...	...	...	...
29	1030	...	...	...	...	...	...	...	...	...
30	1030	...	...	...	...	...	...	...	...	...
31	1100	...	...	...	...	...	...	...	...	...
32	1100	...	...	...	...	...	...	...	...	...
33	1170	...	...	...	...	...	...	...	...	...
34	1170	...	...	...	...	...	...	...	...	...
35	241	228	221	217	214	212	211	209	208	207
36	207	196	189	186	183	182	181	180	178	177
37	276	261	252	248	245	243	241	239	238	236
38	517	493	477	468	461	454	448	442	436	431
39	517	493	477	468	461	454	448	442	436	431
40	724	690	668	656	645	636	627	619	611	604
41	724	690	668	656	645	636	627	619	611	604
42	724	690	668	656	645	636	627	619	611	604
43	793	756	732	718	707	696	687	678	669	662
44	793	756	732	718	707	696	687	678	669	662
45	793	756	732	718	707	696	687	678	669	662

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	205	202	199	194	189	182	175	166	156	145
6	176	173	170	167	162	157	150	142	134	124
7	426	421	414	409	399	391	381	366	345	315
8	426	421	414	409	399	391	381	366	345	315
9	597	589	580	572	559	548	533	512	483	441
10	597	589	580	572	559	548	533	512	483	441
11	654	645	635	627	612	600	584	561	529	483
12	654	645	635	627	612	600	584	561	529	483
13	710	701	690	681	666	653	635	610	575	525
14	710	701	690	681	666	653	635	610	575	525
15	824	814	801	790	772	757	736	707	668	609
16	824	814	801	790	772	757	736	707	668	609
17	881	870	856	845	825	809	787	756	714	651
18	881	870	856	845	825	809	787	756	714	651
19	966	954	939	926	905	887	863	829	782	713
20	966	954	939	926	905	887	863	829	782	713
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...
35	205	202	199	194	189	182	175	166	156	145
36	176	173	170	167	162	157	150	142	134	124
37	234	231	227	223	216	209	200	190	179	166
38	426	421	414	409	399	391	381	366	345	315
39	426	421	414	409	399	391	381	366	345	315
40	597	589	580	572	559	548	533	512	483	441
41	597	589	580	572	559	548	533	512	483	441
42	597	589	580	572	559	548	533	512	483	441
43	654	645	635	627	612	600	584	561	529	483
44	654	645	635	627	612	600	584	561	529	483
45	654	645	635	627	612	600	584	561	529	483

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
(25) 1	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1075
(25) 2	17Cr-4Ni-4Cu	Plate	SA-693	630	S17400	H1075
(25) 3	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1075
(25) 4	17Cr-4Ni-4Cu	Bar	SA-564	630	S17400	H1025
(25) 5	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H1025
(25) 6	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H925
(25) 7	17Cr-4Ni-4Cu	Forgings	SA-705	630	S17400	H900
8	17Cr-7Ni-1Al	Forgings	SA-705	631	S17700	TH1050
9	17Cr-7Ni-1Al	Forgings	SA-705	631	S17700	RH950
10	18Cr-2Mo	Plate	SA-240	...	S44400	...
11	18Cr-2Mo	Smls. & wld. tube	SA-268	...	S44400	...
(25) 12	18Cr-2Mo	Bar	SA-479	...	S44400	...
13	18Cr-Ti	Plate	SA-240	...	S43932	...
(25) 14	18Cr-Ti	Plate	SA-240	439	S43035	...
15	18Cr-Ti	Smls. & wld. tube	SA-268	TP439	S43035	...
16	18Cr-Ti	Wld. tube	SA-803	TP439	S43035	...
(25) 17	...	...	...	...	...	...
18	18Cr-Ti	Smls. & wld. tube	SA-268	TP430 Ti	S43036	...
19	18Cr-Ti	Bar	SA-479	439	S43035	...
20	26Cr-3Ni-3Mo	Plate	SA-240	26-3-3	S44660	...
21	26Cr-3Ni-3Mo	Smls. & wld. tube	SA-268	26-3-3	S44660	...
22	26Cr-3Ni-3Mo	Wld. tube	SA-803	26-3-3	S44660	...
23	27Cr	Smls. tube	SA-268	TP446-1	S44600	...
24	27Cr-1Mo	Forgings	SA-182	FXM-27Cb	S44627	...
25	27Cr-1Mo	Plate	SA-240	XM-27	S44627	...
26	27Cr-1Mo	Smls. & wld. tube	SA-268	TPXM-27	S44627	...
27	27Cr-1Mo	Bar	SA-479	XM-27	S44627	...
(25) 28	...	...	...	...	...	...
(25) 29	...	...	...	...	...	...
30	27Cr-1Mo-Ti	Plate	SA-240	XM-33	S44626	...
31	27Cr-1Mo-Ti	Smls. & wld. tube	SA-268	TPXM-33	S44626	...
32	29Cr-4Mo	Bar	SA-479	...	S44700	...
33	29Cr-4Mo	Plate	SA-240	...	S44700	...
34	29Cr-4Mo	Smls. & wld. tube	SA-268	29-4	S44700	...
35	29Cr-4Mo-2Ni	Bar	SA-479	...	S44800	...
36	29Cr-4Mo-2Ni	Plate	SA-240	...	S44800	...
37	29Cr-4Mo-2Ni	Smls. & wld. tube	SA-268	29-4-2	S44800	...
38	29Cr-4Mo-Ti	Smls. & wld. tube	SA-268	...	S44735	...
39	Mn- $\frac{1}{4}$ Mo	Forgings	SA-372	D	K14508	...
40	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2	J13005	A
41	Mn- $\frac{1}{4}$ Mo-V	Castings	SA-487	2	J13005	B
42	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	A	K12021	...
43	Mn- $\frac{1}{2}$ Mo	Wld. pipe	SA-672	H75	K12021	...
44	Mn- $\frac{1}{2}$ Mo	Plate	SA-302	B	K12022	...
45	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	1

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	...	1000	860	...
2	...	1000	860	...
3	...	1000	860	...
4	...	1070	1000	...
5	...	1070	1000	...
6	...	1170	1070	...
7	...	1310	1170	...
8	...	1170	965	...
9	...	1275	1035	...
10	...	415	275	...
11	...	415	275	...
12	$t \leq 10$	415	310	...
13	...	415	205	...
14	...	415	205	...
15	...	415	205	...
16	...	415	205	...
17	...	...	...	...
18	...	415	240	...
19	...	485	275	...
20	≤ 5	585	450	...
21	≤ 5	585	450	...
22	≤ 5	585	450	...
23	...	485	275	...
24	...	415	240	...
25	...	450	275	...
26	...	450	275	...
27	...	450	275	...
28	...	...	...	...
29	...	...	...	...
30	...	470	310	...
31	...	470	310	...
32	...	485	380	...
33	...	550	415	...
34	...	550	415	...
35	...	485	380	...
36	...	550	415	...
37	...	550	415	...
38	...	515	415	...
39	...	725	450	...
40	...	585	365	...
41	...	620	450	...
42	...	515	310	...
43	...	515	310	...
44	...	550	345	...
45	...	550	345	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	862	822	795	780	768	757	747	737	728	719
2	862	822	795	780	768	757	747	737	728	719
3	862	822	795	780	768	757	747	737	728	719
4	1000	953	923	905	891	878	866	855	844	834
5	1000	953	923	905	891	878	866	855	844	834
6	1069	1019	987	968	952	939	926	914	902	892
7	1172	1117	1082	1061	1044	1029	1015	1002	989	978
8	965	...	...	...	...	...	...	...	...	...
9	1030	...	...	...	...	...	...	...	...	...
10	276	252	238	230	223	218	213	209	204	200
11	276	252	238	230	223	218	213	209	204	200
12	310	283	268	259	251	245	239	235	229	225
13	207	189	176	168	162	156	152	148	145	143
14	207	189	176	168	162	156	152	148	145	143
15	207	189	176	168	162	156	152	148	145	143
16	207	189	176	168	162	156	152	148	145	143
17	...	...	...	...	...	...	...	...	...	...
18	241	221	206	197	189	182	177	172	169	167
19	276	252	236	225	215	208	202	197	193	191
20	448	418	399	387	377	368	362	356	351	347
21	448	418	399	387	377	368	362	356	351	347
22	448	418	399	387	377	368	362	356	351	347
23	276	252	236	225	215	208	202	197	193	191
24	241	222	206	197	190	183	178	174	172	170
25	276	253	235	225	215	208	203	199	196	194
26	276	253	235	225	215	208	203	199	196	194
27	276	253	235	225	215	208	203	199	196	194
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	310	287	269	257	247	238	230	222	216	212
31	310	287	269	257	247	238	230	222	216	212
32	379	351	330	318	308	300	295	290	288	286
33	414	382	360	347	336	327	321	316	314	312
34	414	382	360	347	336	327	321	316	314	312
35	379	338	311	294	280	267	256	247	239	233
36	414	369	339	321	305	291	279	269	261	254
37	414	369	339	321	305	291	279	269	261	254
38	414	369	339	321	305	291	279	269	261	254
39	448	433	422	416	411	407	404	403	402	400
40	365	353	346	340	332	323	313	304	295	289
41	448	433	424	416	407	396	384	372	362	354
42	310	299	290	286	282	278	275	272	269	266
43	310	299	290	286	282	278	275	272	269	266
44	345	332	323	318	314	309	305	302	299	296
45	345	332	323	318	314	309	305	302	299	296

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	710	701	690	681	666	653	635	610	575	525
2	710	701	690	681	666	653	635	610	575	525
3	710	701	690	681	666	653	635	610	575	525
4	824	814	801	790	772	757	736	707	668	609
5	824	814	801	790	772	757	736	707	668	609
6	881	870	856	845	825	809	787	756	714	651
7	966	954	939	926	905	887	863	829	782	713
8	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...
10	196	191	187	183	178	173	168	162	155	147
11	196	191	187	183	178	173	168	162	155	147
12	220	215	210	206	200	195	189	182	174	165
13	142	141	140	139	139	137	134	131	126	119
14	142	141	140	139	139	137	134	131	126	119
15	142	141	140	139	139	137	134	131	126	119
16	142	141	140	139	139	137	134	131	126	119
17	...	...	...	...	...	...	...	...	...	...
18	165	164	163	162	161	159	157	...	153	147
19	189	188	187	185	184	182	179	174	167	158
20	344	342	341	340	...	...	...	...	...	...
21	344	342	341	340	...	...	...	...	...	...
22	344	342	341	340	...	...	...	...	...	...
23	189	188	187	185	184	182	179	174	167	158
24	170	170	170	...	...	...	...	...	...	...
25	193	193	193	193	193	193	193	193	193	193
26	193	193	193	193	193	193	193	193	193	193
27	193	193	193	193	193	193	193	193	193	193
28	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...
30	208	206	205	204	...	...	...	...	...	...
31	208	206	205	204	...	...	...	...	...	...
32	285	284	283	279	273	...	...	...	...	...
33	311	310	308	305	298	...	...	...	...	...
34	311	310	308	305	298	...	...	...	...	...
35	229	226	224	223	221	...	...	...	...	...
36	249	247	245	243	241	...	...	...	...	...
37	249	247	245	243	241	...	...	...	...	...
38	249	247	245	243	241	...	...	...	...	...
39	399	396	392	385	377	366	353	339	323	306
40	284	281	278	274	...	...	...	...	...	...
41	348	345	341	336	...	...	...	...	...	...
42	263	260	256	252	247	240	231	220	206	187
43	263	260	256	252	247	240	231	220	206	187
44	292	289	285	280	274	267	257	245	229	208
45	292	289	285	280	274	267	257	245	229	208

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

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

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	2
2	Mn- $\frac{1}{2}$ Mo	Plate	SA-533	A	K12521	3
3	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	1
4	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	2
5	Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni	Plate	SA-533	D	K12529	3
6	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-302	C	K12039	...
7	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	1
8	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	H80	K12039	...
9	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J80	K12539	...
10	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	2
11	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J90	K12539	...
12	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Plate	SA-533	B	K12539	3
13	Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni	Wld. pipe	SA-672	J100	K12539	...
14	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-302	D	K12054	...
15	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	1
16	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	1
17	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	2
18	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	E	K12554	2
19	Mn- $\frac{1}{2}$ Mo- $\frac{3}{4}$ Ni	Plate	SA-533	C	K12554	3
20	Mn- $\frac{1}{2}$ Ni-V	Plate	SA-225	C	K12524	...
21	Mn-V	Castings	SA-487	1	J13002	A
22	Mn-V	Castings	SA-487	1	J13002	B
23	$\frac{1}{2}$ Si- $\frac{1}{2}$ Mo	Smls. pipe	SA-335	P15	K11578	...
24	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	A
25	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	B
26	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Castings	SA-487	4	J13047	E
27	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	1
28	$\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V	Forgings	SA-541	3	K12045	2
29	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...
30	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Plate	SA-517	F	K11576	...
31	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-592	F	K11576	...
32	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo	Smls. & wld. tube	SA-423	2	K11540	...
33	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	1
34	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	1
35	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-508	2	K12766	2
36	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V	Forgings	SA-541	2	K12765	2
37	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	1
38	$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V	Forgings	SA-508	3	K12042	2
39	$\frac{3}{4}$ Ni-1Cu- $\frac{3}{4}$ Cr	Plate	SA-736	A	K12042	3
40	$\frac{3}{4}$ Ni-1Cu- $\frac{3}{4}$ Cr	Plate	SA-736	A	K12042	3
41	$\frac{3}{4}$ Ni-1Mo- $\frac{3}{4}$ Cr	Castings	SA-217	WC5	J22000	...
42	1Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Castings	SA-217	WC4	J12082	...
43	$\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...
44	$\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo	Plate	SA-517	P	K21650	...
45	$\frac{1}{2}$ Ni	Forgings	SA-350	LF5	K13050	1

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	...	620	485	...
2	...	690	570	...
3	...	550	345	...
4	...	620	485	...
5	...	690	570	...
6	...	550	345	...
7	...	550	345	...
8	...	550	345	...
9	...	550	345	...
10	...	620	485	...
11	...	620	485	...
12	...	690	570	...
13	...	690	570	...
14	...	550	345	...
15	...	550	345	...
16	...	550	345	...
17	...	620	485	...
18	...	620	485	...
19	...	690	570	...
20	...	725	485	...
21	...	585	380	...
22	...	620	450	...
23	...	415	205	...
24	...	620	415	...
25	...	725	585	...
26	...	795	655	...
27	...	550	345	...
28	...	620	450	...
29	$65 < t \leq 100$	725	620	...
30	≤ 65	795	690	...
31	≤ 65	795	690	...
32	...	415	255	...
33	...	550	345	...
34	...	550	345	...
35	...	620	450	...
36	...	620	450	...
37	...	550	345	...
38	...	620	450	...
39	$50 < t \leq 100$	515	450	...
40	≤ 50	585	515	...
41	...	485	275	...
42	...	485	275	...
43	$65 < t \leq 100$	725	620	...
44	≤ 65	795	690	...
45	...	415	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	483	464	452	445	439	433	428	423	418	414
2	572	551	536	528	520	513	507	501	496	490
3	345	332	323	318	314	309	305	302	299	296
4	483	464	452	445	439	433	428	423	418	414
5	572	551	536	528	520	513	507	501	496	490
6	345	332	323	318	314	309	305	302	299	296
7	345	332	323	318	314	309	305	302	299	296
8	345	332	323	318	314	309	305	302	299	296
9	345	332	323	318	314	309	305	302	299	296
10	483	464	452	445	439	433	428	423	418	414
11	483	464	452	445	439	433	428	423	418	414
12	572	551	536	528	520	513	507	501	496	490
13	572	551	536	528	520	513	507	501	496	490
14	345	332	323	318	314	309	305	302	299	296
15	345	332	323	318	314	309	305	302	299	296
16	345	332	323	318	314	309	305	302	299	296
17	483	464	452	445	439	433	428	423	418	414
18	483	464	452	445	439	433	428	423	418	414
19	572	551	536	528	520	513	507	501	496	490
20	483	448	438	434	430	423	414	403	391	379
21	379	...	...	...	...	...	...	...	...	...
22	448	...	...	...	...	...	...	...	...	...
23	207	199	194	191	188	186	183	181	179	177
24	414	405	390	381	375	371	368	365	360	353
25	586	573	553	540	531	525	521	517	511	501
26	655	641	618	604	594	587	583	578	571	559
27	345	332	323	318	314	309	305	302	299	296
28	448	435	425	419	415	411	407	404	401	398
29	621	604	591	581	573	566	559	553	546	540
30	689	670	656	646	637	629	621	614	607	600
31	689	670	656	646	637	629	621	614	607	600
32	255	...	...	...	...	...	...	...	...	...
33	345	332	323	318	314	309	305	302	299	296
34	345	332	323	318	314	309	305	302	299	296
35	448	431	420	413	407	402	397	393	388	384
36	448	431	420	413	407	402	397	393	388	384
37	345	332	323	318	314	309	305	302	299	296
38	448	431	420	413	407	402	397	393	388	384
39	448	433	420	413	406	399	392	385	380	375
40	517	499	485	476	468	460	452	444	438	433
41	276	265	258	255	251	248	245	242	239	236
42	276	265	258	255	251	248	245	242	239	236
43	621	604	591	581	573	566	559	553	546	540
44	689	670	656	646	637	629	621	614	607	600
45	207	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	409	404	398	392	384	374	361	343	321	291
2	485	479	473	465	455	443	427	407	380	345
3	292	289	285	280	274	267	257	245	229	208
4	409	404	398	392	384	374	361	343	321	291
5	485	479	473	465	455	443	427	407	380	345
6	292	289	285	280	274	267	257	245	229	208
7	292	289	285	280	274	267	257	245	229	208
8	292	289	285	280	274	267	257	245	229	208
9	292	289	285	280	274	267	257	245	229	208
10	409	404	398	392	384	374	361	343	321	291
11	409	404	398	392	384	374	361	343	321	291
12	485	479	473	465	455	443	427	407	380	345
13	485	479	473	465	455	443	427	407	380	345
14	292	289	285	280	274	267	257	245	229	208
15	292	289	285	280	274	267	257	245	229	208
16	292	289	285	280	274	267	257	245	229	208
17	409	404	398	392	384	374	361	343	321	291
18	409	404	398	392	384	374	361	343	321	291
19	485	479	473	465	455	443	427	407	380	345
20	368	358	350	343	335	323	310	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	175	173	171	168	165	160	154	147	138	125
24	343	330	318	307	...	...	...	...	...	...
25	486	468	449	435	...	...	...	...	...	...
26	543	523	503	486	...	...	...	...	...	...
27	292	289	285	280	274	267	257	245	229	208
28	395	393	389	385	381	375	369	362	352	341
29	534	528	521	514	505	494	481	466	447	423
30	594	587	579	571	561	549	534	517	496	470
31	594	587	579	571	561	549	534	517	496	470
32	...	...	...	...	...	...	...	...	...	...
33	292	289	285	280	274	267	257	245	229	208
34	292	289	285	280	274	267	257	245	229	208
35	380	375	370	364	357	347	335	319	298	270
36	380	375	370	364	357	347	335	319	298	270
37	292	289	285	280	274	267	257	245	229	208
38	380	375	370	364	357	347	335	319	298	270
39	371	365	357	...	...	...	...	...	...	...
40	428	422	412	...	...	...	...	...	...	...
41	234	231	228	224	219	213	206	196	183	166
42	234	231	228	224	219	213	206	196	183	166
43	534	528	521	514	505	494	481	466	447	423
44	594	587	579	571	561	549	534	517	496	470
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	1 $\frac{1}{2}$ Ni	Forgings	SA-350	LF5	K13050	2
2	1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-320	L43	G43400	...
3	1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Forgings	SA-372	L	K24055	...
4	1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340	G43400	...
5	1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-574	4340	G43400	...
6	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	5
7	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	5
8	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	4
9	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	3
(25) 10	Alloy steel	Bolting	SA/ISO 898-1	10.9	...	...
(25) 11	Alloy steel	Bolting	SA/ISO 898-1	12.9	...	...
12	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	2
13	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo	Bolting	SA-540	B23	H43400	1
14	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	5
15	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	5
16	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	4
17	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	3
18	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	2
19	2Ni- $\frac{3}{4}$ Cr- $\frac{1}{3}$ Mo	Bolting	SA-540	B24	K24064	1
20	2Ni-1Cu	Forgings	SA-182	FR	K22035	...
21	2Ni-1Cu	Fittings	SA-234	WPR	K22035	...
22	2Ni-1Cu	Smls. & wld. pipe	SA-333	9	K22035	...
23	2Ni-1Cu	Tube	SA-334	9	K22035	...
24	2Ni-1Cu	Forgings	SA-350	LF9	K22036	...
25	2Ni-1Cu	Smls. & wld. fittings	SA-420	WPL9	K22035	...
(25) 26	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N	K23550	100
27	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	1
(25) 28	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-372	N	K23550	120
29	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	2
30	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	2a
31	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	3
32	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	4
33	2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V	Forgings	SA-723	1	K23550	5
34	2 $\frac{1}{2}$ Ni	Pipe	SA-333	7	K21903	...
35	2 $\frac{1}{2}$ Ni	Tube	SA-334	7	K21903	...
36	2 $\frac{1}{2}$ Ni	Plate	SA-203	A	K21703	...
37	2 $\frac{1}{2}$ Ni	Plate	SA-203	B	K22103	...
38	2 $\frac{1}{2}$ Ni	Castings	SA-352	LC2	J22500	...
39	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	...	3
40	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	...	1
41	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo	Plate	SA-543	C	...	2
(25) 42	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-372	P	K34035	100
43	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2	K34035	1
(25) 44	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-372	P	K34035	120
45	2 $\frac{3}{4}$ Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V	Forgings	SA-723	2	K34035	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	260	...
2	≤100	860	725	...
3	...	1070	930	...
4	≥16	1170	930	...
5	≤13	1240	965	...
6	150 < t ≤ 240	795	690	...
7	≤150	825	725	...
8	≤240	930	825	...
9	≤240	1000	895	...
10	...	1040	940	...
11	...	1220	1100	...
12	≤240	1070	965	...
13	≤200	1140	1035	...
14	150 < t ≤ 240	795	690	...
15	≤150	825	725	...
16	≤240	930	825	...
17	≤240	1000	895	...
18	≤240	1070	965	...
19	≤200	1140	1035	...
20	...	435	315	...
21	...	435	315	...
22	...	435	315	...
23	...	435	315	...
24	...	435	315	...
25	...	435	315	...
26	...	795	690	...
27	...	795	690	...
28	...	930	825	...
29	...	930	825	...
30	...	1000	895	...
31	...	1070	965	...
32	...	1205	1105	...
33	...	1310	1240	...
34	...	450	240	...
35	...	450	240	...
36	...	450	255	...
37	...	485	275	...
38	...	485	275	...
39	...	620	485	...
40	...	725	585	...
41	...	795	690	...
42	...	795	690	...
43	...	795	690	...
44	...	930	825	...
45	...	930	825	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	259	...	...	...	...	...	...	...	...	...
2	724	702	679	669	659	647	635	624	615	603
3	931	911	891	879	869	862	856	851	846	840
4	931	911	890	879	870	863	857	851	846	840
5	965	945	923	912	903	895	888	883	877	871
6	689	675	659	651	644	639	634	630	626	622
7	724	709	692	684	677	671	666	662	658	654
8	827	810	791	781	773	767	761	757	752	747
9	896	878	857	846	838	831	825	820	814	809
10	940	922	901	888	880	...	...	...	...	...
11	1100	1079	1054	1040	1030	...	...	...	...	...
12	965	945	923	912	903	895	888	883	877	871
13	1030	1010	989	977	967	959	952	946	940	934
14	689	675	659	651	644	639	634	630	626	622
15	724	709	692	684	677	671	666	662	658	654
16	827	810	791	781	773	767	761	757	752	747
17	896	878	857	846	838	831	825	820	814	809
18	965	945	923	912	903	895	888	883	877	871
19	1030	1010	989	977	967	959	952	946	940	934
20	317	...	...	...	...	...	...	...	...	...
21	317	...	...	...	...	...	...	...	...	...
22	317	...	...	...	...	...	...	...	...	...
23	317	...	...	...	...	...	...	...	...	...
24	317	...	...	...	...	...	...	...	...	...
25	317	...	...	...	...	...	...	...	...	...
26	689	673	660	651	644	639	634	630	626	622
27	689	673	660	651	644	639	634	630	626	622
28	827	807	792	782	773	767	761	757	752	747
29	827	807	792	782	773	767	761	757	752	747
30	896	874	857	847	838	831	825	820	815	809
31	965	942	923	912	903	895	888	883	877	871
32	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
33	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
34	241	227	220	216	213	210	207	203	198	192
35	241	227	220	216	213	210	207	203	198	192
36	255	240	233	228	225	222	219	214	209	203
37	276	259	251	247	244	241	237	232	227	220
38	276	259	251	247	244	241	237	232	227	220
39	483	464	453	446	440	436	432	428	425	421
40	586	564	550	541	534	528	523	519	515	511
41	689	664	647	636	628	622	616	611	607	602
42	689	673	660	651	644	639	634	630	626	622
43	689	673	660	651	644	639	634	630	626	622
44	827	807	792	782	773	767	761	757	752	747
45	827	807	792	782	773	767	761	757	752	747

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	...	...	...	...	...	...	...	...	...	...
2	590	576	562	543	...	...	...	...	...	...
3	833	824	812	798	781	760	738	714	690	667
4	833	824	812	798	781	761	738	714	689	667
5	864	855	842	828	810	789	766	740	715	692
6	617	610	602	591	579	564	546	528	511	494
7	648	641	632	621	607	591	574	555	536	519
8	740	732	722	709	694	676	656	634	613	593
9	802	793	782	769	752	732	711	687	664	642
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...
12	864	855	842	828	810	789	766	740	715	692
13	926	915	902	887	868	845	820	793	766	741
14	617	610	602	591	579	564	546	528	511	494
15	648	641	632	621	607	591	574	555	536	519
16	740	732	722	709	694	676	656	634	613	593
17	802	793	782	769	752	732	711	687	664	642
18	864	855	842	828	810	789	766	740	715	692
19	926	915	902	887	868	845	820	793	766	741
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
26	617	610	601	591	578	563	559	551	540	530
27	617	610	601	591	578	563	559	551	540	530
28	740	733	722	709	694	676	670	660	648	637
29	740	733	722	709	694	676	670	660	648	637
30	802	793	782	768	752	732	...	...	...	...
31	864	855	842	828	810	788	782	771	756	743
32	987	976	963	946	925	901	894	881	864	849
33	1110	1100	1080	1060	1040	1010	1010	990	972	955
34	186	178	170	161	152	142	133	123	114	105
35	186	178	170	161	152	142	133	123	114	105
36	196	189	180	170	161	150	140	130	120	111
37	212	204	195	185	174	163	152	140	130	120
38	212	204	195	185	174	163	152	140	130	120
39	418	413	409	404	397	388	378	366	352	336
40	507	502	497	490	482	472	459	445	428	407
41	596	591	584	576	566	554	541	523	503	479
42	617	610	601	591	578	563	559	551	540	530
43	617	610	601	591	578	563	559	551	540	530
44	740	733	722	709	694	676	670	660	648	637
45	740	733	722	709	694	676	670	660	648	637

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	2a
2	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	3
3	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	4
4	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	2	K34035	5
5	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	3
6	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-372	M	K42365	85
7	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	1
8	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-508	5	K42365	2
9	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Plate	SA-543	B	K42339	2
10	$3\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	Forgings	SA-372	M	K42365	100
11	$3\frac{1}{2}\text{Ni}$	Pipe	SA-333	3	K31918	...
12	$3\frac{1}{2}\text{Ni}$	Tube	SA-334	3	K31918	...
13	$3\frac{1}{2}\text{Ni}$	Fittings	SA-420	WPL3	...	...
14	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	D	K31718	...
15	$3\frac{1}{2}\text{Ni}$	Forgings	SA-350	LF3	K32025	...
16	$3\frac{1}{2}\text{Ni}$	Forgings	SA-765	III	K32026	...
17	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	E	K32018	...
18	$3\frac{1}{2}\text{Ni}$	Castings	SA-352	LC3	J31550	...
19	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	F	...	...
20	$3\frac{1}{2}\text{Ni}$	Plate	SA-203	F	...	...
(25)	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17	...	A
(25)	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17	...	A
(25)	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17	...	A
(25)	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	Castings	SA-487	17	...	A
25	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N	K22375	3
26	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	4N	K42343	3
27	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N	K22375	1
28	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	5	K42348	1
29	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-508	4N	K22375	2
30	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	4N	K42343	2
31	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-541	5	K42348	2
32	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	1
33	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	2
34	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	2a
35	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	3
36	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	4
37	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	Forgings	SA-723	3	K44045	5
38	$5\text{Ni}-\frac{1}{4}\text{Mo}$	Plate	SA-645	A	K41583	...
39	7Ni	Plate	SA-553	III	K61365	...
40	8Ni	Forgings	SA-522	II	K71340	...
41	8Ni	Plate	SA-553	II	K71340	...
42	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	NNT640
43	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	QT640
44	9Ni	Plate	SA/EN 10028-4	X7Ni9	...	QT
45	9Ni	Plate	SA/EN 10028-4	X8Ni9	...	QT680

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	...	1000	895	...
2	...	1070	965	...
3	...	1205	1105	...
4	...	1310	1240	...
5	...	620	485	...
6	...	725	585	...
7	...	725	585	...
8	...	795	690	...
9	...	795	690	...
10	...	825	690	...
11	...	450	240	...
12	...	450	240	...
13	...	450	240	...
14	...	450	255	...
15	...	485	260	...
16	...	485	260	...
17	...	485	275	...
18	...	485	275	...
19	>50	515	345	...
20	≤50	550	380	...
21	300 < t ≤ 360	705	605	...
22	200 < t ≤ 300	730	625	...
23	150 < t ≤ 200	760	650	...
24	≤150	780	670	...
25	...	620	485	...
26	...	620	485	...
27	...	725	585	...
28	...	725	585	...
29	...	795	690	...
30	...	795	690	...
31	...	795	690	...
32	...	795	690	...
33	...	930	825	...
34	...	1000	895	...
35	...	1070	965	...
36	...	1205	1105	...
37	...	1310	1240	...
38	...	655	450	...
39	≤50	690	585	...
40	...	690	515	...
41	...	690	585	...
42	≤50	640	480	...
43	≤50	640	480	...
44	≤50	680	575	...
45	≤50	680	575	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	896	874	857	847	838	831	825	820	815	809
2	965	942	923	912	903	895	888	883	877	871
3	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
4	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
5	483	464	453	446	440	436	432	428	425	421
6	586	564	549	541	534	529	524	519	515	511
7	586	564	550	541	534	528	523	519	515	511
8	690	663	646	637	629	622	616	611	606	602
9	689	664	647	636	628	622	616	611	607	602
10	690	663	646	637	629	622	616	611	606	602
11	241	227	220	216	213	210	207	203	198	192
12	241	227	220	216	213	210	207	203	198	192
13	241	227	220	216	213	210	207	203	198	192
14	255	240	233	228	225	222	219	214	209	203
15	259	244	235	232	229	225	221	217	212	206
16	259	244	235	232	229	225	221	217	212	206
17	276	259	251	247	244	241	237	232	227	220
18	276	259	251	247	244	241	237	232	227	220
19	345	324	314	309	305	300	295	290	283	275
20	379	357	346	340	335	330	325	319	311	302
21	607	...	...	...	...	...	...	...	...	...
22	627	...	...	...	...	...	...	...	...	...
23	648	...	...	...	...	...	...	...	...	...
24	669	...	...	...	...	...	...	...	...	...
25	483	464	453	446	440	436	432	428	425	421
26	483	464	453	446	440	436	432	428	425	421
27	586	564	550	541	534	528	523	519	515	511
28	586	564	550	541	534	528	523	519	515	511
29	689	664	647	636	628	622	616	611	607	602
30	689	664	647	636	628	622	616	611	607	602
31	689	664	647	636	628	622	616	611	607	602
32	689	673	660	651	644	639	634	630	626	622
33	827	807	792	782	773	767	761	757	752	747
34	896	874	857	847	838	831	825	820	815	809
35	965	942	923	912	903	895	888	883	877	871
36	1100	1080	1060	1040	1030	1020	1020	1010	1000	995
37	1240	1210	1190	1170	1160	1150	1140	1140	1130	1120
38	448	...	...	...	...	...	...	...	...	...
39	586	559	...	...	...	...	...	...	...	...
40	517	502	495	483	461	...	...	...	...	...
41	586	569	561	548	522	...	...	...	...	...
42	480	466	459	449	427	...	...	...	...	...
43	480	466	459	449	427	...	...	...	...	...
44	575	558	550	538	512	...	...	...	...	...
45	575	558	550	538	512	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	802	793	782	768	752	732	...	...	...	...
2	864	855	842	828	810	788	782	771	756	743
3	987	976	963	946	925	901	894	881	864	849
4	1110	1100	1080	1060	1040	1010	1010	990	972	955
5	418	413	409	404	397	388	378	366	352	336
6	507	502	497	490	482	472	460	445	428	408
7	507	502	497	490	482	472	459	445	428	407
8	597	591	584	576	567	555	541	524	503	480
9	596	591	584	576	566	554	541	523	503	479
10	597	591	584	576	567	555	541	524	503	480
11	186	178	170	161	152	142	133	123	114	105
12	186	178	170	161	152	142	133	123	114	105
13	186	178	170	161	152	142	133	123	114	105
14	196	189	180	170	161	150	140	130	120	111
15	199	191	182	173	163	152	142	132	122	112
16	199	191	182	173	163	152	142	132	122	112
17	212	204	195	185	174	163	152	140	130	120
18	212	204	195	185	174	163	152	140	130	120
19	265	254	243	230	217	204	189	176	162	150
20	292	280	267	254	239	224	208	193	179	165
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	418	413	409	404	397	388	378	366	352	336
26	418	413	409	404	...	...	...	...	...	...
27	507	502	497	490	482	472	459	445	428	407
28	507	502	497	490	...	...	...	...	...	...
29	596	591	584	576	566	554	541	523	503	479
30	596	591	584	576	...	...	...	...	...	...
31	596	591	584	576	...	...	...	...	...	...
32	617	610	601	591	578	563	559	551	540	530
33	740	733	722	709	694	676	670	660	648	637
34	802	793	782	768	752	732	...	...	...	...
35	864	855	842	828	810	788	782	771	756	743
36	987	976	963	946	925	901	894	881	864	849
37	1110	1100	1080	1060	1040	1010	1010	990	972	955
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)
(25)
(25)
(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	9Ni	Smls. & wld. pipe	SA-333	8	K81340	...
2	9Ni	Smls. & wld. tube	SA-334	8	K81340	...
3	9Ni	Plate	SA-353	...	K81340	...
4	9Ni	Smls. & wld. fittings	SA-420	WPL8	K81340	...
5	9Ni	Forgings	SA-522	I	K81340	...
6	9Ni	Plate	SA-553	I	K81340	...
(25) 7	46Fe-24Ni-21Cr-6Mo-N	Smls. & wld. fittings	SA-403	...	N08367	...
(25) 8	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-182	F62	N08367	...
(25) 9	46Fe-24Ni-21Cr-6Mo-N	Forgings	SA-965	F62	N08367	...
(25) 10	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...
(25) 11	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...
(25) 12	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...
(25) 13	46Fe-24Ni-21Cr-6Mo-N	Plate	SA-240	...	N08367	...
(25) 14	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...
(25) 15	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-276	...	N08367	...
(25) 16	46Fe-24Ni-21Cr-6Mo-N	Bar	SA-479	...	N08367	...
(25) 17	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SA-312	...	N08367	...
(25) 18	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-688	...	N08367	...
(25) 19	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SA-249	...	N08367	...
(25) 20	46Fe-24Ni-21Cr-6Mo-N	Sheet, strip	SA-240	...	N08367	...
(25) 21	46Fe-24Ni-21Cr-6Mo-N	Smls. tube	SA-213	...	N08367	...
22	25Ni-15Cr-2Ti	Bolting	SA-453	660	S66286	A
23	25Ni-15Cr-2Ti	Bolting	SA-453	660	S66286	B
24	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660	S66286	1
25	25Ni-15Cr-2Ti	Forgings, bar	SA-638	660	S66286	2
(25) 26	25Ni-47Fe-21Cr-5Mo	Forgings	SA-182	F700	N08700	...
(25) 27	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SA-240	...	N08700	...
(25) 28	25Ni-47Fe-21Cr-5Mo	Bar	SA-276	...	N08700	...
(25) 29	25Ni-47Fe-21Cr-5Mo	Wld. pipe	SA-358	...	N08700	...
(25) 30	25Ni-47Fe-21Cr-5Mo	Fittings	SA-403	700	N08700	...
(25) 31	25Ni-47Fe-21Cr-5Mo	Bar	SA-479	...	N08700	...
(25) 32	25Ni-47Fe-21Cr-5Mo	Forgings	SA-965	F700	N08700	...
33	27Ni-22Cr-7Mo-Mn-Cu-N	Forgings	SA-182	...	S31277	...
34	27Ni-22Cr-7Mo-Mn-Cu-N	Smls. tube	SA-213	...	S31277	...
35	27Ni-22Cr-7Mo-Mn-Cu-N	Plate	SA-240	...	S31277	...
36	27Ni-22Cr-7Mo-Mn-Cu-N	Wld. tube	SA-249	...	S31277	...
37	29Ni-20Cr-3Cu-2Mo	Castings	SA-351	CN7M	J95150	...
(25) 38	35Ni-35Fe-20Cr-Cb	Forgings	SA-182	F20	N08020	...
(25) 39	35Ni-35Fe-20Cr-Cb	Forgings	SA-965	F20	N08020	...
(25) 40	35Ni-35Fe-20Cr-Cb	Plate	SA-240	...	N08020	...
(25) 41	35Ni-35Fe-20Cr-Cb	Bar	SA-276	Alloy 20	N08020	...
(25) 42	35Ni-35Fe-20Cr-Cb	Bar	SA-479	Alloy 20	N08020	...
(25) 43	35Ni-35Fe-20Cr-Cb	Smls. pipe	SA-312	Alloy 20	N08020	...
(25) 44	35Ni-35Fe-20Cr-Cb	Wld. pipe	SA-312	Alloy 20	N08020	...
(25) 45	35Ni-35Fe-20Cr-Cb	Smls. tube	SA-213	Alloy 20	N08020	...

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	...	690	515	...
2	...	690	515	...
3	...	690	515	...
4	...	690	515	...
5	...	690	515	...
6	...	690	585	...
7	...	655	310	...
8	...	655	310	...
9	...	655	310	...
10	>5	655	310	...
11	>5	655	310	...
12	>5	655	310	...
13	≥5	655	310	...
14	>5	655	310	...
15	...	655	310	...
16	...	655	310	...
17	≤5	690	310	...
18	≤5	690	310	...
19	≤5	690	310	...
20	<5	690	310	...
21	≤5	690	310	...
22	...	895	585	...
23	...	895	585	...
24	...	895	585	...
25	...	895	585	...
26	...	550	240	...
27	...	550	240	...
28	...	550	240	...
29	...	550	240	...
30	...	550	240	...
31	...	550	240	...
32	...	550	240	...
33	...	772	359	...
34	...	772	359	...
35	...	772	359	...
36	...	772	359	...
37	...	425	170	...
38	...	550	240	...
39	...	550	240	...
40	...	550	240	...
41	...	550	240	...
42	...	550	240	...
43	...	550	240	...
44	...	550	240	...
45	...	550	240	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	517	502	495	483	461	...	...	...	...	...
2	517	502	495	483	461	...	...	...	...	...
3	517	502	495	483	461	...	...	...	...	...
4	517	502	495	483	461	...	...	...	...	...
5	517	502	495	483	461	...	...	...	...	...
6	586	569	561	548	522	...	...	...	...	...
7	310	285	268	256	246	236	228	221	215	209
8	310	285	268	256	246	236	228	221	215	209
9	310	285	268	256	246	236	228	221	215	209
10	310	285	268	256	246	236	228	221	215	209
11	310	285	268	256	246	236	228	221	215	209
12	310	285	268	256	246	236	228	221	215	209
13	310	285	268	256	246	236	228	221	215	209
14	310	285	268	256	246	236	228	221	215	209
15	310	285	268	256	246	236	228	221	215	209
16	310	285	268	256	246	236	228	221	215	209
17	310	285	268	256	246	236	228	221	215	209
18	310	285	268	256	246	236	228	221	215	209
19	310	285	268	256	246	236	228	221	215	209
20	310	285	268	256	246	236	228	221	215	209
21	310	285	268	256	246	236	228	221	215	209
22	586	580	573	569	565	562	558	553	549	544
23	586	580	573	569	565	562	558	553	549	544
24	586	580	573	569	565	561	557	553	549	545
25	586	580	573	569	565	561	557	553	549	545
26	241	228	215	205	196	189	184	181	178	176
27	241	228	215	205	196	189	184	181	178	176
28	241	228	215	205	196	189	184	181	178	176
29	241	228	215	205	196	189	184	181	178	176
30	241	228	215	205	196	189	184	181	178	176
31	241	228	215	205	196	189	184	181	178	176
32	241	228	215	205	196	189	184	181	178	176
33	359	348	328	...	314	...	274	...	265	...
34	359	348	328	...	314	...	274	...	265	...
35	359	348	328	...	314	...	274	...	265	...
36	359	348	328	...	314	...	274	...	265	...
37	172	160	147	140	133	128	122	117	113	109
38	241	221	212	208	204	200	196	193	189	186
39	241	221	212	208	204	200	196	193	189	186
40	241	221	212	208	204	200	196	193	189	186
41	241	221	212	208	204	200	196	193	189	186
42	241	221	212	208	204	200	196	193	189	186
43	241	221	212	208	204	200	196	193	189	186
44	241	221	212	208	204	200	196	193	189	186
45	241	221	212	208	204	200	196	193	189	186

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
Ferrous Materials (Cont'd)										
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	204	199	196	192	189	186	184	181	179	...
8	204	199	196	192	189	186	184	181	179	...
9	204	199	196	192	189	186	184	181	179	...
10	204	199	196	192	189	186	184	181	179	...
11	204	199	196	192	189	186	184	181	179	...
12	204	199	196	192	189	186	184	181	179	...
13	204	199	196	192	189	186	184	181	179	...
14	204	199	196	192	189	186	184	181	179	...
15	204	199	196	192	189	186	184	181	179	...
16	204	199	196	192	189	186	184	181	179	...
17	204	199	196	192	189	186	184	181	179	...
18	204	199	196	192	189	186	184	181	179	...
19	204	199	196	192	189	186	184	181	179	...
20	204	199	196	192	189	186	184	181	179	...
21	204	199	196	192	189	186	184	181	179	...
22	540	536	531	526	522	517	511	506	501	495
23	540	536	531	526	522	517	511	506	501	495
24	540	535	531	526	522	517	511	506	501	495
25	540	535	531	526	522	517	511	506	501	495
26	173	168	163	...	...	...	...	...	...	...
27	173	168	163	...	...	...	...	...	...	...
28	173	168	163	...	...	...	...	...	...	...
29	173	168	163	...	...	...	...	...	...	...
30	173	168	163	...	...	...	...	...	...	...
31	173	168	163	...	...	...	...	...	...	...
32	173	168	163	...	...	...	...	...	...	...
33	263	263	262	261	260	258	257	...	...	...
34	263	263	262	261	260	258	257	...	...	...
35	263	263	262	261	260	258	257	...	...	...
36	263	263	262	261	260	258	257	...	...	...
37	106	102	99.2	96.0	...	...	...	...	...	...
38	184	182	180	179	178	174	170	...	...	...
39	184	182	180	179	178	174	170	...	...	...
40	184	182	180	179	178	174	170	...	...	...
41	184	182	180	179	178	174	170	...	...	...
42	184	182	180	179	178	174	170	...	...	...
43	184	182	180	179	178	174	170	...	...	...
44	184	182	180	179	178	174	170	...	...	...
45	184	182	180	179	178	174	170	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
(25) 1	35Ni-35Fe-20Cr-Cb	Wld. tube	SA-249	Alloy 20	N08020	...
(25) 2	35Ni-35Fe-20Cr-Cb	Smls. & wld. fittings	SA-403	...	N08020	...
(25) 3	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11	N08811	...
(25) 4	42Fe-33Ni-21Cr	Smls. tube	SA-213	...	N08811	...
(25) 5	42Fe-33Ni-21Cr	Plate	SA-240	...	N08811	...
(25) 6	42Fe-33Ni-21Cr	Wld. tube	SA-249	...	N08811	...
(25) 7	42Fe-33Ni-21Cr	Bar	SA-276	...	N08811	...
(25) 8	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...	N08811	...
(25) 9	42Fe-33Ni-21Cr	Bar	SA-479	...	N08811	...
(25) 10	42Fe-33Ni-21Cr	Wld. tube	SA-688	...	N08811	...
(25) 11	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11	N08811	...
12	14Cr-16Ni-6Si-Cu-Mo	Smls. tube	SA-213	...	S38815	...
13	14Cr-16Ni-6Si-Cu-Mo	Plate	SA-240	...	S38815	...
14	14Cr-16Ni-6Si-Cu-Mo	Wld. tube	SA-249	...	S38815	...
15	14Cr-16Ni-6Si-Cu-Mo	Wld. pipe	SA-312	...	S38815	...
16	14Cr-16Ni-6Si-Cu-Mo	Smls. & wld. fittings	SA-403	...	S38815	...
17	14Cr-16Ni-6Si-Cu-Mo	Bar	SA-479	...	S38815	...
18	16Cr-4Ni-6Mn	Plate	SA-240	201LN	S20153	...
19	16Cr-9Mn-2Ni-N	Plate	SA-240	204	S20400	...
20	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...
21	16Cr-12Ni-2Mo	Forgings	SA-965	F316L	S31603	...
22	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316L	...	...
23	16Cr-12Ni-2Mo	Forgings	SA-182	F316L	S31603	...
24	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316L	S31603	...
25	16Cr-12Ni-2Mo	Plate	SA-240	316L	S31603	...
26	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316L	S31603	...
27	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316L	S31603	...
28	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	1
29	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	3
30	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316L	S31603	4
31	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316L	S31603	...
32	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316L	S31603	...
33	16Cr-12Ni-2Mo	Bar	SA-479	316L	S31603	Annealed
34	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316L	S31603	...
35	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316L	S31603	...
36	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316L	S31603	...
37	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...
38	16Cr-12Ni-2Mo	Forgings	SA-965	F316	S31600	...
39	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...
40	16Cr-12Ni-2Mo	Forgings	SA-965	F316H	S31609	...
41	16Cr-12Ni-2Mo	Forgings	SA-182	F316	S31600	...
42	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	1
43	16Cr-12Ni-2Mo	Bolting	SA-193	B8MA	S31600	1A
44	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316	S31600	...
45	16Cr-12Ni-2Mo	Plate	SA-240	316	S31600	...

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	...	585	275	...
3	...	450	170	...
4	...	450	170	...
5	...	450	170	...
6	...	450	170	...
7	...	450	170	...
8	...	450	170	...
9	...	450	170	...
10	...	450	170	...
11	...	450	170	...
12	...	540	255	...
13	...	540	255	...
14	...	540	255	...
15	...	540	255	...
16	...	540	255	...
17	...	540	255	...
18	...	655	310	...
19	...	655	330	...
20	>130	450	170	...
21	...	450	170	...
22	...	480	175	...
23	≤130	485	170	...
24	...	485	170	...
25	...	485	170	...
26	...	485	170	...
27	...	485	170	...
28	...	485	170	...
29	...	485	170	...
30	...	485	170	...
31	...	485	170	...
32	...	485	170	...
33	...	485	170	...
34	...	485	170	...
35	...	485	170	...
36	...	485	170	...
37	>130	485	205	...
38	...	485	205	...
39	>130	485	205	...
40	...	485	205	...
41	≤130	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	515	205	...
45	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	241	221	212	208	204	200	196	193	189	186
2	276	253	243	237	233	228	225	221	217	213
3	172	164	157	153	149	145	141	138	134	131
4	172	164	157	153	149	145	141	138	134	131
5	172	164	157	153	149	145	141	138	134	131
6	172	164	157	153	149	145	141	138	134	131
7	172	164	157	153	149	145	141	138	134	131
8	172	164	157	153	149	145	141	138	134	131
9	172	164	157	153	149	145	141	138	134	131
10	172	164	157	153	149	145	141	138	134	131
11	172	164	157	153	149	145	141	138	134	131
12	255	230	212	201	191	183	177	173	170	167
13	255	230	212	201	191	183	177	173	170	167
14	255	230	212	201	191	183	177	173	170	167
15	255	230	212	201	191	183	177	173	170	167
16	255	230	212	201	191	183	177	173	170	167
17	255	230	212	201	191	183	177	173	170	167
18	310	269	246	235	226	220	215	211	208	205
19	331	279	246	225	210	197	186	179	173	169
20	172	157	145	137	131	125	121	118	114	111
21	172	157	145	137	131	125	121	118	114	111
22	172	157	145	137	131	125	121	118	114	111
23	172	157	145	137	131	125	121	118	114	111
24	172	157	145	137	131	125	121	118	114	111
25	172	157	145	137	131	125	121	118	114	111
26	172	157	145	137	131	125	121	118	114	111
27	172	157	145	137	131	125	121	118	114	111
28	172	157	145	137	131	125	121	118	114	111
29	172	157	145	137	131	125	121	118	114	111
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	207	189	176	168	161	154	148	144	139	136
38	207	189	176	168	161	154	148	144	139	136
39	207	189	176	168	161	154	148	144	139	136
40	207	189	176	168	161	154	148	144	139	136
41	207	189	176	168	161	154	148	144	139	136
42	207	192	176	168	161	155	149	144	139	136
43	207	192	176	168	161	155	149	144	139	136
44	207	189	176	168	161	154	148	144	139	136
45	207	189	176	168	161	154	148	144	139	136

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	184	182	180	179	178	174	170	...	...	...
2	210	208	207	205	203	199	195	...	...	...
3	128	125	123	120	118	115	113	112	110	108
4	128	125	123	120	118	115	113	112	110	108
5	128	125	123	120	118	115	113	112	110	108
6	128	125	123	120	118	115	113	112	110	108
7	128	125	123	120	118	115	113	112	110	108
8	128	125	123	120	118	115	113	112	110	108
9	128	125	123	120	118	115	113	112	110	108
10	128	125	123	120	118	115	113	112	110	108
11	128	125	123	120	118	115	113	112	110	108
12	166	166	166	166	166	166	166	...	...	...
13	166	166	166	166	166	166	166	...	...	...
14	166	166	166	166	166	166	166	...	...	...
15	166	166	166	166	166	166	166	...	...	...
16	166	166	166	166	166	166	166	...	...	...
17	166	166	166	166	166	166	166	...	...	...
18	201	196	191	185	179	173	168	164	162	162
19	166	163	162	160	159	157	154	150	144	136
20	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
21	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
22	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
23	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
24	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
25	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
26	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
27	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
28	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
29	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
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	132	129	127	125	123	122	121	120	118	117
38	132	129	127	125	123	122	121	120	118	117
39	132	129	127	125	123	122	121	120	118	117
40	132	129	127	125	123	122	121	120	118	117
41	132	129	127	125	123	122	121	120	118	117
42	132	129	127	125	123	122	121	120	118	117
43	132	129	127	125	123	122	121	120	118	117
44	132	129	127	125	123	122	121	120	118	117
45	132	129	127	125	123	122	121	120	118	117

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
3	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
4	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
5	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
6	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
7	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
8	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
9	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
10	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
11	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
21	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
24	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
25	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
26	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
27	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
28	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
29	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
30	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
31	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
32	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
33	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
34	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
35	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
36	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
37	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
38	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
42	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
43	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
44	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
45	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316	S31600	...
2	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316	S31600	...
3	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	1
4	16Cr-12Ni-2Mo	Bolting	SA-320	B8MA	S31600	1A
5	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	1
6	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	3
7	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316	S31600	4
8	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316	S31600	...
9	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316	S31600	...
10	16Cr-12Ni-2Mo	Wld. pipe	SA-409	TP316	S31600	...
11	16Cr-12Ni-2Mo	Bar	SA-479	316	S31600	Annealed
12	16Cr-12Ni-2Mo	Wld. tube	SA-688	TP316	S31600	...
13	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316	S31600	...
14	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316	S31600	...
15	16Cr-12Ni-2Mo	Bar	SA/JIS G4303	SUS316	...	...
16	16Cr-12Ni-2Mo	Forgings	SA-182	F316H	S31609	...
17	16Cr-12Ni-2Mo	Smls. tube	SA-213	TP316H	S31609	...
18	16Cr-12Ni-2Mo	Plate	SA-240	316H	S31609	...
19	16Cr-12Ni-2Mo	Wld. tube	SA-249	TP316H	S31609	...
20	16Cr-12Ni-2Mo	Smls. & wld. pipe	SA-312	TP316H	S31609	...
21	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	1
22	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	3
23	16Cr-12Ni-2Mo	Wld. pipe	SA-358	316H	S31609	4
24	16Cr-12Ni-2Mo	Smls. pipe	SA-376	TP316H	S31609	...
25	16Cr-12Ni-2Mo	Smls. & wld. fittings	SA-403	316H	S31609	...
26	16Cr-12Ni-2Mo	Bar	SA-479	316H	S31609	...
27	16Cr-12Ni-2Mo	Wld. pipe	SA-813	TP316H	S31609	...
28	16Cr-12Ni-2Mo	Wld. pipe	SA-814	TP316H	S31609	...
29	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X2CrNiMo17-12-2	...	...
30	16Cr-12Ni-2Mo	Plate	SA/EN 10028-7	X5CrNiMo17-12-2	...	...
31	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B
32	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	S
33	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2
34	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2
35	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B
36	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	S
37	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	B
38	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2
39	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2
40	16Cr-12Ni-2Mo	Bolting	SA-193	B8M2	S31600	2B
41	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	S
42	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	B
43	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2
44	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2
45	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	B

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	...	515	205	...
14	...	515	205	...
15	...	520	205	...
16	≤130	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	≤75	520	220	...
30	≤75	520	220	...
31	64 < t ≤ 72	550	380	...
32	64 < t ≤ 75	550	380	...
33	30 < t ≤ 36	620	345	...
34	32 < t ≤ 40	620	345	...
35	48 < t ≤ 64	620	450	...
36	50 < t ≤ 64	620	450	...
37	38 < t ≤ 44	655	310	...
38	24 < t ≤ 30	655	450	...
39	25 < t ≤ 32	655	450	...
40	≤48	655	515	...
41	≤50	655	515	...
42	32 < t ≤ 38	690	345	...
43	20 < t ≤ 24	690	550	...
44	20 < t ≤ 25	690	550	...
45	25 < t ≤ 32	725	450	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	189	176	168	161	154	148	144	139	136
2	207	189	176	168	161	154	148	144	139	136
3	207	192	176	168	161	155	149	144	139	136
4	207	192	176	168	161	155	149	144	139	136
5	207	189	176	168	161	154	148	144	139	136
6	207	189	176	168	161	154	148	144	139	136
7	207	189	176	168	161	154	148	144	139	136
8	207	189	176	168	161	154	148	144	139	136
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	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	220	199	185	176	168	161	155	150	145	142
30	220	201	187	179	171	164	158	153	148	144
31	379	368	354	345	336	329	322	317	313	311
32	379	368	354	345	336	328	322	317	313	311
33	345	334	322	313	306	299	293	288	285	283
34	345	334	322	313	306	299	293	288	285	283
35	448	435	418	408	397	388	380	374	370	367
36	448	435	418	408	397	388	380	374	370	367
37	310	301	290	282	275	268	263	259	256	254
38	448	435	418	408	397	388	380	374	370	367
39	448	435	418	408	397	388	380	374	370	367
40	517	502	483	470	458	447	438	432	427	423
41	517	502	483	470	458	447	438	432	427	423
42	345	334	322	313	306	299	293	288	285	283
43	552	509	472	460	451	434	414	397	383	374
44	552	509	472	460	451	434	414	397	383	374
45	448	435	418	408	397	388	380	374	370	367

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	132	129	127	125	123	122	121	120	118	117
2	132	129	127	125	123	122	121	120	118	117
3	132	129	127	125	123	122	121	120	118	117
4	132	129	127	125	123	122	121	120	118	117
5	132	129	127	125	123	122	121	120	118	117
6	132	129	127	125	123	122	121	120	118	117
7	132	129	127	125	123	122	121	120	118	117
8	132	129	127	125	123	122	121	120	118	117
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
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
23	132	129	127	125	123	122	121	120	118	117
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	139	136	134	132	129	127	125	122	120	117
30	141	138	135	133	131	130	128	127	126	125
31	308	305	301	297	294	290	287	283	279	276
32	308	305	...	...	...	...	...	...	...	...
33	280	277	274	270	267	264	261	257	254	251
34	280	277	274	270	267	264	261	257	254	251
35	364	360	356	351	347	343	339	335	330	325
36	364	360	...	...	...	...	...	...	...	...
37	252	249	...	...	...	...	...	...	...	...
38	364	360	356	351	347	343	339	335	330	325
39	364	360	356	351	347	343	339	335	330	325
40	419	416	411	405	400	396	391	386	381	376
41	419	416	...	...	...	...	...	...	...	...
42	280	277	...	...	...	...	...	...	...	...
43	364	350	338	333	329	325	322	319	316	314
44	364	350	338	333	329	325	322	319	316	314
45	364	360	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
2	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
3	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
4	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
5	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
6	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
7	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
8	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
9	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
10	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
11	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
12	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
13	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
14	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	16Cr-12Ni-2Mo	Bolting	SA-193	B8M	S31600	2
2	16Cr-12Ni-2Mo	Bolting	SA-320	B8M	S31600	2
3	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	B
4	16Cr-12Ni-2Mo	Bar	SA-276	316	S31600	B
5	16Cr-12Ni-2Mo-Cb	Plate	SA-240	316Cb	S31640	...
6	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...
7	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316LN	S31653	...
8	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316LN	S31653	...
9	16Cr-12Ni-2Mo-N	Bolting	SA-193	B8MNA	S31651	1A
10	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316LN	S31653	...
11	16Cr-12Ni-2Mo-N	Plate	SA-240	316LN	S31653	...
12	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316LN	S31653	...
13	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316LN	S31653	...
14	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	1
15	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	3
16	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316LN	S31653	4
17	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316LN	S31653	...
18	16Cr-12Ni-2Mo-N	Fittings	SA-403	316LN	S31653	...
19	16Cr-12Ni-2Mo-N	Bar	SA-479	316LN	S31653	...
20	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316LN	S31653	...
21	16Cr-12Ni-2Mo-N	Forgings	SA-182	F316N	S31651	...
22	16Cr-12Ni-2Mo-N	Smls. tube	SA-213	TP316N	S31651	...
23	16Cr-12Ni-2Mo-N	Plate	SA-240	316N	S31651	...
24	16Cr-12Ni-2Mo-N	Wld. tube	SA-249	TP316N	S31651	...
25	16Cr-12Ni-2Mo-N	Smls. & wld. pipe	SA-312	TP316N	S31651	...
26	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	1
27	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	3
28	16Cr-12Ni-2Mo-N	Wld. pipe	SA-358	316N	S31651	4
29	16Cr-12Ni-2Mo-N	Smls. pipe	SA-376	TP316N	S31651	...
30	16Cr-12Ni-2Mo-N	Smls. & wld. fittings	SA-403	316N	S31651	...
31	16Cr-12Ni-2Mo-N	Bar	SA-479	316N	S31651	...
32	16Cr-12Ni-2Mo-N	Wld. tube	SA-688	TP316N	S31651	...
33	16Cr-12Ni-2Mo-N	Wld. pipe	SA-813	TP316N	S31651	...
34	16Cr-12Ni-2Mo-N	Wld. pipe	SA-814	TP316N	S31651	...
35	16Cr-12Ni-2Mo-N	Forgings	SA-965	F316N	S31651	...
36	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-11-2	...	...
37	16Cr-12Ni-2Mo-N	Plate	SA/EN 10028-7	X2CrNiMoN17-13-3	...	...
38	16Cr-12Ni-2Mo-Ti	Smls. tube	SA-213	TP316Ti	S31635	...
39	16Cr-12Ni-2Mo-Ti	Plate	SA-240	316Ti	S31635	...
40	16Cr-12Ni-2Mo-Ti	Smls. & wld. pipe	SA-312	TP316Ti	S31635	...
(25) 41	...	Plate	SA/EN 10088-2	X6CrNiMoTi17-12-2	...	...
42	17Cr-4Ni-6Mn	Plate	SA-240	201-1	S20100	...
43	17Cr-4Ni-6Mn	Plate	SA-666	201-1	S20100	...
44	17Cr-4Ni-6Mn	Plate	SA-240	201-2	S20100	...
45	17Cr-4Ni-6Mn	Plate	SA-666	201-2	S20100	...

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	≤ 20	760	655	...
2	≤ 20	760	655	...
3	$19 < t \leq 25$	795	550	...
4	≤ 19	860	690	...
5	...	515	205	...
6	> 130	485	205	...
7	...	485	205	...
8	≤ 130	515	205	...
9	...	515	205	...
10	...	515	205	...
11	...	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	...	550	240	...
22	...	550	240	...
23	...	550	240	...
24	...	550	240	...
25	...	550	240	...
26	...	550	240	...
27	...	550	240	...
28	...	550	240	...
29	...	550	240	...
30	...	550	240	...
31	...	550	240	...
32	...	550	240	...
33	...	550	240	...
34	...	550	240	...
35	...	550	240	...
36	≤ 75	580	280	...
37	≤ 75	580	280	...
38	...	515	205	...
39	...	515	205	...
40	...	515	205	...
41	$t \leq 8$	540	240	...
42	...	515	260	...
43	...	515	260	...
44	...	655	310	...
45	...	655	310	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	655	597	537	509	489	471	454	440	428	418
2	655	597	537	509	489	471	454	440	428	418
3	552	535	515	501	489	477	468	460	455	451
4	689	669	643	627	611	596	584	576	570	564
5	207	193	180	172	164	156	149	143	138	134
6	207	187	174	165	158	151	146	141	136	132
7	207	187	174	165	158	151	146	141	136	132
8	207	187	174	165	158	151	146	141	136	132
9	207	192	182	175	168	162	157	152	148	144
10	207	187	174	165	158	151	146	141	136	132
11	207	187	174	165	158	151	146	141	136	132
12	207	187	174	165	158	151	146	141	136	132
13	207	187	174	165	158	151	146	141	136	132
14	207	187	174	165	158	151	146	141	136	132
15	207	187	174	165	158	151	146	141	136	132
16	207	187	174	165	158	151	146	141	136	132
17	207	187	174	165	158	151	146	141	136	132
18	207	187	174	165	158	151	146	141	136	132
19	207	187	174	165	158	151	146	141	136	132
20	207	187	174	165	158	151	146	141	136	132
21	241	224	212	204	196	189	183	177	172	168
22	241	224	212	204	196	189	183	177	172	168
23	241	224	212	204	196	189	183	177	172	168
24	241	224	212	204	196	189	183	177	172	168
25	241	224	212	204	196	189	183	177	172	168
26	241	224	212	204	196	189	183	177	172	168
27	241	224	212	204	196	189	183	177	172	168
28	241	224	212	204	196	189	183	177	172	168
29	241	224	212	204	196	189	183	177	172	168
30	241	224	212	204	196	189	183	177	172	168
31	241	224	212	204	196	189	183	177	172	168
32	241	224	212	204	196	189	183	177	172	168
33	241	224	212	204	196	189	183	177	172	168
34	241	224	212	204	196	189	183	177	172	168
35	241	224	212	204	196	189	183	177	172	168
36	280	253	235	224	214	205	197	190	184	179
37	280	253	235	224	214	205	197	190	184	179
38	207	193	180	172	164	156	149	143	138	134
39	207	193	180	172	164	156	149	143	138	134
40	207	193	180	172	164	156	149	143	138	134
41	241	230	220	212	206	201	194	189	183	180
42	262	220	195	182	172	165	158	151	...	...
43	262	220	195	182	172	165	158	151	...	...
44	310	261	231	215	204	195	187	179	...	...
45	310	261	231	215	204	195	187	179	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	408	399	391	383	375	369	362	356	349	342
2	408	399	391	383	375	369	362	356	349	342
3	448	444	...	...	...	...	...	...	...	...
4	559	555	...	...	...	...	...	...	...	...
5	131	128	126	124	123	121	121	120	120	119
6	128	125	122	119	116	114	111	109	108	106
7	128	125	122	119	116	114	111	109	108	106
8	128	125	122	119	116	114	111	109	108	106
9	141	137	134	131	129	126	124	122	120	118
10	128	125	122	119	116	114	111	109	108	106
11	128	125	122	119	116	114	111	109	108	106
12	128	125	122	119	116	114	111	109	108	106
13	128	125	122	119	116	114	111	109	108	106
14	128	125	122	119	116	114	111	109	108	106
15	128	125	122	119	116	114	111	109	108	106
16	128	125	122	119	116	114	111	109	108	106
17	128	125	122	119	116	114	111	109	108	106
18	128	125	122	119	116	114	111	109	108	106
19	128	125	122	119	116	114	111	109	108	106
20	128	125	122	119	116	114	111	109	108	106
21	164	160	156	153	150	147	145	142	140	137
22	164	160	156	153	150	147	145	142	140	137
23	164	160	156	153	150	147	145	142	140	137
24	164	160	156	153	150	147	145	142	140	137
25	164	160	156	153	150	147	145	142	140	137
26	164	160	156	153	150	147	145	142	140	137
27	164	160	156	153	150	147	145	142	140	137
28	164	160	156	153	150	147	145	142	140	137
29	164	160	156	153	150	147	145	142	140	137
30	164	160	156	153	150	147	145	142	140	137
31	164	160	156	153	150	147	145	142	140	137
32	164	160	156	153	150	147	145	142	140	137
33	164	160	156	153	150	147	145	142	140	137
34	164	160	156	153	150	147	145	142	140	137
35	164	160	156	153	150	147	145	142	140	137
36	174	169	165	161	158	154	151	...	...	...
37	174	169	165	161	158	154	151	...	...	...
38	131	128	126	124	123	121	121	120	120	119
39	131	128	126	124	123	121	121	120	120	119
40	131	128	126	124	123	121	121	120	120	119
41	175	171	169	166	164	163	162	162	162	162
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	116	115	114	113	112	110	109	107	105	103	101	...	...	...
39	118	116	115	114	113	112	110	109	107	105	103	101	...	...	...
40	118	116	115	114	113	112	110	109	107	105	103	101	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	17Cr-7Ni	Plate, sheet, strip	SA-240	301	S30100	...
2	17.5Cr-17.5Ni-5.3Si	Plate	SA-240	...	S30601	...
3	18Cr-3Ni-12Mn	Plate	SA-240	XM-29	S24000	...
4	18Cr-3Ni-12Mn	Wld. tube	SA-249	XM-29	S24000	...
5	18Cr-3Ni-12Mn	Wld. pipe	SA-312	XM-29	S24000	...
6	18Cr-3Ni-12Mn	Bar	SA-479	XM-29	S24000	...
7	18Cr-3Ni-12Mn	Wld. tube	SA-688	TPXM-29	S24000	...
8	18Cr-5Ni-3Mo	Smls. & wld. tube	SA-789	...	S31500	...
9	18Cr-5Ni-3Mo	Smls. & wld. pipe	SA-790	...	S31500	...
10	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...
11	18Cr-8Ni	Forgings	SA-965	F304L	S30403	...
12	18Cr-8Ni	Bar	SA/JIS G4303	SUS304L	...	...
13	18Cr-8Ni	Forgings	SA-182	F304L	S30403	...
14	18Cr-8Ni	Smls. tube	SA-213	TP304L	S30403	...
15	18Cr-8Ni	Plate	SA-240	304L	S30403	...
16	18Cr-8Ni	Wld. tube	SA-249	TP304L	S30403	...
17	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304L	S30403	...
18	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	1
19	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	3
20	18Cr-8Ni	Wld. pipe	SA-358	304L	S30403	4
21	18Cr-8Ni	Smls. & wld. fittings	SA-403	304L	S30403	...
22	18Cr-8Ni	Wld. pipe	SA-409	TP304L	S30403	...
23	18Cr-8Ni	Bar	SA-479	304L	S30403	Annealed
24	18Cr-8Ni	Wld. tube	SA-688	TP304L	S30403	...
25	18Cr-8Ni	Wld. pipe	SA-813	TP304L	S30403	...
26	18Cr-8Ni	Wld. pipe	SA-814	TP304L	S30403	...
27	18Cr-8Ni	Forgings	SA-182	F304	S30400	...
28	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...
29	18Cr-8Ni	Castings	SA-351	CF3	J92500	...
30	18Cr-8Ni	Castings	SA-351	CF8	J92600	...
31	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...
32	18Cr-8Ni	Cast pipe	SA-451	CPF3	J92500	...
33	18Cr-8Ni	Cast pipe	SA-451	CPF8	J92600	...
34	18Cr-8Ni	Forgings	SA-965	F304	S30400	...
35	18Cr-8Ni	Forgings	SA-965	F304H	S30409	...
36	18Cr-8Ni	Plate	SA/EN 10028-7	X2CrNi18-9	...	...
37	18Cr-8Ni	Forgings	SA-182	F304	S30400	...
38	18Cr-8Ni	Forgings	SA-182	F304H	S30409	...
39	18Cr-8Ni	Bolting	SA-193	B8	S30400	1
40	18Cr-8Ni	Bolting	SA-193	B8A	S30400	1A
41	18Cr-8Ni	Smls. tube	SA-213	TP304	S30400	...
42	18Cr-8Ni	Smls. tube	SA-213	TP304H	S30409	...
43	18Cr-8Ni	Plate	SA-240	302	S30200	...
44	18Cr-8Ni	Plate	SA-240	304	S30400	...
45	18Cr-8Ni	Plate	SA-240	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	...	515	205	...
2	...	540	255	...
3	...	690	380	...
4	...	690	380	...
5	...	690	380	...
6	...	690	380	...
7	...	690	380	...
8	...	635	440	...
9	...	635	440	...
10	>130	450	170	...
11	...	450	170	...
12	...	480	175	...
13	≤130	485	170	...
14	...	485	170	...
15	...	485	170	...
16	...	485	170	...
17	...	485	170	...
18	...	485	170	...
19	...	485	170	...
20	...	485	170	...
21	...	485	170	...
22	...	485	170	...
23	...	485	170	...
24	...	485	170	...
25	...	485	170	...
26	...	485	170	...
27	>130	485	205	...
28	>130	485	205	...
29	...	485	205	...
30	...	485	205	...
31	≥200	485	205	...
32	...	485	205	...
33	...	485	205	...
34	...	485	205	...
35	...	485	205	...
36	≤75	500	200	...
37	≤130	515	205	...
38	≤130	515	205	...
39	...	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	515	205	...
45	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	179	164	155	149	144	140	137	135	133
2	255	230	206	195	186	179	172	165	159	153
3	379	334	299	277	258	242	229	219	211	205
4	379	334	299	277	258	242	229	219	211	205
5	379	334	299	277	258	242	229	219	211	205
6	379	334	299	277	258	242	229	219	211	205
7	379	334	299	277	258	242	229	219	211	205
8	441	384	357	345	338	333	329	326	323	319
9	441	384	357	345	338	333	329	326	323	319
10	172	157	146	138	132	126	121	117	114	111
11	172	157	146	138	132	126	121	117	114	111
12	172	157	146	138	132	126	121	117	114	111
13	172	157	146	138	132	126	121	117	114	111
14	172	157	146	138	132	126	121	117	114	111
15	172	157	146	138	132	126	121	117	114	111
16	172	157	146	138	132	126	121	117	114	111
17	172	157	146	138	132	126	121	117	114	111
18	172	157	146	138	132	126	121	117	114	111
19	172	157	146	138	132	126	121	117	114	111
20	172	157	146	138	132	126	121	117	114	111
21	172	157	146	138	132	126	121	117	114	111
22	172	157	146	138	132	126	121	117	114	111
23	172	157	146	138	132	126	121	117	114	111
24	172	157	146	138	132	126	121	117	114	111
25	172	157	146	138	132	126	121	117	114	111
26	172	157	146	138	132	126	121	117	114	111
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	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	200	182	169	161	153	147	141	136	132	129
37	207	184	170	161	154	148	144	139	135	132
38	207	184	170	161	154	148	144	139	135	132
39	207	188	169	161	154	149	144	139	135	132
40	207	188	169	161	154	149	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
43	207	184	170	161	154	148	144	139	135	132
44	207	184	170	161	154	148	144	139	135	132
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	131	128	126	123	119	115	112	109	108	...
2	...	...	...	...	...	...	...	...	...	...
3	200	197	194	191	188	184	179	175	169	164
4	200	197	194	191	188	184	179	175	169	164
5	200	197	194	191	188	184	179	175	169	164
6	200	197	194	191	188	184	179	175	169	164
7	200	197	194	191	188	184	179	175	169	164
8	315	310	305	300	295	292	289	...	...	...
9	315	310	305	300	295	292	289	...	...	...
10	108	106	104	103	101	100	98.9	97.1	95.2	93.0
11	108	106	104	103	101	100	98.9	97.1	95.2	93.0
12	108	106	104	103	101	100	98.9	97.1	95.2	93.0
13	108	106	104	103	101	100	98.9	97.1	95.2	93.0
14	108	106	104	103	101	100	98.9	97.1	95.2	93.0
15	108	106	104	103	101	100	98.9	97.1	95.2	93.0
16	108	106	104	103	101	100	98.9	97.1	95.2	93.0
17	108	106	104	103	101	100	98.9	97.1	95.2	93.0
18	108	106	104	103	101	100	98.9	97.1	95.2	93.0
19	108	106	104	103	101	100	98.9	97.1	95.2	93.0
20	108	106	104	103	101	100	98.9	97.1	95.2	93.0
21	108	106	104	103	101	100	98.9	97.1	95.2	93.0
22	108	106	104	103	101	100	98.9	97.1	95.2	93.0
23	108	106	104	103	101	100	98.9	97.1	95.2	93.0
24	108	106	104	103	101	100	98.9	97.1	95.2	93.0
25	108	106	104	103	101	100	98.9	97.1	95.2	93.0
26	108	106	104	103	101	100	98.9	97.1	95.2	93.0
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	126	123	121	119	118	116	115	113	111	108
37	129	126	123	121	118	117	114	112	110	108
38	129	126	123	121	118	117	114	112	110	108
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
43	129	126	123	121	118	117	114	112	110	108
44	129	126	123	121	118	117	114	112	110	108
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
11	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
14	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
15	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
16	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
17	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
18	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
19	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
20	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
21	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
22	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
23	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
24	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
25	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
26	90.7	89.4	88.0	86.4	84.6	...	...	...	...	...	...	...	...	...	...
27	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
40	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
41	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-8Ni	Wld. tube	SA-249	TP304	S30400	...
2	18Cr-8Ni	Wld. tube	SA-249	TP304H	S30409	...
3	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304	S30400	...
4	18Cr-8Ni	Smls. & wld. pipe	SA-312	TP304H	S30409	...
5	18Cr-8Ni	Bolting	SA-320	B8	S30400	1
6	18Cr-8Ni	Bolting	SA-320	B8A	S30400	1A
7	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	1
8	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	3
9	18Cr-8Ni	Wld. pipe	SA-358	304	S30400	4
10	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	1
11	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	3
12	18Cr-8Ni	Wld. pipe	SA-358	304H	S30409	4
13	18Cr-8Ni	Wld. pipe	SA-358	304LN	S30453	1
14	18Cr-8Ni	Wld. pipe	SA-358	304LN	S30453	3
15	18Cr-8Ni	Wld. pipe	SA-358	304LN	S30453	4
16	18Cr-8Ni	Smls. pipe	SA-376	TP304	S30400	...
17	18Cr-8Ni	Smls. pipe	SA-376	TP304H	S30409	...
18	18Cr-8Ni	Smls. & wld. fittings	SA-403	304	S30400	...
19	18Cr-8Ni	Smls. & wld. fittings	SA-403	304H	S30409	...
20	18Cr-8Ni	Wld. pipe	SA-409	TP304	S30400	...
21	18Cr-8Ni	Bar	SA-479	302	S30200	...
22	18Cr-8Ni	Bar	SA-479	304	S30400	Annealed
23	18Cr-8Ni	Bar	SA-479	304H	S30409	...
24	18Cr-8Ni	Wld. tube	SA-688	TP304	S30400	...
25	18Cr-8Ni	Wld. pipe	SA-813	TP304	S30400	...
26	18Cr-8Ni	Wld. pipe	SA-813	TP304H	S30409	...
27	18Cr-8Ni	Wld. pipe	SA-814	TP304	S30400	...
28	18Cr-8Ni	Wld. pipe	SA-814	TP304H	S30409	...
29	18Cr-8Ni	Bar	SA/JIS G4303	SUS302	...	...
30	18Cr-8Ni	Bar	SA/JIS G4303	SUS304	...	...
31	18Cr-8Ni	Plate	SA/EN 10028-7	X5CrNi18-10	...	...
32	18Cr-8Ni	Castings	SA-351	CF3A	J92500	...
33	18Cr-8Ni	Castings	SA-351	CF8A	J92600	...
34	18Cr-8Ni	Cast pipe	SA-451	CPF3A	J92500	...
35	18Cr-8Ni	Cast pipe	SA-451	CPF8A	J92600	...
36	18Cr-8Ni	Bolting	SA-193	B8	S30400	2
37	18Cr-8Ni	Bolting	SA-320	B8	S30400	2
38	18Cr-8Ni	Bolting	SA-193	B8	S30400	2
39	18Cr-8Ni	Bolting	SA-320	B8	S30400	2
40	18Cr-8Ni	Bolting	SA-193	B8	S30400	2
41	18Cr-8Ni	Bolting	SA-320	B8	S30400	2
42	18Cr-8Ni	Bolting	SA-193	B8	S30400	2
43	18Cr-8Ni	Bolting	SA-320	B8	S30400	2
44	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...
45	18Cr-8Ni-N	Forgings	SA-965	F304LN	S30453	...

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	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	<200	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	...	520	205	...
30	...	520	205	...
31	≤75	520	210	...
32	...	530	240	...
33	...	530	240	...
34	...	530	240	...
35	...	530	240	...
36	30 < t ≤ 36	690	345	...
37	32 < t ≤ 40	690	345	...
38	24 < t ≤ 30	725	450	...
39	25 < t ≤ 32	725	450	...
40	20 < t ≤ 24	795	550	...
41	20 < t ≤ 25	795	550	...
42	≤20	860	690	...
43	≤20	860	690	...
44	>130	485	205	...
45	...	485	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	188	169	161	154	149	144	139	135	132
6	207	188	169	161	154	149	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	184	170	161	154	148	144	139	135	132
18	207	184	170	161	154	148	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	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	144	139	135	132
31	210	187	172	164	157	151	146	141	137	134
32	241	216	198	188	180	173	167	162	157	154
33	241	216	198	188	180	173	167	162	157	154
34	241	216	198	188	180	173	167	162	157	154
35	241	216	198	188	180	173	167	162	157	154
36	345	307	283	268	257	247	240	232	225	220
37	345	307	283	268	257	247	240	232	225	220
38	448	398	368	348	333	320	312	301	292	286
39	448	398	368	348	333	320	312	301	292	286
40	552	491	453	429	411	395	384	371	360	352
41	552	491	453	429	411	395	384	371	360	352
42	689	612	566	536	513	493	479	463	449	439
43	689	612	566	536	513	493	479	463	449	439
44	207	184	170	161	154	148	144	139	135	132
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	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
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	131	128	125	123	121	118	116	114	112	110
32	150	147	144	141	138	136	134	131	129	126
33	150	147	144	141	138	136	134	131	129	126
34	150	147	144	141	138	136	134	131	129	126
35	150	147	144	141	138	136	134	131	129	126
36	215	210	205	202	197	195	190	187	183	180
37	215	210	205	202	197	195	190	187	183	180
38	279	273	266	262	255	253	247	242	238	234
39	279	273	266	262	255	253	247	242	238	234
40	344	336	328	323	315	312	304	299	293	288
41	344	336	328	323	315	312	304	299	293	288
42	429	419	409	403	393	389	379	373	366	359
43	429	419	409	403	393	389	379	373	366	359
44	129	126	123	121	118	117	114	112	110	108
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
6	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
7	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
8	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
9	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
25	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	105	103	101	98.6	95.8	92.6	89.1	85.2	80.8	75.8	70.2	64.0	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-8Ni-N	Forgings	SA-182	F304LN	S30453	...
2	18Cr-8Ni-N	Bolting	SA-193	B8NA	S30451	1A
3	18Cr-8Ni-N	Smls. tube	SA-213	TP304LN	S30453	...
4	18Cr-8Ni-N	Plate	SA-240	304LN	S30453	...
5	18Cr-8Ni-N	Wld. tube	SA-249	TP304LN	S30453	...
6	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304LN	S30453	...
7	18Cr-8Ni-N	Smls. pipe	SA-376	TP304LN	S30453	...
8	18Cr-8Ni-N	Smls. & wld. fittings	SA-403	304LN	S30453	WP
9	18Cr-8Ni-N	Bar	SA-479	304LN	S30453	...
10	18Cr-8Ni-N	Wld. tube	SA-688	TP304LN	S30453	...
11	18Cr-8Ni-N	Wld. pipe	SA-813	TP304LN	S30453	...
12	18Cr-8Ni-N	Wld. pipe	SA-814	TP304LN	S30453	...
13	18Cr-8Ni-N	Forgings	SA-182	F304N	S30451	...
14	18Cr-8Ni-N	Smls. tube	SA-213	TP304N	S30451	...
15	18Cr-8Ni-N	Plate	SA-240	304N	S30451	...
16	18Cr-8Ni-N	Wld. tube	SA-249	TP304N	S30451	...
17	18Cr-8Ni-N	Smls. & wld. pipe	SA-312	TP304N	S30451	...
18	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	1
19	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	3
20	18Cr-8Ni-N	Wld. pipe	SA-358	304N	S30451	4
21	18Cr-8Ni-N	Smls. pipe	SA-376	TP304N	S30451	...
22	18Cr-8Ni-N	Smls. & wld. fittings	SA-403	304N	S30451	...
23	18Cr-8Ni-N	Bar	SA-479	304N	S30451	...
24	18Cr-8Ni-N	Wld. tube	SA-688	TP304N	S30451	...
25	18Cr-8Ni-N	Wld. pipe	SA-813	TP304N	S30451	...
26	18Cr-8Ni-N	Wld. pipe	SA-814	TP304N	S30451	...
27	18Cr-8Ni-N	Forgings	SA-965	F304N	S30451	...
28	18Cr-8Ni-N	Plate	SA/EN 10028-7	X2CrNiN18-10	...	...
29	18Cr-8Ni-N	Plate	SA/EN 10028-7	X5CrNiN19-9	...	...
(25) 30	18Cr-8Ni-S	Bolting	SA-320	B8F	S30300	1
(25) 31	18Cr-8Ni-S	Bolting	SA-320	B8FA	S30300	1A
32	18Cr-8Ni-Se	Bolting	SA-320	B8F	S30323	1
33	18Cr-8Ni-Se	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	...
36	18Cr-8Ni-4Si-N	Bar	SA-479	...	S21800	...
37	18Cr-9Ni-3Cu-Cb-N	Smls. tube	SA-213	...	S30432	...
38	18Cr-10Ni-Cb	Forgings	SA-965	F348H	S34809	...
39	18Cr-10Ni-Cb	Castings	SA-351	CF8C	J92710	...
40	18Cr-10Ni-Cb	Cast pipe	SA-451	CPF8C	J92710	...
41	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...
42	18Cr-10Ni-Cb	Forgings	SA-965	F347	S34700	...
43	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...
44	18Cr-10Ni-Cb	Forgings	SA-965	F347H	S34709	...
45	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...

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	≤130	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	...	550	240	...
14	...	550	240	...
15	...	550	240	...
16	...	550	240	...
17	...	550	240	...
18	...	550	240	...
19	...	550	240	...
20	...	550	240	...
21	...	550	240	...
22	...	550	240	...
23	...	550	240	...
24	...	550	240	...
25	...	550	240	...
26	...	550	240	...
27	...	550	240	...
28	≤75	550	270	...
29	≤75	550	270	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	515	205	...
34	...	655	345	...
35	...	655	345	...
36	...	655	345	...
37	...	590	235	...
38	...	450	170	...
39	...	485	205	...
40	...	485	205	...
41	>130	485	205	...
42	...	485	205	...
43	>130	485	205	...
44	...	485	205	...
45	>130	485	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	188	169	161	154	149	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	207	184	170	161	154	148	144	139	135	132
13	241	213	194	182	172	164	157	151	146	142
14	241	213	194	182	172	164	157	151	146	142
15	241	213	194	182	172	164	157	151	146	142
16	241	213	194	182	172	164	157	151	146	142
17	241	213	194	182	172	164	157	151	146	142
18	241	213	194	182	172	164	157	151	146	142
19	241	213	194	182	172	164	157	151	146	142
20	241	213	194	182	172	164	157	151	146	142
21	241	213	194	182	172	164	157	151	146	142
22	241	213	194	182	172	164	157	151	146	142
23	241	213	194	182	172	164	157	151	146	142
24	241	213	194	182	172	164	157	151	146	142
25	241	213	194	182	172	164	157	151	146	142
26	241	213	194	182	172	164	157	151	146	142
27	241	213	194	182	172	164	157	151	146	142
28	270	240	222	211	202	194	187	181	176	172
29	270	238	217	204	193	183	175	169	164	159
30	207	188	169	161	154	149	144	139	135	132
31	207	188	169	161	154	149	144	139	135	132
32	207	188	169	161	154	149	144	139	135	132
33	207	188	169	161	154	149	144	139	135	132
34	345	294	262	243	228	216	206	198	192	188
35	345	294	262	243	228	216	206	198	192	188
36	345	294	262	243	228	216	206	198	192	188
37	235	215	203	196	189	183	178	174	170	167
38	172	164	157	152	147	143	139	135	131	128
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
43	207	197	189	182	177	172	166	162	157	154
44	207	197	189	182	177	172	166	162	157	154
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	129	126	123	121	118	117	114	112	110	108
13	139	136	134	131	130	128	125	123	120	118
14	139	136	134	131	130	128	125	123	120	118
15	139	136	134	131	130	128	125	123	120	118
16	139	136	134	131	130	128	125	123	120	118
17	139	136	134	131	130	128	125	123	120	118
18	139	136	134	131	130	128	125	123	120	118
19	139	136	134	131	130	128	125	123	120	118
20	139	136	134	131	130	128	125	123	120	118
21	139	136	134	131	130	128	125	123	120	118
22	139	136	134	131	130	128	125	123	120	118
23	139	136	134	131	130	128	125	123	120	118
24	139	136	134	131	130	128	125	123	120	118
25	139	136	134	131	130	128	125	123	120	118
26	139	136	134	131	130	128	125	123	120	118
27	139	136	134	131	130	128	125	123	120	118
28	168	164	161	158	155	152	149	...	...	...
29	156	152	150	147	145	143	140	137	135	132
30	129	126	123	121	118	117	114	...	...	...
31	129	126	123	121	118	117	114	...	...	...
32	129	126	123	121	118	117	114	...	...	...
33	129	126	123	121	118	117	114	...	...	...
34	184	181	178	176	175	174	173	172	172	172
35	184	181	178	176	175	174	173	172	172	172
36	184	181	178	176	175	174	173	172	172	172
37	164	161	158	156	154	152	150	148	146	144
38	125	123	121	119	118	117	117	116	116	116
39	150	147	145	142	141	140	139	139	139	139
40	150	147	145	142	141	140	139	139	139	139
41	150	147	145	142	141	140	139	139	139	139
42	150	147	145	142	141	140	139	139	139	139
43	150	147	145	142	141	140	139	139	139	139
44	150	147	145	142	141	140	139	139	139	139
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
42	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...

(25)

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-10Ni-Cb	Forgings	SA-965	F348	S34800	...
2	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...
3	18Cr-10Ni-Cb	Forgings	SA-182	F347	S34700	...
4	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	1
5	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347	S34700	...
6	18Cr-10Ni-Cb	Plate	SA-240	347	S34700	...
7	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347	S34700	...
8	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347	S34700	...
9	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	1
10	18Cr-10Ni-Cb	Bolting	SA-320	B8CA	S34700	1A
11	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	1
12	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	3
13	18Cr-10Ni-Cb	Wld. pipe	SA-358	347	S34700	4
14	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347	S34700	...
15	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	347	S34700	...
16	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP347	S34700	...
17	18Cr-10Ni-Cb	Bar	SA-479	347	S34700	...
18	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347	S34700	...
19	18Cr-10Ni-Cb	Forgings	SA-182	F347H	S34709	...
20	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347H	S34709	...
21	18Cr-10Ni-Cb	Plate	SA-240	347H	S34709	...
22	18Cr-10Ni-Cb	Wld. tube	SA-249	TP347H	S34709	...
23	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP347H	S34709	...
24	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP347H	S34709	...
25	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	347H	S34709	...
26	18Cr-10Ni-Cb	Bar	SA-479	347H	S34709	...
27	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP347H	S34709	...
28	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP347H	S34709	...
29	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347LN	S34751	...
30	18Cr-10Ni-Cb	Smls. pipe	SA-312	TP347LN	S34751	...
31	18Cr-10Ni-Cb	Forgings	SA-182	F348	S34800	...
32	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348	S34800	...
33	18Cr-10Ni-Cb	Plate	SA-240	348	S34800	...
34	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348	S34800	...
35	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348	S34800	...
36	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	1
37	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	3
38	18Cr-10Ni-Cb	Wld. pipe	SA-358	348	S34800	4
39	18Cr-10Ni-Cb	Smls. pipe	SA-376	TP348	S34800	...
40	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	348	S34800	...
41	18Cr-10Ni-Cb	Wld. pipe	SA-409	TP348	S34800	...
42	18Cr-10Ni-Cb	Bar	SA-479	348	S34800	...
43	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348	S34800	...
44	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348	S34800	...
45	18Cr-10Ni-Cb	Forgings	SA-182	F348H	S34809	...

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	205	...
2	>130	485	205	...
3	≤130	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	...	515	205	...
14	...	515	205	...
15	...	515	205	...
16	...	515	205	...
17	...	515	205	...
18	...	515	205	...
19	≤130	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	≤130	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	...
43	...	515	205	...
44	...	515	205	...
45	≤130	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	198	189	182	177	172	166	161	157	153
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	198	189	182	177	172	166	161	157	153
10	207	198	189	182	177	172	166	161	157	153
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	197	189	182	177	172	166	162	157	154
15	207	197	189	182	177	172	166	162	157	154
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	192	180	172	165	158	152	147	142	138
30	207	192	180	172	165	158	152	147	142	138
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	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
43	207	197	189	182	177	172	166	162	157	154
44	207	197	189	182	177	172	166	162	157	154
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	141	140	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	141	140	139	139	139
10	150	147	145	142	141	141	140	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	150	147	145	142	141	140	139	139	139	139
15	150	147	145	142	141	140	139	139	139	139
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
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	135	133	131	130	129	129	129	129	128	128
30	135	133	131	130	129	129	129	129	128	128
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	150	147	145	142	141	140	139	139	139	139
41	150	147	145	142	141	140	139	139	139	139
42	150	147	145	142	141	140	139	139	139	139
43	150	147	145	142	141	140	139	139	139	139
44	150	147	145	142	141	140	139	139	139	139
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
4	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
5	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
6	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
7	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
8	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
9	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
10	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
11	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
12	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
13	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
14	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
15	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
16	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
17	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
18	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
32	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
33	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
34	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
35	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
36	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
37	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
38	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
39	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
40	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
41	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
42	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
43	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
44	135	134	132	129	126	122	117	111	104	95.7	86.2	75.5	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-10Ni-Cb	Smls. tube	SA-213	TP348H	S34809	...
2	18Cr-10Ni-Cb	Plate	SA-240	348H	S34809	...
3	18Cr-10Ni-Cb	Wld. tube	SA-249	TP348H	S34809	...
4	18Cr-10Ni-Cb	Smls. & wld. pipe	SA-312	TP348H	S34809	...
5	18Cr-10Ni-Cb	Smls. & wld. fittings	SA-403	348H	S34809	...
6	18Cr-10Ni-Cb	Bar	SA-479	348H	S34809	...
7	18Cr-10Ni-Cb	Wld. pipe	SA-813	TP348H	S34809	...
8	18Cr-10Ni-Cb	Wld. pipe	SA-814	TP348H	S34809	...
9	18Cr-10Ni-Cb	Bar	SA/JIS G4303	SUS347	...	...
10	18Cr-10Ni-Cb	Smls. tube	SA-213	TP347HFG	S34710	...
11	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2
12	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2
13	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2
14	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2
15	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2
16	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2
17	18Cr-10Ni-Cb	Bolting	SA-193	B8C	S34700	2
18	18Cr-10Ni-Cb	Bolting	SA-320	B8C	S34700	2
19	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321	S32100	...
20	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...
21	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321H	S32109	...
22	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...
23	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...
24	18Cr-10Ni-Ti	Forgings	SA-965	F321	S32100	...
25	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...
26	18Cr-10Ni-Ti	Forgings	SA-965	F321H	S32109	...
27	18Cr-10Ni-Ti	Plate	SA/EN 10028-7	X6CrNiTi18-10	...	...
28	18Cr-10Ni-Ti	Forgings	SA-182	F321	S32100	...
29	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	1
30	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321	S32100	...
31	18Cr-10Ni-Ti	Plate	SA-240	321	S32100	...
32	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321	S32100	...
33	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321	S32100	...
34	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	1
35	18Cr-10Ni-Ti	Bolting	SA-320	B8TA	S32100	1A
36	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	1
37	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	3
38	18Cr-10Ni-Ti	Wld. pipe	SA-358	321	S32100	4
39	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321	S32100	...
40	18Cr-10Ni-Ti	Smls. & wld. fittings	SA-403	321	S32100	...
41	18Cr-10Ni-Ti	Wld. pipe	SA-409	TP321	S32100	...
42	18Cr-10Ni-Ti	Bar	SA-479	321	S32100	...
43	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321	S32100	...
44	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321	S32100	...
45	18Cr-10Ni-Ti	Forgings	SA-182	F321H	S32109	...

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	...	520	205	...
10	...	550	205	...
11	$30 < t \leq 36$	690	345	...
12	$32 < t \leq 40$	690	345	...
13	$24 < t \leq 30$	725	450	...
14	$25 < t \leq 32$	725	450	...
15	$20 < t \leq 24$	795	550	...
16	$20 < t \leq 25$	795	550	...
17	≤ 20	860	690	...
18	≤ 20	860	690	...
19	> 9.5	485	170	...
20	> 9.5	485	170	...
21	> 9.5	485	170	...
22	> 9.5	485	170	...
23	> 130	485	205	...
24	...	485	205	...
25	> 130	485	205	...
26	...	485	205	...
27	≤ 75	500	200	...
28	≤ 130	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	≤ 9.5	515	205	...
34	...	515	205	...
35	...	515	205	...
36	...	515	205	...
37	...	515	205	...
38	...	515	205	...
39	≤ 9.5	515	205	...
40	...	515	205	...
41	...	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	515	205	...
45	≤ 130	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	194	185	179	174	170	165	162	158	155
11	345	328	315	303	295	287	277	270	262	257
12	345	328	315	303	295	287	277	270	262	257
13	450	428	411	396	385	374	361	352	341	335
14	448	428	411	396	385	374	361	352	341	335
15	550	523	502	484	470	457	441	430	417	409
16	552	523	502	484	470	457	441	430	417	409
17	690	657	630	607	590	573	553	540	523	513
18	689	657	630	607	590	573	553	540	523	513
19	172	162	154	147	143	138	133	129	125	121
20	172	162	154	147	143	138	133	129	125	121
21	172	162	154	147	143	138	133	129	125	121
22	172	162	154	147	143	138	133	129	125	121
23	207	194	184	177	171	165	160	154	150	146
24	207	194	184	177	171	165	160	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	200	187	178	171	165	160	154	149	145	141
28	207	194	184	177	171	165	160	154	150	146
29	207	196	184	177	171	165	159	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	196	184	177	171	165	159	154	150	146
35	207	196	184	177	171	165	159	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
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	152	150	148	146	144	142	141	139	138	137
11	250	245	242	237	235	233	232	232	232	232
12	250	245	242	237	235	233	232	232	232	232
13	326	320	315	309	307	304	302	302	302	302
14	326	320	315	309	307	304	302	302	302	302
15	399	391	385	377	375	372	369	369	369	369
16	399	391	385	377	375	372	369	369	369	369
17	500	490	483	473	470	467	463	463	463	463
18	500	490	483	473	470	467	463	463	463	463
19	118	116	113	111	110	108	107	106	105	104
20	118	116	113	111	110	108	107	106	105	104
21	118	116	113	111	110	108	107	106	105	104
22	118	116	113	111	110	108	107	106	105	104
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
27	137	134	131	129	127	126	124	123	122	121
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
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	102	100	98.5	96.6	94.4	91.9	89.1	86.0	82.4	78.4	73.9	68.9	...	...	...
20	102	100	98.5	96.6	94.4	91.9	89.1	86.0	82.4	78.4	73.9	68.9	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
24	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
29	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
30	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
31	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
32	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
33	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
34	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
35	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
36	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
37	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
38	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
39	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
40	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
41	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
42	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
43	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
44	123	121	119	116	114	111	107	104	99.4	94.6	89.2	83.1	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-10Ni-Ti	Smls. tube	SA-213	TP321H	S32109	...
2	18Cr-10Ni-Ti	Plate	SA-240	321H	S32109	...
3	18Cr-10Ni-Ti	Wld. tube	SA-249	TP321H	S32109	...
4	18Cr-10Ni-Ti	Smls. & wld. pipe	SA-312	TP321H	S32109	...
5	18Cr-10Ni-Ti	Smls. pipe	SA-376	TP321H	S32109	...
6	18Cr-10Ni-Ti	Smls. & wld. fittings	SA-403	321H	S32109	...
7	18Cr-10Ni-Ti	Bar	SA-479	321H	S32109	...
8	18Cr-10Ni-Ti	Wld. pipe	SA-813	TP321H	S32109	...
9	18Cr-10Ni-Ti	Wld. pipe	SA-814	TP321H	S32109	...
10	18Cr-10Ni-Ti	Bar	SA/JIS G4303	SUS321	...	...
11	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2
12	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2
13	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2
14	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2
15	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2
16	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2
17	18Cr-10Ni-Ti	Bolting	SA-193	B8T	S32100	2
18	18Cr-10Ni-Ti	Bolting	SA-320	B8T	S32100	2
19	18Cr-11Ni	Bolting	SA-193	B8P	S30500	1
20	18Cr-11Ni	Plate	SA-240	305	S30500	...
21	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2
22	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2
23	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2
24	18Cr-11Ni	Bolting	SA-193	B8P	S30500	2
25	18Cr-12Ni-2Mo	Castings	SA-351	CF3M	J92800	...
26	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF3M	J92800	...
27	18Cr-12Ni-2Mo	Castings	SA-351	CF8M	J92900	...
28	18Cr-12Ni-2Mo	Cast pipe	SA-451	CPF8M	J92900	...
29	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...
30	18Cr-13Ni-3Mo	Forgings	SA-182	F317L	S31703	...
31	18Cr-13Ni-3Mo	Forgings	SA-182	F317	S31700	...
32	18Cr-13Ni-3Mo	Plate	SA-240	317	S31700	...
33	18Cr-13Ni-3Mo	Plate	SA-240	317L	S31703	...
34	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317	S31700	...
35	18Cr-13Ni-3Mo	Wld. tube	SA-249	TP317L	S31703	...
36	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317	S31700	...
37	18Cr-13Ni-3Mo	Smls. & wld. pipe	SA-312	TP317L	S31703	...
38	18Cr-13Ni-3Mo	Smls. & wld. fittings	SA-403	317	S31700	...
39	18Cr-13Ni-3Mo	Fittings	SA-403	317L	S31703	...
40	18Cr-15Ni-4Si	Forgings	SA-182	...	S30600	Solution ann.
41	18Cr-15Ni-4Si	Plate	SA-240	...	S30600	Solution ann.
42	18Cr-15Ni-4Si	Smls. & wld. pipe	SA-312	...	S30600	Solution ann.
43	18Cr-15Ni-4Si	Bar	SA-479	...	S30600	Solution ann.
44	18Cr-18Ni-2Si	Smls. tube	SA-213	XM-15	S38100	...
45	18Cr-18Ni-2Si	Plate	SA-240	XM-15	S38100	...

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	≤ 9.5	515	205	...
5	≤ 9.5	515	205	...
6	...	515	205	...
7	...	515	205	...
8	...	515	205	...
9	...	515	205	...
10	...	520	205	...
11	$30 < t \leq 36$	690	345	...
12	$32 < t \leq 40$	690	345	...
13	$24 < t \leq 30$	725	450	...
14	$25 < t \leq 32$	725	450	...
15	$20 < t \leq 24$	795	550	...
16	$20 < t \leq 25$	795	550	...
17	≤ 20	860	690	...
18	≤ 20	860	690	...
19	...	515	205	...
20	...	515	205	...
21	$30 < t \leq 36$	690	345	...
22	$24 < t \leq 30$	725	450	...
23	$20 < t \leq 24$	795	550	...
24	≤ 20	860	690	...
25	...	485	205	...
26	...	485	205	...
27	...	485	205	...
28	...	485	205	...
29	> 130	450	170	...
30	≤ 130	485	170	...
31	≤ 130	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	...	540	240	...
41	≤ 50	540	240	...
42	...	540	240	...
43	≤ 100	540	240	...
44	...	515	205	...
45	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	207	194	184	177	171	165	160	154	150	146
2	207	194	184	177	171	165	160	154	150	146
3	207	194	184	177	171	165	160	154	150	146
4	207	194	184	177	171	165	160	154	150	146
5	207	194	184	177	171	165	160	154	150	146
6	207	194	184	177	171	165	160	154	150	146
7	207	194	184	177	171	165	160	154	150	146
8	207	194	184	177	171	165	160	154	150	146
9	207	194	184	177	171	165	160	154	150	146
10	207	194	184	177	171	165	160	154	150	146
11	345	327	307	295	285	275	265	257	250	243
12	345	327	307	295	285	275	265	257	250	243
13	448	424	398	383	370	357	344	333	325	316
14	448	424	398	383	370	357	344	333	325	316
15	552	523	491	472	456	440	424	411	400	389
16	552	523	491	472	456	440	424	411	400	389
17	689	652	612	589	569	549	529	513	499	486
18	689	652	612	589	569	549	529	513	499	486
19	207	184	170	161	154	148	144	139	135	132
20	207	184	170	161	154	148	144	139	135	132
21	345	307	283	268	257	247	240	232	225	220
22	450	400	370	350	335	322	313	302	293	287
23	550	489	452	428	409	393	383	369	359	351
24	690	613	567	537	513	493	480	463	450	440
25	207	189	176	168	160	154	148	143	139	135
26	207	189	176	168	160	154	148	143	139	135
27	207	189	176	168	160	154	148	143	139	135
28	207	189	176	168	160	154	148	143	139	135
29	172	157	145	137	131	125	121	118	114	111
30	172	157	145	137	131	125	121	118	114	111
31	207	189	176	168	161	154	148	144	139	136
32	207	189	176	168	161	154	148	144	139	136
33	207	189	173	165	157	151	146	141	137	134
34	207	189	176	168	161	154	148	144	139	136
35	207	189	173	165	157	151	146	141	137	134
36	207	189	176	168	161	154	148	144	139	136
37	207	189	173	165	157	151	146	141	137	134
38	207	189	176	168	161	154	148	144	139	136
39	207	189	173	165	157	151	146	141	137	134
40	241	209	182	173	166	...	...	...	...	...
41	241	209	182	173	166	...	...	...	...	...
42	241	209	182	173	166	...	...	...	...	...
43	241	209	182	173	166	...	...	...	...	...
44	207	184	170	161	154	148	144	139	135	132
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	142	139	136	133	132	130	128	127	126	125
2	142	139	136	133	132	130	128	127	126	125
3	142	139	136	133	132	130	128	127	126	125
4	142	139	136	133	132	130	128	127	126	125
5	142	139	136	133	132	130	128	127	126	125
6	142	139	136	133	132	130	128	127	126	125
7	142	139	136	133	132	130	128	127	126	125
8	142	139	136	133	132	130	128	127	126	125
9	142	139	136	133	132	130	128	127	126	125
10	142	139	136	133	132	130	128	127	126	125
11	237	232	227	222	220	217	213	212	210	208
12	237	232	227	222	220	217	213	212	210	208
13	307	301	294	288	286	281	277	275	273	271
14	307	301	294	288	286	281	277	275	273	271
15	379	371	363	355	352	347	341	339	336	333
16	379	371	363	355	352	347	341	339	336	333
17	473	463	453	443	439	433	426	423	419	416
18	473	463	453	443	439	433	426	423	419	416
19	129	126	123	121	118	117	114	112	110	108
20	129	126	123	121	118	117	114	112	110	108
21	215	210	205	202	197	195	190	187	183	180
22	280	274	267	263	257	254	248	243	239	235
23	343	335	327	321	314	311	303	298	292	287
24	430	420	410	403	393	390	380	373	367	360
25	131	129	126	124	123	121	120	119	118	117
26	131	129	126	124	123	121	120	119	118	117
27	131	129	126	124	123	121	120	119	118	117
28	131	129	126	124	123	121	120	119	118	117
29	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
30	109	107	105	103	101	99.4	97.5	95.7	93.8	92.0
31	132	129	127	125	123	122	121	120	118	117
32	132	129	127	125	123	122	121	120	118	117
33	131	128	126	124	121	119	117	115	112	110
34	132	129	127	125	123	122	121	120	118	117
35	131	128	126	124	121	119	117	115	112	110
36	132	129	127	125	123	122	121	120	118	117
37	131	128	126	124	121	119	117	115	112	110
38	132	129	127	125	123	122	121	120	118	117
39	131	128	126	124	121	119	117	115	112	110
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	129	126	123	121	118	117	114	112	110	108
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
30	89.7	88.9	87.9	86.7	85.3	...	...	...	...	...	...	...	...	...	...
31	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
32	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
33	108	107	106	105	103	...	...	...	...	...	...	...	...	...	...
34	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
35	108	107	106	105	103	...	...	...	...	...	...	...	...	...	...
36	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
37	108	107	106	105	103	...	...	...	...	...	...	...	...	...	...
38	114	112	111	110	109	108	106	105	103	101	99.0	96.5	...	...	...
39	108	107	106	105	103	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Design./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	18Cr-18Ni-2Si	Wld. tube	SA-249	TPXM-15	S38100	...
2	18Cr-18Ni-2Si	Wld. pipe	SA-312	TPXM-15	S38100	...
3	18Cr-20Ni-5.5Si	Smls. tube	SA-213	...	S32615	Solution ann.
4	18Cr-20Ni-5.5Si	Plate	SA-240	...	S32615	Solution ann.
5	18Cr-20Ni-5.5Si	Smls. & wld. pipe	SA-312	...	S32615	Solution ann.
6	18Cr-20Ni-5.5Si	Bar	SA-479	...	S32615	Solution ann.
7	19Cr-9Ni- $\frac{1}{2}$ Mo	Castings	SA-351	CF10	J92590	...
8	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B
9	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	B
10	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A
11	19Cr-9Ni-Mo-W	Bolting	SA-453	651	S63198	A
12	19Cr-9Ni-2Mo	Castings	SA-351	CF10M	...	...
13	19Cr-10Ni-3Mo	Castings	SA-351	CG8M	J93000	...
14	19Cr-15Ni-4Mo	Smls. tube	SA-213	...	S31725	...
15	19Cr-15Ni-4Mo	Plate	SA-240	...	S31725	...
16	19Cr-15Ni-4Mo	Wld. tube	SA-249	...	S31725	...
17	19Cr-15Ni-4Mo	Smls. & wld. pipe	SA-312	...	S31725	...
18	19Cr-15Ni-4Mo	Wld. pipe	SA-358	...	S31725	...
19	19Cr-15Ni-4Mo	Smls. pipe	SA-376	...	S31725	...
20	19Cr-15Ni-4Mo	Wld. pipe	SA-409	...	S31725	...
21	19Cr-15Ni-4Mo	Bar	SA-479	...	S31725	...
22	20Cr-3Ni-1.5Mo-N	Plate	SA-240	...	S32003	...
23	20Cr-3Ni-1.5Mo-N	Wld. pipe	SA-790	...	S32003	...
24	20Cr-3Ni-1.5Mo-N	Sheet	SA-240	...	S32003	...
25	20Cr-3Ni-1.5Mo-N	Smls. & wld. tube	SA-789	...	S32003	...
26	20Cr-10Ni	Bar	SA-479	ER308	S30880	...
27	20Cr-18Ni-6Mo	Castings	SA-351	CK3MCuN	J93254	...
28	20Cr-18Ni-6Mo	Forgings	SA-182	F44	S31254	...
29	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...
30	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...
31	20Cr-18Ni-6Mo	Smls. & wld. pipe	SA-312	...	S31254	...
32	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...
33	20Cr-18Ni-6Mo	Smls. tube	SA-213	...	S31254	...
34	20Cr-18Ni-6Mo	Wld. tube	SA-249	...	S31254	...
35	20Cr-18Ni-6Mo	Smls. & wld. pipe	SA-312	...	S31254	...
36	20Cr-18Ni-6Mo	Plate	SA-240	...	S31254	...
37	20Cr-18Ni-6Mo	Wld. pipe	SA-358	...	S31254	...
38	20.5Cr-8.8Ni-Mo-N	Plate	SA-240	...	S31655	...
39	21Cr-5Mn-1.5Ni-Cu-N	Plate	SA-240	...	S32101	...
40	21Cr-5Mn-1.5Ni-Cu-N	Bar	SA-479	...	S32101	...
41	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. tube	SA-789	...	S32101	...
42	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. pipe	SA-790	...	S32101	...
43	21Cr-5Mn-1.5Ni-Cu-N	Fittings	SA-815	...	S32101	...
44	21Cr-5Mn-1.5Ni-Cu-N	Sheet, strip	SA-240	...	S32101	...
45	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. tube	SA-789	...	S32101	...

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	...	550	220	...
4	...	550	220	...
5	...	550	220	...
6	...	550	220	...
7	...	485	205	...
8	>76	655	345	...
9	≤76	655	415	...
10	≤76	690	415	...
11	>76	690	485	...
12	...	485	205	...
13	...	515	240	...
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	>5	655	450	...
23	...	655	450	...
24	≤5	690	485	...
25	...	690	485	...
26	...	515	205	...
27	...	550	260	...
28	...	650	300	...
29	$t > 5$	655	310	...
30	$t > 5$	655	310	...
31	$t > 5$	655	310	...
32	$t \geq 5$	655	310	...
33	$t \leq 5$	675	310	...
34	$t \leq 5$	675	310	...
35	$t \leq 5$	675	310	...
36	...	690	310	...
37	$t < 5$	690	310	...
38	...	635	310	...
39	>5	650	450	...
40	...	650	450	...
41	>5	650	450	...
42	>5	650	450	...
43	...	650	450	...
44	≤5	700	530	...
45	≤5	700	530	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	221	198	180	175	171	166	160	155	...	...
4	221	198	180	175	171	166	160	155	...	...
5	221	198	180	175	171	166	160	155	...	...
6	221	198	180	175	171	166	160	155	...	...
7	207	184	170	161	154	148	143	138	134	131
8	345	332	318	311	305	299	294	289	285	281
9	414	398	381	373	366	359	353	348	343	338
10	414	398	381	373	366	359	353	348	343	338
11	483	464	445	435	427	419	412	405	399	394
12	207	191	178	170	162	155	149	143	139	135
13	241	211	191	179	169	160	153	148	143	139
14	207	186	172	164	157	151	146	141	137	134
15	207	186	172	164	157	151	146	141	137	134
16	207	186	172	164	157	151	146	141	137	134
17	207	186	172	164	157	151	146	141	137	134
18	207	186	172	164	157	151	146	141	137	134
19	207	186	172	164	157	151	146	141	137	134
20	207	186	172	164	157	151	146	141	137	134
21	207	186	172	164	157	151	146	141	137	134
22	448	409	380	363	348	338	330	324	319	315
23	448	409	380	363	348	338	330	324	319	315
24	483	440	409	390	375	364	355	348	343	339
25	483	440	409	390	375	364	355	348	343	339
26	207	184	170	161	154	148	144	139	135	132
27	262	230	211	200	191	184	178	172	168	165
28	303	266	244	231	221	213	206	200	195	190
29	310	272	249	236	226	218	211	204	199	194
30	310	272	249	236	226	218	211	204	199	194
31	310	272	249	236	226	218	211	204	199	194
32	310	272	249	236	226	218	211	204	199	194
33	310	272	249	236	226	218	211	204	199	194
34	310	272	249	236	226	218	211	204	199	194
35	310	272	249	236	226	218	211	204	199	194
36	310	272	250	237	226	218	211	205	199	195
37	310	272	249	236	226	218	211	204	199	194
38	310	268	243	229	218	209	201	195	190	186
39	450	427	402	...	355	...	342	...	337	...
40	450	427	402	...	355	...	342	...	337	...
41	450	427	402	...	355	...	342	...	337	...
42	450	427	402	...	355	...	342	...	337	...
43	450	427	402	...	355	...	342	...	337	...
44	530	503	473	...	419	...	403	...	397	...
45	530	503	473	...	419	...	403	...	397	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	129	126	123	121	118	117	115	113	111	108
8	277	274	271	268	264	261	258	254	250	246
9	333	329	325	321	317	313	309	305	300	295
10	333	329	325	321	317	313	309	305	300	295
11	389	383	379	374	370	365	361	355	350	345
12	131	129	127	125	123	121	120	119	118	117
13	136	133	130	129	127	126	124	123	121	119
14	131	128	126	124	121	119	117	115	113	111
15	131	128	126	124	121	119	117	115	113	111
16	131	128	126	124	121	119	117	115	113	111
17	131	128	126	124	121	119	117	115	113	111
18	131	128	126	124	121	119	117	115	113	111
19	131	128	126	124	121	119	117	115	113	111
20	131	128	126	124	121	119	117	115	113	111
21	131	128	126	124	121	119	117	115	113	111
22	310	305	299	293	286	282	282	...	...	...
23	310	305	299	293	286	282	282	...	...	...
24	334	329	322	315	308	304	304	...	...	...
25	334	329	322	315	308	304	304	...	...	...
26	129	126	123	121	118	117	114	112	110	108
27	162	159	157	156	154	154	153	151	...	...
28	187	184	182	180	179	178	177	175	...	...
29	191	188	186	184	183	182	181	179	...	...
30	191	188	186	184	183	182	181	179	...	...
31	191	188	186	184	183	182	181	179	...	...
32	191	188	186	184	183	182	181	179	...	...
33	191	188	186	184	183	182	181	179	...	...
34	191	188	186	184	183	182	181	179	...	...
35	191	188	186	184	183	182	181	179	...	...
36	191	188	186	185	183	182	181	180	...	...
37	191	188	186	184	183	182	181	179	...	...
38	182	179	176	173	170	167	163	160	...	...
39	324	316	316	...	...	...	...	...	...	...
40	324	316	316	...	...	...	...	...	...	...
41	324	316	316	...	...	...	...	...	...	...
42	324	316	316	...	...	...	...	...	...	...
43	324	316	316	...	...	...	...	...	...	...
44	381	373	372	...	...	...	...	...	...	...
45	381	373	372	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	21Cr-5Mn-1.5Ni-Cu-N	Smls. & wld. pipe	SA-790	...	S32101	...
2	21Cr-6Ni-9Mn	Forgings	SA-182	FXM-11	S21904	...
3	21Cr-6Ni-9Mn	Smls. & wld. pipe	SA-312	TPXM-11	S21904	...
4	21Cr-6Ni-9Mn	Plate	SA-666	XM-11	S21904	...
5	21Cr-6Ni-9Mn	Forgings	SA-965	FXM-11	S21904	...
6	21Cr-11Ni-N	Forgings	SA-182	F45	S30815	...
7	21Cr-11Ni-N	Smls. tube	SA-213	...	S30815	...
8	21Cr-11Ni-N	Plate	SA-240	...	S30815	...
9	21Cr-11Ni-N	Wld. tube	SA-249	...	S30815	...
10	21Cr-11Ni-N	Smls. & wld. pipe	SA-312	...	S30815	...
11	21Cr-11Ni-N	Bar	SA-479	...	S30815	...
12	22Cr-2Ni-Mo-N	Forgings	SA-182	F66	S32202	...
13	22Cr-2Ni-Mo-N	Plate	SA-240	...	S32202	...
14	22Cr-2Ni-Mo-N	Bar	SA-479	...	S32202	...
15	22Cr-2Ni-Mo-N	Smls. & wld. tube	SA-789	...	S32202	...
16	22Cr-2Ni-Mo-N	Smls. & wld. pipe	SA-790	...	S32202	...
17	22Cr-2Ni-Mo-N	Smls. & wld. fittings	SA-815	...	S32202	...
18	22Cr-5Ni-3Mo-N	Castings	SA-995	4A	J92205	...
19	22Cr-5Ni-3Mo-N	Forgings	SA-182	F51	S31803	...
20	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S31803	...
21	22Cr-5Ni-3Mo-N	Bar	SA-479	...	S31803	...
22	22Cr-5Ni-3Mo-N	Smls. & wld. tube	SA-789	...	S31803	...
23	22Cr-5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...	S31803	...
24	22Cr-5Ni-3Mo-N	Smls. & wld. fittings	SA-815	...	S31803	...
25	22Cr-5Ni-3Mo-N	Plate	SA-240	...	S32205	...
26	22Cr-5Ni-3Mo-N	Bar	SA-479	...	S32205	...
27	22Cr-5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...	S32205	...
28	22Cr-5Ni-3Mo-N	Smls. & wld. fittings	SA-815	...	S32205	...
29	22Cr-5Ni-3Mo-N	Forgings	SA-182	F60	S32205	...
30	22Cr-5Ni-3Mo-N	Smls. & wld. tube	SA-789	...	S32205	...
31	22Cr-13Ni-5Mn	Castings	SA-351	CG6MMN	J93790	...
32	22Cr-13Ni-5Mn	Forgings	SA-182	FXM-19	S20910	...
33	22Cr-13Ni-5Mn	Bolting	SA-193	B8R	S20910	Annealed
34	22Cr-13Ni-5Mn	Bolting	SA-193	B8RA	S20910	Annealed
35	22Cr-13Ni-5Mn	Smls. tube	SA-213	XM-19	S20910	...
36	22Cr-13Ni-5Mn	Plate	SA-240	XM-19	S20910	...
37	22Cr-13Ni-5Mn	Wld. tube	SA-249	TPXM-19	S20910	...
38	22Cr-13Ni-5Mn	Smls. & wld. pipe	SA-312	TPXM-19	S20910	...
39	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	1
40	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	3
41	22Cr-13Ni-5Mn	Wld. pipe	SA-358	XM-19	S20910	4
42	22Cr-13Ni-5Mn	Smls. & wld. fittings	SA-403	XM-19	S20910	...
43	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	Annealed
44	22Cr-13Ni-5Mn	Wld. pipe	SA-813	TPXM-19	S20910	...
45	22Cr-13Ni-5Mn	Wld. pipe	SA-814	TPXM-19	S20910	...

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	≤5	700	530	...
2	...	620	345	...
3	...	620	345	...
4	...	620	345	...
5	...	620	345	...
6	...	600	310	...
7	...	600	310	...
8	...	600	310	...
9	...	600	310	...
10	...	600	310	...
11	...	600	310	...
12	...	648	448	...
13	...	648	448	...
14	...	648	448	...
15	...	648	448	...
16	...	648	448	...
17	...	648	448	...
18	...	620	415	...
19	...	620	450	...
20	...	620	450	...
21	...	620	450	...
22	...	620	450	...
23	...	620	450	...
24	...	620	450	...
25	...	655	450	...
26	...	655	450	...
27	...	655	450	...
28	...	655	450	...
29	...	655	480	...
30	...	655	480	...
31	...	585	295	...
32	...	690	380	...
33	...	690	380	...
34	...	690	380	...
35	...	690	380	...
36	...	690	380	...
37	...	690	380	...
38	...	690	380	...
39	...	690	380	...
40	...	690	380	...
41	...	690	380	...
42	...	690	380	...
43	...	690	380	...
44	...	690	380	...
45	...	690	380	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	530	503	473	...	419	...	403	...	397	...
2	345	294	261	242	227	215	204	196	189	184
3	345	294	261	242	227	215	204	196	189	184
4	345	294	261	242	227	215	204	196	189	184
5	345	294	261	242	227	215	204	196	189	184
6	310	278	255	240	227	216	208	200	194	189
7	310	278	255	240	227	216	208	200	194	189
8	310	278	255	240	227	216	208	200	194	189
9	310	278	255	240	227	216	208	200	194	189
10	310	278	255	240	227	216	208	200	194	189
11	310	278	255	240	227	216	208	200	194	189
12	448	411	377	355	339	328	321	317	315	312
13	448	411	377	355	339	328	321	317	315	312
14	448	411	377	355	339	328	321	317	315	312
15	448	411	377	355	339	328	321	317	315	312
16	448	411	377	355	339	328	321	317	315	312
17	448	411	377	355	339	328	321	317	315	312
18	414	395	366	346	330	318	308	301	294	288
19	448	418	395	381	370	361	354	349	344	339
20	448	418	395	381	370	361	354	349	344	339
21	448	418	395	381	370	361	354	349	344	339
22	448	418	395	381	370	361	354	349	344	339
23	448	418	395	381	370	361	354	349	344	339
24	448	418	395	381	370	361	354	349	344	339
25	448	418	395	381	370	361	354	349	344	339
26	448	418	395	381	370	361	354	349	344	339
27	448	418	395	381	370	361	354	349	344	339
28	448	418	395	381	370	361	354	349	344	339
29	483	449	425	410	399	389	382	376	370	365
30	483	449	425	410	399	389	382	376	370	365
31	293	265	248	238	230	223	218	213	209	205
32	379	344	321	308	298	289	282	275	270	265
33	379	344	321	308	298	289	282	275	270	265
34	379	344	321	308	298	289	282	275	270	265
35	379	344	321	308	298	289	282	275	270	265
36	379	344	321	308	298	289	282	275	270	265
37	379	344	321	308	298	289	282	275	270	265
38	379	344	321	308	298	289	282	275	270	265
39	379	344	321	308	298	289	282	275	270	265
40	379	344	321	308	298	289	282	275	270	265
41	379	344	321	308	298	289	282	275	270	265
42	379	344	321	308	298	289	282	275	270	265
43	379	344	321	308	298	289	282	275	270	265
44	379	344	321	308	298	289	282	275	270	265
45	379	344	321	308	298	289	282	275	270	265

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	381	373	372	...	...	...	...	...	...	...
2	179	176	174	172	171	170	168	167	164	159
3	179	176	174	172	171	170	168	167	164	159
4	179	176	174	172	171	170	168	167	164	159
5	179	176	174	172	171	170	168	167	164	159
6	185	182	179	178	176	174	173	171	169	166
7	185	182	179	178	176	174	173	171	169	166
8	185	182	179	178	176	174	173	171	169	166
9	185	182	179	178	176	174	173	171	169	166
10	185	182	179	178	176	174	173	171	169	166
11	185	182	179	178	176	174	173	171	169	166
12	307	299	290	281	276	...	...	...	...	...
13	307	299	290	281	276	...	...	...	...	...
14	307	299	290	281	276	...	...	...	...	...
15	307	299	290	281	276	...	...	...	...	...
16	307	299	290	281	276	...	...	...	...	...
17	307	299	290	281	276	...	...	...	...	...
18	284	...	...	...	...	...	...	...	...	...
19	334	328	322	...	...	...	...	...	...	...
20	334	328	322	...	...	...	...	...	...	...
21	334	328	322	...	...	...	...	...	...	...
22	334	328	322	...	...	...	...	...	...	...
23	334	328	322	...	...	...	...	...	...	...
24	334	328	322	...	...	...	...	...	...	...
25	334	328	322	...	...	...	...	...	...	...
26	334	328	322	...	...	...	...	...	...	...
27	334	328	322	...	...	...	...	...	...	...
28	334	328	322	...	...	...	...	...	...	...
29	360	353	347	...	...	...	...	...	...	...
30	360	353	347	...	...	...	...	...	...	...
31	201	198	195	193	190	188	186	185	183	181
32	260	256	253	250	247	244	241	239	236	234
33	260	256	253	250	247	244	241	239	236	234
34	260	256	253	250	247	244	241	239	236	234
35	260	256	253	250	247	244	241	239	236	234
36	260	256	253	250	247	244	241	239	236	234
37	260	256	253	250	247	244	241	239	236	234
38	260	256	253	250	247	244	241	239	236	234
39	260	256	253	250	247	244	241	239	236	234
40	260	256	253	250	247	244	241	239	236	234
41	260	256	253	250	247	244	241	239	236	234
42	260	256	253	250	247	244	241	239	236	234
43	260	256	253	250	247	244	241	239	236	234
44	260	256	253	250	247	244	241	239	236	234
45	260	256	253	250	247	244	241	239	236	234

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
33	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
34	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
35	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
36	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
37	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
38	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
39	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
40	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
41	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
42	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
43	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
44	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
45	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	22Cr-13Ni-5Mn	Forgings	SA-965	FXM-19	S20910	...
2	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	Hot rolled
3	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	Hot rolled
4	22Cr-13Ni-5Mn	Bar	SA-479	XM-19	S20910	Hot rolled
5	23Cr-4Ni-Mo-Cu-N	Plate	SA-240	...	S32304	...
6	23Cr-4Ni-Mo-Cu-N	Smls. & wld. tube	SA-789	...	S32304	...
7	23Cr-4Ni-Mo-Cu-N	Smls. & wld. pipe	SA-790	...	S32304	...
8	23Cr-4Ni-Mo-Cu-N	Smls. & wld. tube	SA-789	...	S32304	...
9	23Cr-12Ni	Smls. & wld. fittings	SA-403	309	S30900	...
10	23Cr-12Ni	Smls. tube	SA-213	TP309S	S30908	...
11	23Cr-12Ni	Plate	SA-240	309S	S30908	...
12	23Cr-12Ni	Wld. tube	SA-249	TP309S	S30908	...
13	23Cr-12Ni	Smls. & wld. pipe	SA-312	TP309S	S30908	...
14	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	1
15	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	3
16	23Cr-12Ni	Wld. pipe	SA-358	309S	S30908	4
17	23Cr-12Ni	Bar	SA-479	309S	S30908	...
18	23Cr-12Ni	Wld. pipe	SA-813	TP309S	S30908	...
19	23Cr-12Ni	Wld. pipe	SA-814	TP309S	S30908	...
20	23Cr-12Ni	Smls. tube	SA-213	TP309H	S30909	...
21	23Cr-12Ni	Plate	SA-240	309H	S30909	...
22	23Cr-12Ni	Wld. tube	SA-249	TP309H	S30909	...
23	23Cr-12Ni	Smls. & wld. pipe	SA-312	TP309H	S30909	...
24	23Cr-12Ni	Bar	SA-479	309H	S30909	...
25	23Cr-12Ni	Bar	SA/JIS G4303	SUS309S	...	...
26	23Cr-12Ni-Cb	Smls. tube	SA-213	TP309Cb	S30940	...
27	23Cr-12Ni-Cb	Plate	SA-240	309Cb	S30940	...
28	23Cr-12Ni-Cb	Wld. tube	SA-249	TP309Cb	S30940	...
29	23Cr-12Ni-Cb	Smls. & wld. pipe	SA-312	TP309Cb	S30940	...
30	23Cr-12Ni-Cb	Bar	SA-479	309Cb	S30940	...
31	23Cr-12Ni-Cb	Wld. pipe	SA-813	TP309Cb	S30940	...
32	23Cr-12Ni-Cb	Wld. pipe	SA-814	TP309Cb	S30940	...
33	23Cr-25Ni-5.5Mo-N	Forgings	SA-182	...	S32053	...
34	23Cr-25Ni-5.5Mo-N	Bolting	SA-193	...	S32053	...
35	23Cr-25Ni-5.5Mo-N	Plate	SA-240	...	S32053	...
36	23Cr-25Ni-5.5Mo-N	Wld. tube	SA-249	...	S32053	...
37	23Cr-25Ni-5.5Mo-N	Smls. & wld. pipe	SA-312	...	S32053	...
38	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-358	...	S32053	...
39	23Cr-25Ni-5.5Mo-N	Fittings	SA-403	...	S32053	...
40	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-409	...	S32053	...
41	23Cr-25Ni-5.5Mo-N	Bar	SA-479	...	S32053	...
42	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-813	...	S32053	...
43	23Cr-25Ni-5.5Mo-N	Wld. pipe	SA-814	...	S32053	...
44	24Cr-10Ni-4Mo-N	Castings	SA-995	2A	J93345	...
45	24Cr-22Ni-6Mo-2W-Cu-N	Forgings	SA-182	F58	S31266	...

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	...	690	380	...
2	$76.2 < t \leq 203.2$	690	415	...
3	$50.8 < t \leq 76.2$	795	515	...
4	≤ 50.8	930	725	...
5	...	600	400	...
6	>25	600	400	...
7	...	600	400	...
8	≤ 25	690	450	...
9	...	515	205	...
10	...	515	205	...
11	...	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	...	520	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	515	205	...
31	...	515	205	...
32	...	515	205	...
33	...	640	295	...
34	...	640	295	...
35	...	640	295	...
36	...	640	295	...
37	...	640	295	...
38	...	640	295	...
39	...	640	295	...
40	...	640	295	...
41	...	640	295	...
42	...	640	295	...
43	...	640	295	...
44	...	655	450	...
45	...	750	420	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	379	344	321	308	298	289	282	275	270	265
2	414	382	349	335	325	316	307	300	295	289
3	517	477	436	419	406	395	384	376	368	361
4	724	668	611	586	569	553	539	526	516	506
5	400	363	340	328	319	312	308	304	301	297
6	400	363	340	328	319	312	308	304	301	297
7	400	363	340	328	319	312	308	304	301	297
8	448	407	382	368	357	349	343	339	336	333
9	207	191	179	172	167	162	157	153	150	147
10	207	191	179	172	167	162	157	153	150	147
11	207	191	179	172	167	162	157	153	150	147
12	207	191	179	172	167	162	157	153	150	147
13	207	191	179	172	167	162	157	153	150	147
14	207	191	179	172	167	162	157	153	150	147
15	207	191	179	172	167	162	157	153	150	147
16	207	191	179	172	167	162	157	153	150	147
17	207	191	179	172	167	162	157	153	150	147
18	207	191	179	172	167	162	157	153	150	147
19	207	191	179	172	167	162	157	153	150	147
20	207	191	179	172	167	162	157	153	150	147
21	207	191	179	172	167	162	157	153	150	147
22	207	191	179	172	167	162	157	153	150	147
23	207	191	179	172	167	162	157	153	150	147
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	295	266	247	...	226	...	211	...	201	...
34	295	266	247	...	226	...	211	...	201	...
35	295	266	247	...	226	...	211	...	201	...
36	295	266	247	...	226	...	211	...	201	...
37	295	266	247	...	226	...	211	...	201	...
38	295	266	247	...	226	...	211	...	201	...
39	295	266	247	...	226	...	211	...	201	...
40	295	266	247	...	226	...	211	...	201	...
41	295	266	247	...	226	...	211	...	201	...
42	295	266	247	...	226	...	211	...	201	...
43	295	266	247	...	226	...	211	...	201	...
44	448	391	356	337	322	312	304	298	294	291
45	421	388	367	355	344	336	329	324	319	316

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	260	256	253	250	247	244	241	239	236	234
2	284	280	275	272	269	266	263	261	258	255
3	355	350	345	340	336	333	329	326	323	319
4	497	490	483	476	471	466	461	456	452	446
5	293	288	283	278	271	266	262	...	...	...
6	293	288	283	278	271	266	262	...	...	...
7	293	288	283	278	271	266	262	...	...	...
8	329	323	318	311	...	...	...	...	...	...
9	145	143	141	139	138	136	134	132	130	128
10	145	143	141	139	138	136	134	132	130	128
11	145	143	141	139	138	136	134	132	130	128
12	145	143	141	139	138	136	134	132	130	128
13	145	143	141	139	138	136	134	132	130	128
14	145	143	141	139	138	136	134	132	130	128
15	145	143	141	139	138	136	134	132	130	128
16	145	143	141	139	138	136	134	132	130	128
17	145	143	141	139	138	136	134	132	130	128
18	145	143	141	139	138	136	134	132	130	128
19	145	143	141	139	138	136	134	132	130	128
20	145	143	141	139	138	136	134	132	130	128
21	145	143	141	139	138	136	134	132	130	128
22	145	143	141	139	138	136	134	132	130	128
23	145	143	141	139	138	136	134	132	130	128
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
31	145	143	141	139	138	136	134	132	130	128
32	145	143	141	139	138	136	134	132	130	128
33	194	190	187	...	...	...	...	...	...	...
34	194	190	187	...	...	...	...	...	...	...
35	194	190	187	...	...	...	...	...	...	...
36	194	190	187	...	...	...	...	...	...	...
37	194	190	187	...	...	...	...	...	...	...
38	194	190	187	...	...	...	...	...	...	...
39	194	190	187	...	...	...	...	...	...	...
40	194	190	187	...	...	...	...	...	...	...
41	194	190	187	...	...	...	...	...	...	...
42	194	190	187	...	...	...	...	...	...	...
43	194	190	187	...	...	...	...	...	...	...
44	288	284	278	270	...	...	...	...	...	...
45	314	312	311	310	308	307	306	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Ferrous Materials (Cont'd)														
1	229	226	223	218	213	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
11	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
12	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
13	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
14	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
15	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
16	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
17	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
18	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
19	122	119	117	114	111	107	103	98.8	94.0	88.7	82.7	76.2	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	24Cr-22Ni-6Mo-2W-Cu-N	Smls. tube	SA-213	...	S31266	...
2	24Cr-22Ni-6Mo-2W-Cu-N	Plate	SA-240	...	S31266	...
3	24Cr-22Ni-6Mo-2W-Cu-N	Wld. tube	SA-249	...	S31266	...
4	24Cr-22Ni-6Mo-2W-Cu-N	Smls. & wld. pipe	SA-312	...	S31266	...
5	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-358	...	S31266	...
6	24Cr-22Ni-6Mo-2W-Cu-N	Smls. & wld. fittings	SA-403	...	S31266	...
7	24Cr-22Ni-6Mo-2W-Cu-N	Bar, shapes	SA-479	...	S31266	...
8	24Cr-22Ni-6Mo-2W-Cu-N	Wld. pipe	SA-813	...	S31266	...
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	Forgings	SA-182	...	S32506	...
17	25Cr-6Ni-Mo-N	Plate, sheet	SA-240	...	S32506	...
18	25Cr-6Ni-Mo-N	Bar	SA-479	...	S32506	...
19	25Cr-6Ni-Mo-N	Smls. tube	SA-789	...	S32506	...
20	25Cr-6Ni-Mo-N	Wld. tube	SA-789	...	S32506	...
21	25Cr-6Ni-Mo-N	Smls. pipe	SA-790	...	S32506	...
22	25Cr-6Ni-Mo-N	Wld. pipe	SA-790	...	S32506	...
23	25Cr-6Ni-Mo-N	Plate	SA-240	...	S31200	...
24	25Cr-6.5Ni-3Mo-N	Smls. & wld. tube	SA-789	...	S31260	...
25	25Cr-6.5Ni-3Mo-N	Smls. & wld. pipe	SA-790	...	S31260	...
26	25Cr-6.5Ni-3Mo-N	Plate	SA-240	...	S31260	...
27	25Cr-7Ni-3Mo-W-Cu-N	Forgings	SA-182	F54	S39274	...
28	25Cr-7Ni-3Mo-W-Cu-N	Smls. & wld. tube	SA-789	...	S39274	...
29	25Cr-7Ni-3Mo-W-Cu-N	Smls. & wld. pipe	SA-790	...	S39274	...
30	25Cr-7Ni-4Mo-N	Forgings	SA-182	F53	S32750	...
31	25Cr-7Ni-4Mo-N	Plate	SA-240	...	S32750	...
32	25Cr-7Ni-4Mo-N	Smls. & wld. tube	SA-789	...	S32750	...
33	25Cr-7Ni-4Mo-N	Smls. & wld. pipe	SA-790	...	S32750	...
34	25Cr-7.5Ni-3.5Mo-N-Cu-W	Castings	SA-995	CD3MWCuN	J93380	...
35	25Cr-7.5Ni-3.5Mo-N-Cu-W	Forgings	SA-182	F55	S32760	...
36	25Cr-7.5Ni-3.5Mo-N-Cu-W	Plate	SA-240	...	S32760	...
37	25Cr-7.5Ni-3.5Mo-N-Cu-W	Bar	SA-479	...	S32760	Annealed
38	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. tube	SA-789	...	S32760	...
39	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. pipe	SA-790	...	S32760	...
40	25Cr-7.5Ni-3.5Mo-N-Cu-W	Smls. & wld. fittings	SA-815	...	S32760	...
41	25Cr-12Ni	Castings	SA-351	CH8	J93400	...
42	25Cr-12Ni	Cast pipe	SA-451	CPH8	J93400	...
43	25Cr-12Ni	Castings	SA-351	CH20	J93402	...
44	25Cr-12Ni	Cast pipe	SA-451	CPH20	J93402	...
45	25Cr-20Ni	Castings	SA-351	CK20	J94202	...

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	...	750	420	...
2	...	750	420	...
3	...	750	420	...
4	...	750	420	...
5	...	750	420	...
6	...	750	420	...
7	...	750	420	...
8	...	750	420	...
9	...	620	515	...
10	...	620	515	...
11	...	690	485	...
12	...	760	550	...
13	...	760	550	...
14	...	760	550	...
15	...	760	550	...
16	...	620	450	...
17	...	620	450	...
18	...	620	450	...
19	...	620	450	...
20	...	620	450	...
21	...	620	450	...
22	...	620	450	...
23	...	690	450	...
24	...	690	450	...
25	...	690	450	...
26	...	690	485	...
27	...	800	550	...
28	...	800	550	...
29	...	800	550	...
30	...	800	550	...
31	...	800	550	...
32	...	800	550	...
33	...	800	550	...
34	...	690	450	...
35	...	750	550	...
36	...	750	550	...
37	...	750	550	...
38	...	750	550	...
39	...	750	550	...
40	...	750	550	...
41	...	450	195	...
42	...	450	195	...
43	...	485	205	...
44	...	485	205	...
45	...	450	195	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	421	388	367	355	344	336	329	324	319	316
2	421	388	367	355	344	336	329	324	319	316
3	421	388	367	355	344	336	329	324	319	316
4	421	388	367	355	344	336	329	324	319	316
5	421	388	367	355	344	336	329	324	319	316
6	421	388	367	355	344	336	329	324	319	316
7	421	388	367	355	344	336	329	324	319	316
8	421	388	367	355	344	336	329	324	319	316
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	450	416	391	376	363	354	347	342	339	337
17	450	416	391	376	363	354	347	342	339	337
18	450	416	391	376	363	354	347	342	339	337
19	450	416	391	376	363	354	347	342	339	337
20	450	416	391	376	363	354	347	342	339	337
21	450	416	391	376	363	354	347	342	339	337
22	450	416	391	376	363	354	347	342	339	337
23	448	405	377	360	347	337	329	322	316	311
24	448	411	386	372	360	350	343	336	332	328
25	448	411	386	372	360	350	343	336	332	328
26	483	443	416	400	388	377	369	362	357	353
27	552	487	456	440	427	418	410	405	402	401
28	552	487	456	440	427	418	410	405	402	401
29	552	487	456	440	427	418	410	405	402	401
30	552	511	481	462	445	432	420	411	404	399
31	552	511	481	462	445	432	420	411	404	399
32	552	511	481	462	445	432	420	411	404	399
33	552	511	481	462	445	432	420	411	404	399
34	448	396	369	355	346	340	335	332	330	327
35	550	489	455	437	424	415	409	405	404	403
36	550	489	455	437	424	415	409	405	404	403
37	550	489	455	437	424	415	409	405	404	403
38	550	489	455	437	424	415	409	405	404	403
39	550	489	455	437	424	415	409	405	404	403
40	550	489	455	437	424	415	409	405	404	403
41	193	169	156	149	145	142	140	138	136	134
42	193	169	156	149	145	142	140	138	136	134
43	207	180	167	160	156	152	150	148	146	144
44	207	180	167	160	156	152	150	148	146	144
45	193	169	156	149	145	142	140	138	136	134

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	314	312	311	310	308	307	306	...	...	...
2	314	312	311	310	308	307	306	...	...	...
3	314	312	311	310	308	307	306	...	...	...
4	314	312	311	310	308	307	306	...	...	...
5	314	312	311	310	308	307	306	...	...	...
6	314	312	311	310	308	307	306	...	...	...
7	314	312	311	310	308	307	306	...	...	...
8	314	312	311	310	308	307	306	...	...	...
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	335	333	...	...	...	...	...	...	...	...
17	335	333	...	...	...	...	...	...	...	...
18	335	333	...	...	...	...	...	...	...	...
19	335	333	...	...	...	...	...	...	...	...
20	335	333	...	...	...	...	...	...	...	...
21	335	333	...	...	...	...	...	...	...	...
22	335	333	...	...	...	...	...	...	...	...
23	305	298	289	...	...	...	...	...	...	...
24	325	321	318	315	311	...	...	...	...	...
25	325	321	318	315	311	...	...	...	...	...
26	349	346	343	340	336	...	...	...	...	...
27	401	401	401	401	393	...	...	...	...	...
28	401	401	401	401	393	...	...	...	...	...
29	401	401	401	401	393	...	...	...	...	...
30	396	394	393	393	393	...	...	...	...	...
31	396	394	393	393	393	...	...	...	...	...
32	396	394	393	393	393	...	...	...	...	...
33	396	394	393	393	393	...	...	...	...	...
34	325	323	...	...	...	...	...	...	...	...
35	402	401	...	...	...	...	...	...	...	...
36	402	401	...	...	...	...	...	...	...	...
37	402	401	...	...	...	...	...	...	...	...
38	402	401	...	...	...	...	...	...	...	...
39	402	401	...	...	...	...	...	...	...	...
40	402	401	...	...	...	...	...	...	...	...
41	132	130	127	124	121	118	115	111	108	104
42	132	130	127	124	121	118	115	111	108	104
43	141	139	136	133	130	126	123	119	115	112
44	141	139	136	133	130	126	123	119	115	112
45	132	130	127	124	121	118	115	111	108	104

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Design./UNS No.	Class/Condition/ Temper
Ferrous Materials (Cont'd)						
1	25Cr-20Ni	Cast pipe	SA-451	CPK20	J94202	...
2	25Cr-20Ni	Forgings	SA-182	F310	S31000	...
3	25Cr-20Ni	Forgings	SA-965	F310	S31000	...
4	25Cr-20Ni	Smls. tube	SA-213	...	S31002	...
5	25Cr-20Ni	Smls. pipe	SA-312	...	S31002	...
6	25Cr-20Ni	Smls. tube	SA-213	TP310S	S31008	...
7	25Cr-20Ni	Plate	SA-240	310S	S31008	...
8	25Cr-20Ni	Wld. tube	SA-249	TP310S	S31008	...
9	25Cr-20Ni	Smls. & wld. pipe	SA-312	TP310S	S31008	...
10	25Cr-20Ni	Wld. pipe	SA-358	310S	S31008	1
11	25Cr-20Ni	Wld. pipe	SA-358	310S	S31008	3
12	25Cr-20Ni	Wld. pipe	SA-358	310S	S31008	4
13	25Cr-20Ni	Smls. & wld. fittings	SA-403	310S	S31008	...
14	25Cr-20Ni	Bar	SA-479	310S	S31008	...
15	25Cr-20Ni	Wld. pipe	SA-813	TP310S	S31008	...
16	25Cr-20Ni	Wld. pipe	SA-814	TP310S	S31008	...
17	25Cr-20Ni	Smls. tube	SA-213	TP310H	S31009	...
18	25Cr-20Ni	Plate	SA-240	310H	S31009	...
19	25Cr-20Ni	Wld. tube	SA-249	TP310H	S31009	...
20	25Cr-20Ni	Smls. & wld. pipe	SA-312	TP310H	S31009	...
21	25Cr-20Ni	Bar	SA-479	310H	S31009	...
22	25Cr-20Ni	Bar	SA/JIS G4303	SUS310S	...	...
23	25Cr-20Ni-Cb	Smls. tube	SA-213	TP310Cb	S31040	...
24	25Cr-20Ni-Cb	Plate	SA-240	310Cb	S31040	...
25	25Cr-20Ni-Cb	Wld. tube	SA-249	TP310Cb	S31040	...
26	25Cr-20Ni-Cb	Smls. & wld. pipe	SA-312	TP310Cb	S31040	...
27	25Cr-20Ni-Cb	Bar	SA-479	310Cb	S31040	...
28	25Cr-20Ni-Cb	Wld. pipe	SA-813	TP310Cb	S31040	...
29	25Cr-20Ni-Cb	Wld. pipe	SA-814	TP310Cb	S31040	...
30	25Cr-20Ni-Cb-N	Smls. tube	SA-213	TP310HCbN	S31042	...
31	25Cr-22Ni-2Mo-N	Forgings	SA-182	F310MoLN	S31050	...
32	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...
33	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...
34	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...
35	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...
36	25Cr-22Ni-2Mo-N	Smls. tube	SA-213	TP310MoLN	S31050	...
37	25Cr-22Ni-2Mo-N	Plate	SA-240	310MoLN	S31050	...
38	25Cr-22Ni-2Mo-N	Wld. tube	SA-249	TP310MoLN	S31050	...
39	25Cr-22Ni-2Mo-N	Wld. pipe	SA-312	TP310MoLN	S31050	...
40	26Cr-4Ni-Mo	Plate	SA-240	329	S32900	...
41	26Cr-4Ni-Mo	Smls. & wld. tube	SA-789	...	S32900	...
42	26Cr-4Ni-Mo	Smls. & wld. pipe	SA-790	...	S32900	...
43	26Cr-4Ni-Mo-N	Plate	SA-240	...	S32950	...
44	26Cr-4Ni-Mo-N	Smls. & wld. tube	SA-789	...	S32950	...
45	26Cr-4Ni-Mo-N	Smls. & wld. pipe	SA-790	...	S32950	...

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	...	450	195	...
2	≤ 130	515	205	...
3	...	515	205	...
4	...	500	205	...
5	...	500	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	...	515	205	...
17	...	515	205	...
18	...	515	205	...
19	...	515	205	...
20	...	515	205	...
21	...	515	205	...
22	...	520	205	...
23	...	515	205	...
24	...	515	205	...
25	...	515	205	...
26	...	515	205	...
27	...	515	205	...
28	...	515	205	...
29	...	515	205	...
30	...	655	295	...
31	...	540	255	...
32	$6 < t \leq 32$	540	255	...
33	$t > 6$	540	255	...
34	$6 < t \leq 32$	540	255	...
35	$6 < t \leq 32$	540	255	...
36	≤ 6	580	270	...
37	$t \leq 6$	580	270	...
38	≤ 6	580	270	...
39	≤ 6	580	270	...
40	...	620	485	...
41	...	620	485	...
42	...	620	485	...
43	...	690	485	...
44	...	690	485	...
45	...	690	485	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	193	169	156	149	145	142	140	138	136	134
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	183	178	172	168	163	159	155	152
5	207	193	183	178	172	168	163	159	155	152
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	207	193	181	173	167	161	157	152	149	146
22	207	193	181	173	167	161	157	152	149	146
23	207	193	181	173	167	161	157	152	149	146
24	207	193	181	173	167	161	157	152	149	146
25	207	193	181	173	167	161	157	152	149	146
26	207	193	181	173	167	161	157	152	149	146
27	207	193	181	173	167	161	157	152	149	146
28	207	193	181	173	167	161	157	152	149	146
29	207	193	181	173	167	161	157	152	149	146
30	296	265	245	233	224	216	209	204	200	196
31	255	231	215	205	197	190	185	180	175	171
32	255	231	215	205	197	190	185	180	175	171
33	255	231	215	205	197	190	185	180	175	171
34	255	231	215	205	197	190	185	180	175	171
35	255	231	215	205	197	190	185	180	175	171
36	269	243	226	216	208	201	195	189	185	180
37	269	243	226	216	208	201	195	189	185	180
38	269	243	226	216	208	201	195	189	185	180
39	269	243	226	216	208	201	195	189	185	180
40	483	451	426	410	397	384	373	364	356	350
41	483	451	426	410	397	384	373	364	356	350
42	483	451	426	410	397	384	373	364	356	350
43	483	448	423	408	395	383	373	364	356	350
44	483	448	423	408	395	383	373	364	356	350
45	483	448	423	408	395	383	373	364	356	350

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	132	130	127	124	121	118	115	111	108	104
2	144	141	139	137	135	134	132	130	128	126
3	144	141	139	137	135	134	132	130	128	126
4	148	144	140	137	133	130	128	127	127	...
5	148	144	140	137	133	130	128	127	127	...
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	144	141	139	137	135	134	132	130	128	126
22	144	141	139	137	135	134	132	130	128	126
23	144	141	139	137	135	134	132	130	128	126
24	144	141	139	137	135	134	132	130	128	126
25	144	141	139	137	135	134	132	130	128	126
26	144	141	139	137	135	134	132	130	128	126
27	144	141	139	137	135	134	132	130	128	126
28	144	141	139	137	135	134	132	130	128	126
29	144	141	139	137	135	134	132	130	128	126
30	193	191	189	186	184	182	180	178	175	173
31	167	163	160	156	152	149	145	143	140	138
32	167	163	160	156	152	149	145	143	140	138
33	167	163	160	156	152	149	145	143	140	138
34	167	163	160	156	152	149	145	143	140	138
35	167	163	160	156	152	149	145	143	140	138
36	176	172	168	164	160	157	154	150	148	146
37	176	172	168	164	160	157	154	150	148	146
38	176	172	168	164	160	157	154	150	148	146
39	176	172	168	164	160	157	154	150	148	146
40	345	341	338	336	...	...	...	...	...	...
41	345	341	338	336	...	...	...	...	...	...
42	345	341	338	336	...	...	...	...	...	...
43	345	341	338	335	...	...	...	...	...	...
44	345	341	338	335	...	...	...	...	...	...
45	345	341	338	335	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
7	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
8	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
9	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
10	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
11	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
12	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
13	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
14	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
15	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
16	122	119	115	111	105	99.2	92.4	84.8	76.4	67.3	57.3	46.6	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
	Ferrous Materials (Cont'd)					
1	27Cr-7.5Ni-4.5Mo-Co-N	Smls. tube	SA-789	...	S32707	...
2	27Cr-7.5Ni-4.5Mo-Co-N	Smls. pipe	SA-790	...	S32707	...
3	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...
4	29Cr-6.5Ni-2Mo-N	Bar	SA-479	...	S32906	...
5	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...
6	29Cr-6.5Ni-2Mo-N	Smls. pipe	SA-790	...	S32906	...
7	29Cr-6.5Ni-2Mo-N	Plate, sheet, strip	SA-240	...	S32906	...
8	29Cr-6.5Ni-2Mo-N	Smls. tube	SA-789	...	S32906	...
9	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	...	920	700	...
2	...	920	700	...
3	≥10	750	550	...
4	...	750	550	...
5	≥10	750	550	...
6	≥10	750	550	...
7	<10	800	650	...
8	<10	800	650	...
9	<10	800	650	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Ferrous Materials (Cont'd)									
1	696	647	592	565	552	546	541	533	519	510
2	696	647	592	565	552	546	541	533	519	510
3	552	501	470	451	435	...	411	...	396	...
4	552	501	470	451	435	...	411	...	396	...
5	552	501	470	451	435	...	411	...	396	...
6	552	501	470	451	435	...	411	...	396	...
7	648	588	552	530	511	...	483	...	465	...
8	648	588	552	530	511	...	483	...	465	...
9	648	588	552	530	511	...	483	...	465	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Ferrous Materials (Cont'd)									
1	510	...	...	...	...	...	...	...	...	...
2	510	...	...	...	...	...	...	...	...	...
3	387	385	...	...	...	...	...	...	...	...
4	387	385	...	...	...	...	...	...	...	...
5	387	385	...	...	...	...	...	...	...	...
6	387	385	...	...	...	...	...	...	...	...
7	455	452	...	...	...	...	...	...	...	...
8	455	452	...	...	...	...	...	...	...	...
9	455	452	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials						
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	T6
30	...	Plate, sheet	SB-209	...	Alclad 6061	T651
31	...	Plate, sheet	SB-209	...	Alclad 6061	T651
32	...	Plate, sheet	SB-209	...	Alclad 6061	T651
33	...	Castings	SB/EN 1706	...	AC-42000-S	T6
34	...	Plate, sheet	SB-209	...	A91060	O
35	...	Plate, sheet	SB-209	...	A91060	H112
36	...	Plate, sheet	SB-209	...	A91060	H112
37	...	Plate, sheet	SB-209	...	A91060	H112
38	...	Plate, sheet	SB-209	...	A91060	H12
39	...	Plate, sheet	SB-209	...	A91060	H14
40	...	Drawn smls. tube	SB-210	...	A91060	O
41	...	Drawn smls. tube	SB-210	...	A91060	H14
42	...	Drawn smls. tube	SB-210	...	A91060	H113
43	...	Bar, rod, shapes	SB-221	...	A91060	O
44	...	Bar, rod, shapes	SB-221	...	A91060	H112
45	...	Cond. & heat exch. tubes	SB-234	...	A91060	H14

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	0.15–12.67	90	30	...
2	12.70–76.20	95	35	...
3	6.35–12.67	110	60	...
4	12.70–50.80	105	40	...
5	50.83–76.20	100	40	...
6	0.43–12.67	110	75	...
7	12.70–50.80	115	85	...
8	0.23–12.67	130	110	...
9	12.70–25.40	140	115	...
10	0.25–12.70	90	30	...
11	1.27–12.70	90	30	...
12	0.25–12.70	130	110	...
13	0.25–12.70	180	160	...
14	0.25–5.08	130	110	...
15	0.25–5.08	145	125	...
16	...	90	30	...
17	...	90	30	...
18	0.15–12.67	145	55	...
19	12.70–76.20	150	60	...
20	6.35–12.67	150	60	...
21	12.70–76.20	160	60	...
22	0.43–12.67	185	140	...
23	12.70–50.80	195	145	...
24	0.23–12.67	215	165	...
25	12.70–25.40	220	170	...
26	0.25–6.34	185	95	...
27	6.35–12.69	185	95	...
28	12.70–76.20	205	110	...
29	0.25–6.34	260	220	...
30	6.35–12.69	260	220	...
31	12.70–101.60	290	240	...
32	101.61–127.00	275	240	...
33	...	220	180	...
34	0.15–76.2	55	15	...
35	6.35–12.7	75	50	...
36	12.7–25.4	70	35	...
37	25.4–76.2	60	30	...
38	0.43–50.8	75	60	...
39	0.23–25.4	85	70	...
40	0.46–12.7	60	15	...
41	0.46–12.7	85	70	...
42	0.46–12.7	60	15	...
43	...	60	15	...
44	...	60	15	...
45	0.25–5.08	85	70	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials									
1	31.0	29.8	28.9	27.7	26.0	24.3	22.6	21.1	...	...
2	34.5	33.1	32.2	30.7	28.9	27.0	25.2	23.5	...	...
3	62.1	59.8	57.2	54.6	51.5	48.2	45.0	42.0	...	...
4	41.4	39.9	38.4	36.7	34.7	32.7	30.4	28.4	...	...
5	41.4	39.9	38.4	36.7	34.7	32.7	30.4	28.4	...	...
6	75.8	74.5	67.1	58.3	49.0	39.9	28.6	20.5	...	...
7	82.7	81.3	73.2	63.6	53.4	43.5	31.2	22.3	...	...
8	110	106	97.8	88.6	77.2	64.5	51.5	41.2	...	...
9	117	113	104	94.1	82.1	68.5	54.7	43.7	...	...
10	31.0	29.9	28.9	27.6	25.7	23.8	21.8	20.0	...	...
11	31.0	29.9	28.9	27.6	25.7	23.8	21.8	20.0	...	...
12	110	106	97.8	88.6	77.2	64.5	51.5	41.2	...	...
13	159	141	120	104	87.3	68.0	49.3	35.8	...	...
14	110	106	97.8	88.6	77.2	64.5	51.5	41.2	...	...
15	124	117	105	93.4	80.0	64.6	49.0	37.2	...	...
16	31.0	29.9	28.9	27.6	25.7	23.8	21.8	20.0	...	...
17	31.0	29.9	28.9	27.6	25.7	23.8	21.8	20.0	...	...
18	55.2	55.2	55.2	55.2	55.2	55.2	53.4	51.6	...	...
19	58.6	58.6	58.6	58.6	58.6	58.6	56.7	54.8	...	...
20	58.6	58.6	58.6	58.6	58.6	58.6	56.7	54.8	...	...
21	62.1	61.8	61.8	61.8	61.8	61.4	59.3	57.3	...	...
22	138	137	137	134	127	112	89.0	70.8	...	...
23	145	144	144	141	133	118	93.5	74.3	...	...
24	165	164	163	155	136	103	67.0	43.8	...	...
25	172	171	169	162	141	107	69.8	45.6	...	...
26	96.5	95.8	95.8	95.8	95.8	95.8	95.8	95.8	...	...
27	96.5	95.8	95.8	95.8	95.8	95.8	95.8	95.8	...	...
28	110	109	109	109	109	109	109	109	...	...
29	221	217	215	203	175	131	92.8	65.5	...	...
30	221	217	215	203	175	131	92.8	65.5	...	...
31	241	238	235	222	191	144	101	71.7	...	...
32	241	238	235	222	191	144	101	71.7	...	...
33	181	178	168	168	149	...	...	...	...	...
34	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
35	48.3	48.3	47	43	39.4	38.2	38	37.9	...	...
36	34.5	33.6	30.5	25.9	20.5	15.4	10.1	6.5	...	...
37	27.6	27.6	26.1	23.6	20.9	19.1	17.5	16.1	...	...
38	62.1	57.2	52	47.5	42.9	38.1	32	26.8	...	...
39	68.9	65.4	62	56.4	48.6	39.2	28.1	20.1	...	...
40	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
41	68.9	65.4	62	56.4	48.6	39.2	28.1	20.1	...	...
42	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
43	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
44	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
45	68.9	65.4	62	56.4	48.6	39.2	28.1	20.1	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Smls. extr. tube	SB-241	...	A91060	O
2	...	Smls. extr. tube	SB-241	...	A91060	H112
3	...	Plate, sheet	SB-209	...	A91100	O
4	...	Plate, sheet	SB-209	...	A91100	H112
5	...	Plate, sheet	SB-209	...	A91100	H112
6	...	Plate, sheet	SB-209	...	A91100	H112
7	...	Plate, sheet	SB-209	...	A91100	H12
8	...	Plate, sheet	SB-209	...	A91100	H14
9	...	Bar, rod, shapes	SB-221	...	A91100	O
10	...	Bar, rod, shapes	SB-221	...	A91100	H112
11	...	Smls. extr. tube	SB-241	...	A91100	O
12	...	Smls. extr. tube	SB-241	...	A91100	H112
13	...	Plate, sheet	SB-209	...	A93003	O
14	...	Plate, sheet	SB-209	...	A93003	H112
15	...	Plate, sheet	SB-209	...	A93003	H112
16	...	Plate, sheet	SB-209	...	A93003	H112
17	...	Plate, sheet	SB-209	...	A93003	H12
18	...	Plate, sheet	SB-209	...	A93003	H14
19	...	Drawn smls. tube	SB-210	...	A93003	O
20	...	Drawn smls. tube	SB-210	...	A93003	H113
21	...	Drawn smls. tube	SB-210	...	A93003	H12
22	...	Drawn smls. tube	SB-210	...	A93003	H14
23	...	Drawn smls. tube	SB-210	...	A93003	H18
24	...	Bar, rod, shapes	SB-221	...	A93003	O
25	...	Bar, rod, shapes	SB-221	...	A93003	H112
26	...	Cond. & heat exch. tubes	SB-234	...	A93003	H14
27	...	Cond. & heat exch. tubes	SB-234	...	A93003	H25
28	...	Smls. extr. tube	SB-241	...	A93003	O
29	...	Smls. extr. tube	SB-241	...	A93003	H112
30	...	Smls. pipe	SB-241	...	A93003	H112
31	...	Smls. pipe	SB-241	...	A93003	H18
32	...	Die forgings	SB-247	...	A93003	H112
33	...	Plate, sheet	SB-209	...	A93004	O
34	...	Plate, sheet	SB-209	...	A93004	H112
35	...	Plate, sheet	SB-209	...	A93004	H32
36	...	Plate, sheet	SB-209	...	A93004	H34
37	...	Plate, sheet	SB-209	...	A95052	O
38	...	Plate, sheet	SB-209	...	A95052	H112
39	...	Plate, sheet	SB-209	...	A95052	H112
40	...	Plate, sheet	SB-209	...	A95052	H32
41	...	Plate, sheet	SB-209	...	A95052	H34
42	...	Drawn smls. tube	SB-210	...	A95052	O
43	...	Drawn smls. tube	SB-210	...	A95052	H32
44	...	Drawn smls. tube	SB-210	...	A95052	H34
45	...	Cond. & heat exch. tubes	SB-234	...	A95052	H32

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	...	60	15	...
2	...	60	15	...
3	0.15–76.2	75	25	...
4	6.35–12.7	90	50	...
5	12.7–50.8	85	35	...
6	50.8–76.2	80	30	...
7	0.43–50.8	95	75	...
8	0.23–25.4	110	95	...
9	...	75	20	...
10	...	75	20	...
11	...	75	20	...
12	...	75	20	...
13	0.15–76.20	95	35	...
14	6.35–12.67	115	70	...
15	12.70–50.80	105	40	...
16	50.83–76.20	100	40	...
17	0.43–50.80	115	85	...
18	0.23–25.40	140	115	...
19	0.25–12.70	95	35	...
20	0.25–12.70	95	35	...
21	0.25–12.70	115	85	...
22	0.25–12.70	140	115	...
23	0.25–12.70	185	165	...
24	...	95	35	...
25	...	95	35	...
26	0.25–5.08	140	115	...
27	0.25–5.08	150	130	...
28	...	95	35	...
29	...	95	35	...
30	≥25.40	95	35	...
31	<25.40	185	165	...
32	≤101.60	95	35	...
33	0.15–76.20	150	60	...
34	6.35–76.20	160	60	...
35	0.43–50.80	195	145	...
36	0.23–25.40	220	170	...
37	0.15–76.20	170	65	...
38	6.35–12.69	195	110	...
39	12.70–76.20	170	65	...
40	0.43–50.80	215	160	...
41	0.23–25.40	235	180	...
42	0.25–11.43	170	70	...
43	0.25–11.43	215	160	...
44	0.25–11.43	235	180	...
45	0.25–5.08	215	160	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
2	17.2	17	15.9	14.1	12.3	11	9.5	8.2	...	...
3	24.1	24.1	24	23.3	21.8	19.3	16.6	14.3	...	...
4	48.3	48.3	47.9	46.6	44	39.8	34.9	30.7	...	...
5	34.5	34.5	33.9	33	30.9	27.3	23.2	19.6	...	...
6	27.6	27.6	27	26.1	24.3	21.2	17.2	14	...	...
7	75.8	73.8	69.2	63.4	55.9	47.4	38.5	31.3	...	...
8	96.5	93.4	85.9	78.1	68.3	57.3	45.9	36.8	...	...
9	20.7	20.6	20.5	19.8	18.5	16.7	14.8	13.1	...	...
10	20.7	20.6	20.5	19.8	18.5	16.7	14.8	13.1	...	...
11	20.7	20.6	20.5	19.8	18.5	16.7	14.8	13.1	...	...
12	20.7	20.6	20.5	19.8	18.5	16.7	14.8	13.1	...	...
13	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
14	68.9	66.4	63.5	60.6	57.2	53.6	50.0	46.7	...	...
15	41.4	39.9	38.4	36.7	34.7	32.7	30.4	28.4	...	...
16	41.4	39.9	38.4	36.7	34.7	32.7	30.4	28.4	...	...
17	82.7	81.3	73.2	63.6	53.4	43.5	31.2	22.3	...	...
18	117	113	104	94.1	82.1	68.5	54.7	43.7	...	...
19	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
20	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
21	82.7	81.3	73.2	63.6	53.4	43.5	31.2	22.3	...	...
22	117	113	104	94.1	82.1	68.5	54.7	43.7	...	...
23	165	147	125	109	91.0	71.0	51.5	37.3	...	...
24	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
25	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
26	117	113	104	94.1	82.1	68.5	54.7	43.7	...	...
27	131	123	110	98.6	84.4	68.1	51.7	39.2	...	...
28	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
29	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
30	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
31	165	147	125	109	91.0	71.0	51.5	37.3	...	...
32	34.5	33.2	32.2	30.6	28.6	26.4	24.2	22.2	...	...
33	58.6	58.6	58.6	58.6	58.6	58.6	56.7	54.8	...	...
34	62.1	61.8	61.8	61.8	61.8	61.4	59.3	57.3	...	...
35	145	144	144	141	133	118	93.5	74.3	...	...
36	172	171	169	162	141	107	69.8	45.6	...	...
37	65.5	65.5	65.4	65.2	65.1	64.2	59.7	55.5	...	...
38	110	110	110	109	109	108	101	94.2	...	...
39	65.5	65.5	65.4	65.2	65.1	64.2	59.7	55.5	...	...
40	159	158	156	150	136	114	86.5	65.5	...	...
41	179	179	177	172	155	124	88.5	63.3	...	...
42	68.9	68.9	68.9	68.7	68.5	67.6	62.9	58.5	...	...
43	159	158	156	150	136	114	86.5	65.5	...	...
44	179	179	177	172	155	124	88.5	63.3	...	...
45	159	158	156	150	136	114	86.5	65.5	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Cond. & heat exch. tubes	SB-234	...	A95052	H34
2	...	Smls. extr. tube	SB-241	...	A95052	O
3	...	Plate, sheet	SB-209	...	A95083	O
4	...	Plate, sheet	SB-209	...	A95083	O
5	...	Plate, sheet	SB-209	...	A95083	O
6	...	Plate, sheet	SB-209	...	A95083	O
7	...	Plate, sheet	SB-209	...	A95083	O
8	...	Plate, sheet	SB-209	...	A95083	H112
9	...	Plate, sheet	SB-209	...	A95083	H112
10	...	Plate, sheet	SB-209	...	A95083	H32
11	...	Plate, sheet	SB-209	...	A95083	H32
12	...	Bar, rod, shapes	SB-221	...	A95083	O
13	...	Bar, rod, shapes	SB-221	...	A95083	H111
14	...	Bar, rod, shapes	SB-221	...	A95083	H112
15	...	Smls. extr. tube	SB-241	...	A95083	O
16	...	Smls. extr. tube	SB-241	...	A95083	H111
17	...	Smls. extr. tube	SB-241	...	A95083	H112
18	...	Die & hand forgings	SB-247	...	A95083	H111
19	...	Die & hand forgings	SB-247	...	A95083	H112
20	...	Plate, sheet	SB-928	...	A95083	H321
21	...	Plate, sheet	SB-928	...	A95083	H321
22	...	Plate, sheet	SB-209	...	A95086	O
23	...	Plate, sheet	SB-209	...	A95086	H112
24	...	Plate, sheet	SB-209	...	A95086	H112
25	...	Plate, sheet	SB-209	...	A95086	H112
26	...	Plate, sheet	SB-209	...	A95086	H112
27	...	Plate, sheet	SB-209	...	A95086	H32
28	...	Plate, sheet	SB-209	...	A95086	H34
29	...	Bar, rod, shapes	SB-221	...	A95086	H112
30	...	Smls. extr. tube	SB-241	...	A95086	O
31	...	Smls. extr. tube	SB-241	...	A95086	H111
32	...	Smls. extr. tube	SB-241	...	A95086	H112
33	...	Plate, sheet	SB-928	...	A95086	H116
34	...	Plate, sheet	SB-209	...	A95154	O
35	...	Plate, sheet	SB-209	...	A95154	H112
36	...	Plate, sheet	SB-209	...	A95154	H112
37	...	Plate, sheet	SB-209	...	A95154	H32
38	...	Plate, sheet	SB-209	...	A95154	H34
39	...	Drawn smls. tube	SB-210	...	A95154	O
40	...	Drawn smls. tube	SB-210	...	A95154	H34
41	...	Bar, rod, shapes	SB-221	...	A95154	O
42	...	Bar, rod, shapes	SB-221	...	A95154	H112
43	...	Plate, sheet	SB-209	...	A95254	O
44	...	Plate, sheet	SB-209	...	A95254	H112
45	...	Plate, sheet	SB-209	...	A95254	H112

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	0.25–5.08	235	180	...
2	...	170	70	...
3	1.30–38.10	275	125	...
4	38.11–76.20	270	115	...
5	76.21–127.00	260	110	...
6	127.01–177.80	255	105	...
7	177.81–203.20	250	95	...
8	6.35–38.10	275	125	...
9	38.11–76.20	270	115	...
10	$3.20 < t \leq 40.00$	305	215	...
11	$40.00 < t \leq 80.00$	285	200	...
12	≤ 127.00	270	110	...
13	≤ 127.00	275	165	...
14	≤ 127.00	270	110	...
15	...	270	110	...
16	...	275	165	...
17	...	270	110	...
18	≤ 101.60	270	140	...
19	≤ 101.60	270	110	...
20	$3.20 < t \leq 40.00$	305	215	...
21	$40.00 < t \leq 80.00$	285	200	...
22	0.51–50.80	240	95	...
23	4.78–12.69	250	125	...
24	12.70–25.40	240	110	...
25	25.41–50.80	240	95	...
26	50.81–76.20	235	95	...
27	0.51–50.80	275	195	...
28	0.23–25.40	305	235	...
29	≤ 127.00	240	95	...
30	...	240	95	...
31	...	250	145	...
32	...	240	95	...
33	$1.60 < t \leq 50.00$	275	195	...
34	0.51–76.2	205	75	...
35	6.35–12.7	220	125	...
36	12.7–76.2	205	75	...
37	0.51–50.8	250	180	...
38	0.23–25.4	270	200	...
39	0.25–11.4	205	75	...
40	0.25–11.4	270	200	...
41	...	205	75	...
42	...	205	75	...
43	1.30–76.2	205	75	...
44	6.35–12.7	220	125	...
45	12.7–76.2	205	75	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	179	179	177	172	155	124	88.5	63.3	...	...
2	68.9	68.9	68.9	68.7	68.5	67.6	62.9	58.5	...	...
3	124	124	...	...	...	...	...	...	...	...
4	117	117	...	...	...	...	...	...	...	...
5	110	110	...	...	...	...	...	...	...	...
6	103	103	...	...	...	...	...	...	...	...
7	96.5	96.5	...	...	...	...	...	...	...	...
8	124	124	...	...	...	...	...	...	...	...
9	117	117	...	...	...	...	...	...	...	...
10	214	214	...	...	...	...	...	...	...	...
11	200	200	...	...	...	...	...	...	...	...
12	110	110	...	...	...	...	...	...	...	...
13	165	165	...	...	...	...	...	...	...	...
14	110	110	...	...	...	...	...	...	...	...
15	110	110	...	...	...	...	...	...	...	...
16	165	165	...	...	...	...	...	...	...	...
17	110	110	...	...	...	...	...	...	...	...
18	138	138	...	...	...	...	...	...	...	...
19	110	110	...	...	...	...	...	...	...	...
20	214	214	...	...	...	...	...	...	...	...
21	200	200	...	...	...	...	...	...	...	...
22	96.5	96.5	...	...	...	...	...	...	...	...
23	124	124	...	...	...	...	...	...	...	...
24	110	110	...	...	...	...	...	...	...	...
25	96.5	96.5	...	...	...	...	...	...	...	...
26	96.5	96.5	...	...	...	...	...	...	...	...
27	193	193	...	...	...	...	...	...	...	...
28	234	234	...	...	...	...	...	...	...	...
29	96.5	96.5	...	...	...	...	...	...	...	...
30	96.5	96.5	...	...	...	...	...	...	...	...
31	145	145	...	...	...	...	...	...	...	...
32	96.5	96.5	...	...	...	...	...	...	...	...
33	193	193	...	...	...	...	...	...	...	...
34	75.8	75.8	...	...	...	...	...	...	...	...
35	124	124	...	...	...	...	...	...	...	...
36	75.8	75.8	...	...	...	...	...	...	...	...
37	179	179	...	...	...	...	...	...	...	...
38	200	200	...	...	...	...	...	...	...	...
39	75.8	75.8	...	...	...	...	...	...	...	...
40	200	200	...	...	...	...	...	...	...	...
41	75.8	75.8	...	...	...	...	...	...	...	...
42	75.8	75.8	...	...	...	...	...	...	...	...
43	75.8	75.8	...	...	...	...	...	...	...	...
44	124	124	...	...	...	...	...	...	...	...
45	75.8	75.8	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Plate, sheet	SB-209	...	A95254	H32
2	...	Plate, sheet	SB-209	...	A95254	H34
3	...	Plate, sheet	SB-209	...	A95454	O
4	...	Plate, sheet	SB-209	...	A95454	H112
5	...	Plate, sheet	SB-209	...	A95454	H112
6	...	Plate, sheet	SB-209	...	A95454	H32
7	...	Plate, sheet	SB-209	...	A95454	H34
8	...	Bar, rod, shapes	SB-221	...	A95454	O
9	...	Bar, rod, shapes	SB-221	...	A95454	H111
10	...	Bar, rod, shapes	SB-221	...	A95454	H112
11	...	Cond. & heat exch. tubes	SB-234	...	A95454	H32
12	...	Cond. & heat exch. tubes	SB-234	...	A95454	H34
13	...	Smls. extr. tube	SB-241	...	A95454	O
14	...	Smls. extr. tube	SB-241	...	A95454	H111
15	...	Smls. extr. tube	SB-241	...	A95454	H112
16	...	Plate, sheet	SB-209	...	A95456	O
17	...	Plate, sheet	SB-209	...	A95456	O
18	...	Plate, sheet	SB-209	...	A95456	O
19	...	Plate, sheet	SB-209	...	A95456	O
20	...	Plate, sheet	SB-209	...	A95456	O
21	...	Plate, sheet	SB-209	...	A95456	H112
22	...	Plate, sheet	SB-209	...	A95456	H112
23	...	Plate, sheet	SB-209	...	A95456	H32
24	...	Plate, sheet	SB-209	...	A95456	H32
25	...	Plate, sheet	SB-209	...	A95456	H32
26	...	Bar, rod, shapes	SB-221	...	A95456	O
27	...	Bar, rod, shapes	SB-221	...	A95456	H111
28	...	Bar, rod, shapes	SB-221	...	A95456	H112
29	...	Smls. extr. tube	SB-241	...	A95456	O
30	...	Smls. extr. tube	SB-241	...	A95456	H111
31	...	Smls. extr. tube	SB-241	...	A95456	H112
32	...	Plate, sheet	SB-928	...	A95456	H321
33	...	Plate, sheet	SB-928	...	A95456	H321
34	...	Plate, sheet	SB-928	...	A95456	H321
35	...	Plate, sheet	SB-209	...	A96061	T4
36	...	Plate, sheet	SB-209	...	A96061	T451
37	...	Plate, sheet	SB-209	...	A96061	T6
38	...	Plate, sheet	SB-209	...	A96061	T651
39	...	Plate, sheet	SB-209	...	A96061	T651
40	...	Drawn smls. tube	SB-210	...	A96061	T4
41	...	Drawn smls. tube	SB-210	...	A96061	T6
42	...	Bar, rod, wire	SB-211	...	A96061	T6
43	...	Bar, rod, wire	SB-211	...	A96061	T651
44	...	Bar, rod, shapes	SB-221	...	A96061	T4
45	...	Bar, rod, shapes	SB-221	...	A96061	T6

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	1.30–50.8	250	180	...
2	1.30–25.4	270	200	...
3	0.51–76.2	215	85	...
4	6.35–12.7	220	125	...
5	12.7–76.2	215	85	...
6	0.51–50.8	250	180	...
7	0.51–25.4	270	200	...
8	≤127	215	85	...
9	≤127	230	130	...
10	≤127	215	85	...
11	0.25–5.08	250	180	...
12	0.25–5.08	270	200	...
13	...	215	85	...
14	...	230	130	...
15	...	215	85	...
16	1.30–38.10	290	130	...
17	38.13–76.20	285	125	...
18	76.23–127.00	275	115	...
19	127.03–177.80	270	110	...
20	177.83–203.20	260	105	...
21	6.35–38.10	290	130	...
22	38.13–76.20	285	125	...
23	4.78–12.69	315	230	...
24	12.70–38.10	305	215	...
25	38.11–76.20	285	200	...
26	≤127.00	285	130	...
27	≤127.00	290	180	...
28	≤127.00	285	130	...
29	...	285	130	...
30	...	290	180	...
31	...	285	130	...
32	4.00–12.50	315	230	...
33	12.51–40.00	305	215	...
34	40.01–80.00	285	200	...
35	0.15–6.34	205	110	...
36	6.35–76.20	205	110	...
37	0.15–6.34	290	240	...
38	6.35–101.60	290	240	...
39	101.61–152.40	275	240	...
40	0.64–12.70	205	110	...
41	0.64–12.70	290	240	...
42	3.18–203.20	290	240	...
43	3.18–203.20	290	240	...
44	...	180	110	...
45	...	260	240	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	179	179	...	...	...	...	...	...	...	...
2	200	200	...	...	...	...	...	...	...	...
3	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
4	124	124	124	124	123	119	112	105	...	...
5	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
6	179	179	177	172	163	149	129	112	...	...
7	200	197	187	177	164	148	128	111	...	...
8	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
9	131	131	131	131	129	126	118	110	...	...
10	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
11	179	179	177	172	163	149	129	112	...	...
12	200	197	187	177	164	148	128	111	...	...
13	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
14	131	131	131	131	129	126	118	110	...	...
15	82.7	82.7	82.7	82.7	82.3	80.1	75.2	70.7	...	...
16	131	131	...	...	...	...	...	...	...	...
17	124	124	...	...	...	...	...	...	...	...
18	117	117	...	...	...	...	...	...	...	...
19	110	110	...	...	...	...	...	...	...	...
20	103	103	...	...	...	...	...	...	...	...
21	131	131	...	...	...	...	...	...	...	...
22	124	124	...	...	...	...	...	...	...	...
23	227	227	...	...	...	...	...	...	...	...
24	213	213	...	...	...	...	...	...	...	...
25	200	200	...	...	...	...	...	...	...	...
26	131	131	...	...	...	...	...	...	...	...
27	179	179	...	...	...	...	...	...	...	...
28	131	131	...	...	...	...	...	...	...	...
29	131	131	...	...	...	...	...	...	...	...
30	179	179	...	...	...	...	...	...	...	...
31	131	131	...	...	...	...	...	...	...	...
32	228	228	...	...	...	...	...	...	...	...
33	214	214	...	...	...	...	...	...	...	...
34	200	200	...	...	...	...	...	...	...	...
35	110	109	109	109	109	109	109	109	...	...
36	110	109	109	109	109	109	109	109	...	...
37	241	238	235	222	191	144	102	72.0	...	...
38	241	238	235	222	191	144	102	72.0	...	...
39	241	238	235	222	191	144	102	72.0	...	...
40	110	109	109	109	109	109	109	109	...	...
41	241	238	235	222	191	144	102	71.7	...	...
42	241	238	235	222	191	144	102	71.7	...	...
43	241	238	235	222	191	144	102	71.7	...	...
44	110	109	109	109	109	109	109	109	...	...
45	241	238	235	222	191	144	102	71.7	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Cond. & heat exch. tubes	SB-234	...	A96061	T4
2	...	Cond. & heat exch. tubes	SB-234	...	A96061	T6
3	...	Smls. extr. tube	SB-241	...	A96061	T4
4	...	Smls. extr. tube	SB-241	...	A96061	T6
5	...	Smls. pipe	SB-241	...	A96061	T6 drawn
6	...	Smls. pipe	SB-241	...	A96061	T6
7	...	Die forgings	SB-247	...	A96061	T6
8	...	Hand forgings	SB-247	...	A96061	T6
9	...	Hand forgings	SB-247	...	A96061	T6
10	...	Shapes	SB-308	...	A96061	T6
(25) 11	...	Drawn smls. tube	SB-210	...	A96063	T6
12	...	...	...	...	...	...
13	...	Bar, rod, shapes	SB-221	...	A96063	T1
14	...	Bar, rod, shapes	SB-221	...	A96063	T1
15	...	Bar, rod, shapes	SB-221	...	A96063	T5
16	...	Bar, rod, shapes	SB-221	...	A96063	T5
17	...	Bar, rod, shapes	SB-221	...	A96063	T6
18	...	Smls. extr. tube	SB-241	...	A96063	O
19	...	Smls. extr. tube	SB-241	...	A96063	T1
20	...	Smls. extr. tube	SB-241	...	A96063	T1
21	...	Smls. extr. tube	SB-241	...	A96063	T5
22	...	Smls. extr. tube	SB-241	...	A96063	T5
23	...	Smls. extr. tube/pipe	SB-241	...	A96063	T6
24	...	Smls. pipe	SB-241	...	A96063	O
25	...	Smls. pipe	SB-241	...	A96063	T6
26	...	Castings	SB/EN 1706	AlSi7Mg	AC-42000	...
27	...	Castings	SB/EN 1706	...	AC-44300	F
28	...	Bar, rod	SB-187	...	C10200	O60
29	...	Smls. pipe	SB-42	...	C10200	O61
30	...	Smls. tube	SB-75	...	C10200	O60
(25) 31	...	Plate, sheet, strip, bar	SB-152	...	C10200	H00
(25) 32	...	Plate, sheet, strip, bar	SB-152	...	C10200	H01
(25) 33	...	Plate, sheet, strip, bar	SB-152	...	C10200	H02
(25) 34	...	Plate, sheet, strip, bar	SB-152	...	C10200	H03
(25) 35	...	Plate, sheet, strip, bar	SB-152	...	C10200	H04
(25) 36	...	Plate, sheet, strip, bar	SB-152	...	C10200	M20, O25
37	...	Smls. pipe	SB-42	...	C10200	H55
38	...	Smls. tube	SB-75	...	C10200	H55
39	...	Smls. cond. tube	SB-111	...	C10200	H55
40	...	Smls. U-bend tube	SB-395	...	C10200	H55
41	...	Smls. pipe	SB-42	...	C10200	H80
42	...	Smls. tube	SB-75	...	C10200	H80
43	...	Smls. cond. tube	SB-111	...	C10200	H80
(25) 44	...	Plate, sheet, strip, bar	SB-152	...	C10400	H00
(25) 45	...	Plate, sheet, strip, bar	SB-152	...	C10400	H01

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	0.64–5.08	205	110	...
2	0.64–5.08	290	240	...
3	...	180	110	...
4	...	260	240	...
5	<25.40	290	240	...
6	≥25.40	260	240	...
7	≤101.60	260	240	...
8	≤101.60	255	230	...
9	101.61–203.20	240	220	...
10	...	260	240	...
11	0.64–12.70	230	190	...
12	...	...	...	...
13	≤12.70	115	60	...
14	12.71–25.40	110	55	...
15	≤12.70	150	110	...
16	12.71–25.40	145	105	...
17	≤25.40	205	170	...
18	...	110	35	...
19	≤12.70	115	60	...
20	12.71–25.40	110	55	...
21	≤12.70	150	110	...
22	12.71–25.40	145	105	...
23	≤25.40	205	170	...
24	...	110	35	...
25	≤25.40	205	170	...
26	...	140	80	...
27	...	240	130	...
28	All	195	55	...
29	All	205	60	...
30	All	205	62	...
31	...	205	70	...
32	...	205	70	...
33	...	205	70	...
34	...	205	70	...
35	...	205	70	...
36	...	205	70	...
37	50 < DN ≤ 300	250	205	...
38	All	250	205	...
39	...	250	205	...
40	...	250	205	...
41	6 < DN ≤ 50	310	275	...
42	<102	310	275	...
43	...	310	275	...
44	...	205	70	...
45	...	205	70	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	110	109	109	109	109	109	109	109	...	...
2	241	238	235	222	191	144	102	71.7	...	...
3	110	109	109	109	109	109	109	109	...	...
4	241	238	235	222	191	144	102	71.7	...	...
5	241	238	235	222	191	144	102	71.7	...	...
6	241	238	235	222	191	144	102	71.7	...	...
7	241	238	235	222	191	144	102	71.7	...	...
8	228	223	218	203	168	116	64.0	35.5	...	...
9	221	219	219	219	219	219	219	219	...	...
10	241	238	235	222	191	144	102	71.7	...	...
11	193	188	187	173	139	92.1	66.9	48.5	...	...
12	...	...	...	...	...	...	...	...	...	...
13	62.1	60.8	60	58.3	58.2	56.2	36.2	23.3	...	...
14	55.2	53.7	51.8	48.6	46.1	41.1	20.9	10.6	...	...
15	110	107	103	99.8	85	55.3	24.6	10.9	...	...
16	103	101	99.1	97.6	87.3	65.1	39.6	24	...	...
17	172	165	161	145	111	63.1	34.0	18.3	...	...
18	34.5	33.6	32.4	30.4	28.8	25.7	13.0	...	...	...
19	62.1	60.8	60	58.3	58.2	56.2	54.2	52.2	...	...
20	55.2	53.7	51.8	48.6	46.1	41.1	36.7	32.7	...	...
21	110	107	103	99.8	85	55.3	24.6	10.9	...	...
22	103	101	99.1	97.6	87.3	65.1	39.6	24	...	...
23	172	165	161	145	111	63.3	34.1	18.3	...	...
24	34.5	33.6	32.4	30.4	28.8	25.7	13.0	...	...	...
25	172	165	161	145	111	63.3	34.1	18.3	...	...
26	80.0	80.0	80.0	80.0	80.0	...	...	...	...	...
27	130	107	88.4	86.9	86.9	...	...	...	...	...
28	55.2	48.5	48.5	48.5	48.3	46.9	44.9	42.8	41.2	...
29	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
30	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
31	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
32	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
33	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
34	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
35	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
36	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
37	207	205	199	193	186	178	170	161	152	...
38	207	205	199	193	186	178	170	161	152	...
39	207	205	199	193	186	178	170	161	152	...
40	207	205	199	193	186	178	170	161	152	...
41	276	264	258	254	246	233	215	185	154	...
42	276	264	258	254	246	233	215	185	154	...
43	276	264	258	254	246	233	215	185	154	...
44	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
45	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
(25) 1	...	Plate, sheet, strip, bar	SB-152	...	C10400	H02
(25) 2	...	Plate, sheet, strip, bar	SB-152	...	C10400	H03
(25) 3	...	Plate, sheet, strip, bar	SB-152	...	C10400	H04
(25) 4	...	Plate, sheet, strip, bar	SB-152	...	C10400	M20, O25
(25) 5	...	Plate, sheet, strip, bar	SB-152	...	C10500	H00
(25) 6	...	Plate, sheet, strip, bar	SB-152	...	C10500	H01
(25) 7	...	Plate, sheet, strip, bar	SB-152	...	C10500	H02
(25) 8	...	Plate, sheet, strip, bar	SB-152	...	C10500	H03
(25) 9	...	Plate, sheet, strip, bar	SB-152	...	C10500	H04
(25) 10	...	Plate, sheet, strip, bar	SB-152	...	C10500	M20, O25
(25) 11	...	Plate, sheet, strip, bar	SB-152	...	C10700	H00
(25) 12	...	Plate, sheet, strip, bar	SB-152	...	C10700	H01
(25) 13	...	Plate, sheet, strip, bar	SB-152	...	C10700	H02
(25) 14	...	Plate, sheet, strip, bar	SB-152	...	C10700	H03
(25) 15	...	Plate, sheet, strip, bar	SB-152	...	C10700	H04
(25) 16	...	Plate, sheet, strip, bar	SB-152	...	C10700	M20, O25
17	...	Bar	SB-187	...	C11000	H04
18	...	Bar, rod	SB-187	...	C11000	O60
19	...	Plate, sheet, strip, bar	SB-152	...	C11000	M20, O25
20	...	Smls. pipe	SB-42	...	C12000	O61
21	...	Smls. tube	SB-75	...	C12000	O50
22	...	Smls. tube	SB-75	...	C12000	O60
23	...	Smls. pipe	SB-42	...	C12000	H55
24	...	Smls. tube	SB-75	...	C12000	H55
25	...	Smls. cond. tube	SB-111	...	C12000	H55
26	...	Smls. U-bend tube	SB-395	...	C12000	H55
27	...	Smls. pipe	SB-42	...	C12000	H80
28	...	Smls. tube	SB-75	...	C12000	H80
29	...	Smls. cond. tube	SB-111	...	C12000	H80
30	...	Finned tube	SB-359	...	C12200	O62
31	...	Smls. pipe	SB-42	...	C12200	O61
32	...	Smls. tube	SB-75	...	C12200	O50
33	...	Smls. tube	SB-75	...	C12200	O60
34	...	Finned tube	SB-359	...	C12200	O61
35	...	Wld. cond. tube	SB-543	...	C12200	W061
(25) 36	...	Plate, sheet, strip, bar	SB-152	...	C12200	H00
(25) 37	...	Plate, sheet, strip, bar	SB-152	...	C12200	H01
(25) 38	...	Plate, sheet, strip, bar	SB-152	...	C12200	H02
(25) 39	...	Plate, sheet, strip, bar	SB-152	...	C12200	H03
(25) 40	...	Plate, sheet, strip, bar	SB-152	...	C12200	H04
(25) 41	...	Plate, sheet, strip, bar	SB-152	...	C12200	M20, O25
42	...	Wld. cond. tube	SB-543	...	C12200	WC55
43	...	Smls. pipe	SB-42	...	C12200	H55
44	...	Smls. tube	SB-75	...	C12200	H55
45	...	Smls. cond. tube	SB-111	...	C12200	H55

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	70	...
2	...	205	70	...
3	...	205	70	...
4	...	205	70	...
5	...	205	70	...
6	...	205	70	...
7	...	205	70	...
8	...	205	70	...
9	...	205	70	...
10	...	205	70	...
11	...	205	70	...
12	...	205	70	...
13	...	205	70	...
14	...	205	70	...
15	...	205	70	...
16	...	205	70	...
17	All	195	55	...
18	All	195	55	...
19	...	205	70	...
20	All	205	60	...
21	All	205	62	...
22	All	205	62	...
23	50 < DN ≤ 300	250	205	...
24	All	250	205	...
25	...	250	205	...
26	...	250	205	...
27	6 < DN ≤ 50	310	275	...
28	<102	310	275	...
29	...	310	275	...
30	...	205	45	...
31	All	205	60	...
32	All	205	62	...
33	All	205	62	...
34	...	205	62	...
35	...	205	60	...
36	...	205	70	...
37	...	205	70	...
38	...	205	70	...
39	...	205	70	...
40	...	205	70	...
41	...	205	70	...
42	...	220	105	...
43	50 < DN ≤ 300	250	205	...
44	All	250	205	...
45	...	250	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
2	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
3	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
4	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
5	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
6	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
7	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
8	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
9	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
10	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
11	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
12	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
13	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
14	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
15	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
16	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
17	55.2	48.5	48.5	48.5	48.3	46.9	44.9	42.8	41.2	...
18	55.2	48.5	48.5	48.5	48.3	46.9	44.9	42.8	41.2	...
19	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
20	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
21	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
22	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
23	207	205	199	193	186	178	170	161	152	...
24	207	205	199	193	186	178	170	161	152	...
25	207	205	199	193	186	178	170	161	152	...
26	207	205	199	193	186	178	170	161	152	...
27	276	264	258	254	246	233	215	185	154	...
28	276	264	258	254	246	233	215	185	154	...
29	276	264	258	254	246	233	215	185	154	...
30	44.8	39.6	39.6	39.6	39.4	38.3	36.7	34.9	33.7	...
31	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
32	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
33	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
34	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
35	62.1	54.6	54.6	54.6	54.3	52.8	50.5	48.1	46.4	...
36	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
37	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
38	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
39	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
40	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
41	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
42	103	102	99.4	96.7	92.9	89.2	84.9	80.5	76.2	...
43	207	205	199	193	186	178	170	161	152	...
44	207	205	199	193	186	178	170	161	152	...
45	207	205	199	193	186	178	170	161	152	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

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

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Finned tube	SB-359	...	C12200	H55
2	...	Smls. U-bend tube	SB-395	...	C12200	H55
3	...	Smls. pipe	SB-42	...	C12200	H80
4	...	Smls. cond. tube	SB-75	...	C12200	H80
5	...	Smls. tube	SB-111	...	C12200	H80
(25) 6	...	Finned tube	SB-359	...	C12200	H80
7	...	Plate, sheet, strip, bar	SB-152	...	C12300	H00
8	...	Plate, sheet, strip, bar	SB-152	...	C12300	H01
9	...	Plate, sheet, strip, bar	SB-152	...	C12300	H02
10	...	Plate, sheet, strip, bar	SB-152	...	C12300	H03
11	...	Plate, sheet, strip, bar	SB-152	...	C12300	H04
12	...	Plate, sheet, strip, bar	SB-152	...	C12300	M20, O25
(25) 13	...	Plate, sheet, strip, bar	SB-152	...	C14200	M20, O25
14	...	Smls. cond. tube	SB-111	...	C14200	H55
15	...	Smls. U-bend tube	SB-395	...	C14200	H55
16	...	Smls. cond. tube	SB-111	...	C14200	H80
17	...	Smls. cond. tube	SB-111	...	C19200	O61
18	...	Smls. U-bend tube	SB-395	...	C19200	O61
19	...	Wld. cond. tube	SB-543	...	C19400	W061
20	...	Wld. cond. tube	SB-543	...	C19400	WC55
21	...	Smls. pipe	SB-43	...	C23000	O61 and H58
22	...	Smls. cond. tube	SB-111	...	C23000	O61
23	...	Smls. tube	SB-135	...	C23000	O50 and O60
24	...	Smls. U-bend tube	SB-395	...	C23000	O61
25	...	Smls. cond. tube	SB-543	...	C23000	W061 and WC55
26	...	Smls. tube	SB-111	...	C28000	O25
27	...	Plate	SB-171	...	C36500	O25 and M20
28	...	Plate	SB-171	...	C36500	O25 and M20
(25) 29	...	Plate, sheet	SB-171	...	C36500	O25 and M20
(25) 30	...	Forgings, brass	SB-283	...	C37700	M10, O20
(25) 31	...	...	...	...	...	...
(25) 32	...	...	...	...	...	...
(25) 33	...	Forgings, brass	SB-283	...	C37700	M10, O20
(25) 34	...	...	...	...	...	...
(25) 35	...	...	...	...	...	...
(25) 36	...	Plate, sheet	SB-171	...	C44300	M10, M20
(25) 37	...	Plate, sheet	SB-171	...	C44300	O20, O25
38	...	Smls. cond. tube	SB-111	...	C44300	O61
39	...	Finned tube	SB-359	...	C44300	O61
40	...	Smls. U-bend tube	SB-395	...	C44300	O61
41	...	Wld. cond. tube	SB-543	...	C44300	W061
(25) 42	...	Plate, sheet	SB-171	...	C44400	M10, M20
(25) 43	...	Plate, sheet	SB-171	...	C44400	O20, O25
44	...	Smls. cond. tube	SB-111	...	C44400	O61
45	...	Finned tube	SB-359	...	C44400	O61

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	...	250	205	...
2	...	250	205	...
3	$6 < DN \leq 50$	310	275	...
4	<102	310	275	...
5	...	310	275	...
6	...	310	275	...
7	...	205	70	...
8	...	205	70	...
9	...	205	70	...
10	...	205	70	...
11	...	205	70	...
12	...	205	70	...
13	...	205	70	...
14	...	250	205	...
15	...	250	205	...
16	...	310	275	...
17	...	260	85	...
18	...	260	85	...
19	...	310	105	...
20	...	310	150	...
21	...	275	85	...
22	...	275	85	...
23	...	275	85	...
24	...	275	85	...
25	...	275	85	...
26	...	345	140	...
27	$100 < t \leq 140$	275	85	...
28	$50 < t \leq 100$	310	105	...
29	≤ 50	345	140	...
30	>38	317	103	...
31	...	...	...	...
32	...	...	...	...
33	≤ 38	345	125	...
34	...	...	...	...
35	...	...	...	...
36	≤ 100	310	105	...
37	≤ 100	310	105	...
38	...	310	105	...
39	...	310	105	...
40	...	310	105	...
41	...	310	105	...
42	≤ 100	310	105	...
43	≤ 100	310	105	...
44	...	310	105	...
45	...	310	105	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	207	205	199	193	186	178	170	161	152	...
2	207	205	199	193	186	178	170	161	152	...
3	276	264	258	254	246	233	215	185	154	...
4	276	264	258	254	246	233	215	185	154	...
5	276	264	258	254	246	233	215	185	154	...
6	276	264	258	254	246	233	215	185	154	...
7	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
8	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
9	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
10	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
11	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
12	68.9	60.7	60.7	60.7	60.4	58.7	56.1	53.4	51.5	...
13	68.9	58.7	55.5	55.0	53.7	52.5	50.7	48.8	46.9	...
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	82.7	73.9	68.8	65.8	64.0	62.2	60.9	59.2	57.3	...
18	82.7	73.9	68.8	65.8	64.0	62.2	60.9	59.2	57.3	...
19	103	102	100	98.2	95.0	92.6	88.9	85.6	82.6	...
20	152	150	147	144	140	135	131	126	121	...
21	82.7	82.7	82.7	82.7	82.7	82.7	82.3	80.5	77.3	...
22	82.7	82.7	82.7	82.7	82.7	82.7	82.3	80.5	77.3	...
23	82.7	82.7	82.7	82.7	82.7	82.7	82.3	80.5	77.3	...
24	82.7	82.7	82.7	82.7	82.7	82.7	82.3	80.5	77.3	...
25	82.7	82.7	82.7	82.7	82.7	82.7	82.3	80.5	77.3	...
26	138	138	138	138	138	138	138	138	133	...
27	82.7	82.7	82.7	82.7	82.7	82.7	82.7	82.7	79.8	...
28	103	103	103	103	103	103	103	103	100	...
29	138	138	138	138	138	138	138	138	133	...
30	103	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
31	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...
33	124	103	103	103	103	103	103	103	103	103
34	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	103	103	103	103	103	103	103	102	101	98.9
37	103	103	103	103	103	103	103	102	101	98.9
38	103	103	103	103	103	103	103	102	101	98.9
39	103	103	103	103	103	103	103	102	101	98.9
40	103	103	103	103	103	103	103	102	101	98.9
41	103	103	103	103	103	103	103	102	101	98.9
42	103	103	103	103	103	103	103	102	101	98.9
43	103	103	103	103	103	103	103	102	101	98.9
44	103	103	103	103	103	103	103	102	101	98.9
45	103	103	103	103	103	103	103	102	101	98.9

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Smls. U-bend tube	SB-395	...	C44400	O61
2	...	Wld. cond. tube	SB-543	...	C44400	W061
(25) 3	...	Plate, sheet	SB-171	...	C44500	M10, M20
(25) 4	...	Plate, sheet	SB-171	...	C44500	O20, O25
5	...	Smls. cond. tube	SB-111	...	C44500	O61
6	...	Finned tube	SB-359	...	C44500	O61
7	...	Smls. U-bend tube	SB-395	...	C44500	O61
8	...	Wld. cond. tube	SB-543	...	C44500	W061
9	...	Plate	SB-171	...	C46400	M10, M20
(25) 10	...	Plate, sheet	SB-171	...	C46400	O20, O25
11	...	Plate	SB-171	...	C46500	M10, M20
(25) 12	...	Plate, sheet	SB-171	...	C46500	O20, O25
13	...	Smls. cond. tube	SB-111	...	C60800	O61
14	...	Smls. U-bend tube	SB-395	...	C60800	O61
(25) 15	...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
16	...	Plate	SB-171	...	C61400	M10, M20, O20, O25
(25) 17	...	Round rod	SB-150	...	C61400	HR50
(25) 18	...	Plate, sheet	SB-169	...	C61400	M20, O25, O60
19	...	Plate	SB-171	...	C61400	M10, M20, O20, O25
(25) 20	...	Round rod	SB-150	...	C61400	HR50
(25) 21	...	Plate, sheet, bar	SB-169	...	C61400	M20, O25, O60
(25) 22	...	Round rod	SB-150	...	C61400	HR50
(25) 23	...	Round rod	SB-150	...	C61400	HR50
24	...	Plate	SB-171	...	C63000	M10, M20, O20, O25
25	...	Plate	SB-171	...	C63000	M10, M20, O20, O25
26	...	Bar, rod	SB-150	...	C63000	M20, M30
27	...	Bar, rod	SB-150	...	C63000	O20, O25, O30
28	...	Bar, rod	SB-150	...	C63000	HR50
29	...	Bar, rod	SB-150	...	C63000	HR50
30	...	Bar, rod	SB-150	...	C63000	M20, M30
31	...	Bar, rod	SB-150	...	C63000	O20, O25, O30
32	...	Plate	SB-171	...	C63000	M10, M20, O20, O25
33	...	Bar, rod	SB-150	...	C63000	HR50
34	...	Bar, rod	SB-150	...	C63000	HR50
(25) 35	...	Forgings	SB-283	...	C64200	M10, O20
(25) 36	...	Forgings	SB-283	...	C64200	M10, O20
37	...	Bar, rod	SB-150	...	C64200	M10, M20, M30
(25) 38	...	...	...	...	...	...
39	...	Bar, rod	SB-150	...	C64200	M10, M20, M30
40	...	Bar, rod	SB-150	...	C64200	HR50
41	...	Bar, rod	SB-150	...	C64200	HR50
42	...	Bar, rod	SB-150	...	C64200	HR50
43	...	Bar, rod	SB-150	...	C64200	HR50
44	...	Bar, rod	SB-98	...	C65100	O60
45	...	Bar, rod	SB-98	...	C65100	H02

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	...	310	105	...
2	...	310	105	...
3	≤ 100	310	105	...
4	≤ 100	310	105	...
5	...	310	105	...
6	...	310	105	...
7	...	310	105	...
8	...	310	105	...
9	$80 < t \leq 140$	345	125	...
10	≤ 80	345	140	...
11	$80 < t \leq 140$	345	125	...
12	≤ 80	345	140	...
13	...	345	130	...
14	...	345	130	...
15	$50 < t \leq 140$	450	195	...
16	$50 < t \leq 140$	450	195	...
17	$50 < t \leq 80$	485	205	...
18	$12 < t \leq 50$	485	205	...
19	≤ 50	485	205	...
20	$25 < t \leq 50$	485	220	...
21	≤ 12	495	220	...
22	$12 < t \leq 25$	515	240	...
23	≤ 12	550	275	...
24	$100 < t \leq 140$	550	205	...
25	$50 < t \leq 100$	585	230	...
26	> 100	550	275	...
27	> 100	550	275	...
28	> 100	550	275	...
29	$50 < t \leq 100$	585	295	...
30	$50 < t \leq 100$	585	295	...
31	$50 < t \leq 100$	585	295	...
32	≤ 50	620	250	...
33	$25 < t \leq 50$	620	310	...
34	$12 < t \leq 25$	690	345	...
35	> 38	470	160	...
36	≤ 38	485	170	...
37	> 100	485	170	...
38	...	...	...	...
39	$80 < t \leq 100$	485	205	...
40	$50 < t \leq 80$	515	240	...
41	$25 < t \leq 50$	550	290	...
42	$12 < t \leq 25$	585	310	...
43	≤ 12	620	310	...
44	All	275	85	...
45	≤ 50	380	140	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
Nonferrous Materials (Cont'd)										
1	103	103	103	103	103	103	103	102	101	98.9
2	103	103	103	103	103	103	103	102	101	98.9
3	103	103	103	103	103	103	103	102	101	98.9
4	103	103	103	103	103	103	103	102	101	98.9
5	103	103	103	103	103	103	103	102	101	98.9
6	103	103	103	103	103	103	103	102	101	98.9
7	103	103	103	103	103	103	103	102	101	98.9
8	103	103	103	103	103	103	103	102	101	98.9
9	124	124	124	124	124	124	123	120	116	...
10	138	138	138	138	138	138	136	133	129	...
11	124	124	124	124	124	124	123	120	116	...
12	138	138	138	138	138	138	136	133	129	...
13	131	126	126	126	124	121	118	115	112	108
14	131	126	126	126	124	121	118	115	112	108
15	193	192	191	189	189	188	186	184	182	180
16	193	192	191	189	189	188	186	184	182	180
17	207	206	204	203	202	201	199	197	195	193
18	207	206	204	203	202	201	199	197	195	193
19	207	206	204	203	202	201	199	197	195	193
20	221	220	218	216	216	215	213	210	208	206
21	221	220	218	216	216	215	213	210	208	206
22	240	239	237	235	235	233	231	228	226	224
23	275	274	271	269	269	268	265	261	259	256
24	207	207	207	207	207	207	207	206	205	202
25	228	228	228	228	228	228	228	227	225	222
26	276	276	276	276	276	276	276	275	273	269
27	276	276	276	276	276	276	276	275	273	269
28	276	276	276	276	276	276	276	275	273	269
29	293	293	293	293	293	293	293	292	290	286
30	293	293	293	293	293	293	293	292	290	286
31	293	293	293	293	293	293	293	292	290	286
32	248	248	248	248	248	248	248	247	245	242
33	310	310	310	310	310	310	310	309	307	303
34	345	345	345	345	345	345	345	343	341	337
35	158	149	146	146	146	146	146	146	146	146
36	172	162	159	159	159	159	159	159	159	159
37	172	162	159	159	159	159	159	159	159	159
38	...	...	...	...	...	...	...	...	...	...
39	207	194	191	190	190	190	190	190	190	190
40	241	227	222	222	222	222	222	222	222	222
41	289	272	267	267	267	267	267	267	267	267
42	310	291	286	286	286	286	286	286	286	286
43	310	291	286	286	286	286	286	286	286	286
44	82.7	82.1	81.5	81.0	80.4	79.6	78.7	77.4	75.7	...
45	138	138	136	133	129	125	119	114	108	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	197	189	176	156	...	...	...	...	...	...
25	217	208	193	171	...	...	...	...	...	...
26	263	252	234	207	...	...	...	...	...	...
27	263	252	234	207	...	...	...	...	...	...
28	263	252	234	207	...	...	...	...	...	...
29	279	268	249	220	...	...	...	...	...	...
30	279	268	249	220	...	...	...	...	...	...
31	279	268	249	220	...	...	...	...	...	...
32	237	227	211	187	...	...	...	...	...	...
33	296	283	263	233	...	...	...	...	...	...
34	329	315	293	259	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

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

INTENTIONALLY LEFT BLANK

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 Design./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Rod	SB-98	...	C65100	H06
2	...	Rod	SB-98	...	C65100	H06
3	...	Rod	SB-98	...	C65100	H06
(25) 4	...	Smls. pipe & tube	SB-315	...	C65500	O30, O61
(25) 5	...	Plate, sheet, strip, bar	SB-96	...	C65500	O61
6	...	Bar, rod	SB-98	...	C65500	O60
(25) 7	...	Bar, rod	SB-98	...	C65500	H01
8	...	Bar, rod	SB-98	...	C65500	H02
(25) 9	...	Bar, rod	SB-98	...	C66100	O60
(25) 10	...	Bar, rod	SB-98	...	C66100	H01
(25) 11	...	Bar, rod	SB-98	...	C66100	H02
12	...	Smls. cond. tube	SB-111	...	C68700	O61
13	...	Smls. U-bend tube	SB-395	...	C68700	O61
14	...	Wld. cond. tube	SB-543	...	C68700	W061
15	...	Smls. cond. tube	SB-111	...	C70400	O61
16	...	Wld. tube	SB-543	...	C70400	W061
17	...	Smls. cond. tube	SB-111	...	C70400	H55
18	...	Smls. pipe & tube	SB-466	...	C70600	O60
19	...	Wld. pipe	SB-467	...	C70600	W061
20	...	Bar, rod	SB-151	...	C70600	O60
21	...	Plate, sheet	SB-171	...	C70600	M10, M20
22	...	Plate, sheet	SB-171	...	C70600	O20, O25
23	...	Smls. cond. tube	SB-111	...	C70600	O61
24	...	Finned tube	SB-359	...	C70600	O61
25	...	Smls. U-bend tube	SB-395	...	C70600	O61
26	...	Wld. pipe	SB-467	...	C70600	W061
27	...	Wld. tube	SB-543	...	C70600	W061
28	...	Finned wld. tube	SB-956	...	C70600	W061
29	...	Wld. pipe	SB-467	...	C70600	WM50
30	...	Smls. tube	SB-111	...	C70600	H55
31	...	Smls. pipe & tube	SB-466	...	C70600	H55
32	...	Wld. tube	SB-543	...	C70600	WC55
33	...	Finned wld. tube	SB-956	...	C70600	WC55
34	...	Wld. pipe	SB-467	...	C70600	Wld. fr. cold rld. strip
35	...	Smls. pipe & tube	SB-466	...	C70620	O60
36	...	Wld. pipe	SB-467	...	C70620	W061
37	...	Bar, rod	SB-151	...	C70620	O60
38	...	Forgings	SB-283	...	C70620	M10
39	...	Plate, sheet	SB-171	...	C70620	M10, M20
40	...	Forgings	SB-283	...	C70620	O20
41	...	Plate, sheet	SB-171	...	C70620	O20, O25
42	...	Smls. cond. tube	SB-111	...	C70620	O61
43	...	Finned tube	SB-359	...	C70620	O61
44	...	Smls. U-bend tube	SB-395	...	C70620	O61
45	...	Wld. pipe	SB-467	...	C70620	W061

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	$25 < t \leq 38$	515	275	...
2	$12 < t \leq 25$	515	310	...
3	$t \leq 12$	585	380	...
4	...	345	103	...
5	≤ 50	345	125	...
6	All	360	105	...
7	All	380	165	...
8	≤ 50	485	260	...
9	All	360	105	...
10	All	380	165	...
11	≤ 50	485	260	...
12	...	345	125	...
13	...	345	125	...
14	...	345	125	...
15	...	260	85	...
16	...	260	85	...
17	...	275	205	...
18	...	260	90	...
19	>114	260	90	...
20	All	260	105	...
21	≤ 140	275	105	...
22	≤ 140	275	105	...
23	...	275	105	...
24	...	275	105	...
25	...	275	105	...
26	≤ 114	275	105	...
27	...	275	105	...
28	...	275	105	...
29	≤ 114	310	205	...
30	...	310	240	...
31	...	310	240	...
32	...	310	240	...
33	...	310	240	...
34	≤ 114	370	310	...
35	...	260	90	...
36	>114	260	90	...
37	All	260	105	...
38	>152	276	103	...
39	≤ 140	275	105	...
40	...	276	103	...
41	≤ 140	275	105	...
42	...	275	105	...
43	...	275	105	...
44	...	275	105	...
45	≤ 114	275	105	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	276	271	263	257	250	242	233	222	209	...
2	310	305	296	289	281	272	262	250	235	...
3	379	372	362	354	344	333	320	305	287	...
4	103	103	103	103	102	102	101	100	98.6	...
5	124	124	123	123	122	122	121	120	118	...
6	103	103	103	103	102	102	101	100	98.6	...
7	165	162	158	155	151	148	145	143	140	...
8	262	259	255	252	246	239	227	212	191	...
9	103	103	103	103	102	102	101	100	98.6	...
10	165	162	158	155	151	148	145	143	140	...
11	262	259	255	252	246	239	227	212	191	...
12	124	123	122	121	120	119	118	117	115	112
13	124	123	122	121	120	119	118	117	115	112
14	124	123	122	121	120	119	118	117	115	112
15	82.7	79.8	77.6	76.5	75.7	75.2	74.9	74.9	74.9	74.9
16	82.7	79.8	77.6	76.5	75.7	75.2	74.9	74.9	74.9	74.9
17	207	199	194	191	189	188	187	187	187	187
18	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
19	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
20	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
21	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
22	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
23	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
24	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
25	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
26	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
27	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
28	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
29	207	201	195	191	187	183	180	177	175	173
30	241	235	228	223	218	213	210	206	204	202
31	241	235	228	223	218	213	210	206	204	202
32	241	235	228	223	218	213	210	206	204	202
33	241	235	228	223	218	213	210	206	204	202
34	310	301	293	286	280	275	270	266	262	260
35	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
36	89.6	86.9	84.3	82.4	80.6	79.4	78.1	76.9	75.6	74.7
37	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
38	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
39	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
40	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
41	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
42	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
43	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
44	103	101	97.4	95.6	93.7	91.8	89.9	88.6	87.3	86.4
45	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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	110	...	...	...	...	...	...	...	...	...
13	110	...	...	...	...	...	...	...	...	...
14	110	...	...	...	...	...	...	...	...	...
15	74.9	...	...	...	...	...	...	...	...	...
16	74.9	...	...	...	...	...	...	...	...	...
17	187	...	...	...	...	...	...	...	...	...
18	74.5	74.5	...	...	...	...	...	...	...	...
19	74.5	74.5	...	...	...	...	...	...	...	...
20	85.9	85.3	...	...	...	...	...	...	...	...
21	85.9	85.3	...	...	...	...	...	...	...	...
22	85.9	85.3	...	...	...	...	...	...	...	...
23	85.9	85.3	...	...	...	...	...	...	...	...
24	85.9	85.3	...	...	...	...	...	...	...	...
25	85.9	85.3	...	...	...	...	...	...	...	...
26	85.9	85.3	...	...	...	...	...	...	...	...
27	85.9	85.3	...	...	...	...	...	...	...	...
28	85.9	85.3	...	...	...	...	...	...	...	...
29	172	171	...	...	...	...	...	...	...	...
30	201	199	...	...	...	...	...	...	...	...
31	201	199	...	...	...	...	...	...	...	...
32	201	199	...	...	...	...	...	...	...	...
33	201	199	...	...	...	...	...	...	...	...
34	258	257	...	...	...	...	...	...	...	...
35	74.5	74.5	...	...	...	...	...	...	...	...
36	74.5	74.5	...	...	...	...	...	...	...	...
37	85.9	85.3	...	...	...	...	...	...	...	...
38	85.9	85.3	...	...	...	...	...	...	...	...
39	85.9	85.3	...	...	...	...	...	...	...	...
40	85.9	85.3	...	...	...	...	...	...	...	...
41	85.9	85.3	...	...	...	...	...	...	...	...
42	85.9	85.3	...	...	...	...	...	...	...	...
43	85.9	85.3	...	...	...	...	...	...	...	...
44	85.9	85.3	...	...	...	...	...	...	...	...
45	85.9	85.3	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	...	Wld. tube	SB-543	...	C70620	W061
2	...	Finned wld. tube	SB-956	...	C70620	W061
3	...	Forgings	SB-283	...	C70620	M10
4	...	Wld. pipe	SB-467	...	C70620	WM50
5	...	Smls. tube	SB-111	...	C70620	H55
6	...	Smls. pipe & tube	SB-466	...	C70620	H55
7	...	Wld. tube	SB-543	...	C70620	WC55
8	...	Finned wld. tube	SB-956	...	C70620	WC55
9	...	Wld. pipe	SB-467	...	C70620	Wld. fr. cold rld. strip
10	...	Smls. tube	SB-466	...	C71000	O60
11	...	Smls. cond. tube	SB-111	...	C71000	O61
12	...	Finned tube	SB-359	...	C71000	O61
13	...	Smls. tube	SB-395	...	C71000	O61
14	...	Wld. pipe	SB-467	...	C71500	W061
15	...	Plate, sheet	SB-171	...	C71500	M10, M20, O20, O25
16	...	Plate, sheet	SB-171	...	C71500	M10, M20, O20, O25
17	...	Wld. pipe	SB-467	...	C71500	W061
18	...	Smls. pipe & tube	SB-466	...	C71500	O60
19	...	Smls. cond. tube	SB-111	...	C71500	O61
20	...	Finned tube	SB-359	...	C71500	O61
21	...	Smls. U-bend tube	SB-395	...	C71500	O61
22	...	Wld. tube	SB-543	...	C71500	W061
23	...	Finned wld. tube	SB-956	...	C71500	W061
24	...	Smls. cond. tube	SB-111	...	C71500	HR50
25	...	Smls. U-bend tube	SB-395	...	C71500	HR50
26	...	Wld. pipe	SB-467	...	C71520	W061
27	...	Forgings	SB-283	...	C71520	M10
28	...	Forgings	SB-283	...	C71520	O20
29	...	Plate, sheet	SB-171	...	C71520	O25
30	...	Forgings	SB-283	...	C71520	M10
31	...	Plate, sheet	SB-171	...	C71520	O25
32	...	Wld. pipe	SB-467	...	C71520	W061
33	...	Smls. pipe & tube	SB-466	...	C71520	O60
34	...	Smls. cond. tube	SB-111	...	C71520	O61
35	...	Finned tube	SB-359	...	C71520	O61
36	...	Smls. U-bend tube	SB-395	...	C71520	O61
37	...	Wld. tube	SB-543	...	C71520	W061
38	...	Finned wld. tube	SB-956	...	C71520	W061
39	...	Smls. cond. tube	SB-111	...	C71520	HR50
40	...	Smls. U-bend tube	SB-395	...	C71520	HR50
41	...	Smls. cond. tube	SB-111	...	C72200	O61
42	...	Castings	SB-62	...	C83600	...
43	...	Castings	SB-61	...	C92200	M01
44	...	Castings	SB-584	...	C92200	M01
45	...	Castings	SB-584	...	C93700	M01

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	105	...
2	...	275	105	...
3	≤152	310	124	...
4	≤114	310	205	...
5	...	310	240	...
6	...	310	240	...
7	...	310	240	...
8	...	310	240	...
9	≤114	370	310	...
10	...	310	110	...
11	...	310	110	...
12	...	310	110	...
13	...	310	110	...
14	>114	310	105	...
15	60 < t ≤ 140	310	125	...
16	≤60	345	140	...
17	≤114	345	140	...
18	...	360	125	...
19	...	360	125	...
20	...	360	125	...
21	...	360	125	...
22	...	360	125	...
23	...	360	125	...
24	...	495	345	...
25	...	495	345	...
26	>114	310	105	...
27	>152	310	124	...
28	...	310	124	...
29	60 < t ≤ 140	310	125	...
30	≤152	345	138	...
31	≤60	345	140	...
32	≤114	345	140	...
33	...	360	125	...
34	...	360	125	...
35	...	360	125	...
36	...	360	125	...
37	...	360	125	...
38	...	360	125	...
39	...	495	345	...
40	...	495	345	...
41	...	310	110	...
42	...	205	95	...
43	...	235	110	...
44	...	234	110	...
45	...	207	83	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	124	122	117	115	113	111	108	107	105	104
4	207	201	195	191	187	183	180	177	175	173
5	241	235	228	223	218	213	210	206	204	202
6	241	235	228	223	218	213	210	206	204	202
7	241	235	228	223	218	213	210	206	204	202
8	241	235	228	223	218	213	210	206	204	202
9	310	301	293	286	280	275	270	266	262	260
10	110	108	105	103	100	97.6	95.2	92.9	90.7	88.7
11	110	107	105	102	99.9	97.4	95.0	92.7	90.5	88.5
12	110	107	105	102	99.9	97.4	95.0	92.7	90.5	88.5
13	110	107	105	102	99.9	97.4	95.0	92.7	90.5	88.5
14	103	99.8	97.0	95.0	93.0	91.1	89.3	87.6	86.1	84.7
15	124	120	117	114	112	109	107	105	103	102
16	138	133	129	126	124	122	119	117	115	113
17	138	133	129	126	124	122	119	117	115	113
18	124	120	117	114	112	109	107	105	103	102
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	124	120	117	114	112	109	107	105	103	102
23	124	120	117	114	112	109	107	105	103	102
24	345	333	326	322	318	315	311	307	304	301
25	345	333	326	322	318	315	311	307	304	301
26	103	99.8	97.0	95.0	93.0	91.1	89.3	87.6	86.1	84.7
27	124	120	117	114	112	109	107	105	103	102
28	124	120	117	114	112	109	107	105	103	102
29	124	120	117	114	112	109	107	105	103	102
30	138	133	129	126	124	122	119	117	115	113
31	138	133	129	126	124	122	119	117	115	113
32	138	133	129	126	124	122	119	117	115	113
33	124	120	117	114	112	109	107	105	103	102
34	124	120	117	114	112	109	107	105	103	102
35	124	120	117	114	112	109	107	105	103	102
36	124	120	117	114	112	109	107	105	103	102
37	124	120	117	114	112	109	107	105	103	102
38	124	120	117	114	112	109	107	105	103	102
39	345	333	326	322	318	315	311	307	304	301
40	345	333	326	322	318	315	311	307	304	301
41	110	108	104	102	99.6	97.8	96.1	94.6	93.3	...
42	96.5	90.2	86.0	83.3	80.8	78.4	75.9	73.3	70.6	67.6
43	110	104	97.8	94.8	92.9	91.9	91.2	90.6	89.8	88.7
44	110	104	97.8	94.8	92.9	91.9	91.2	90.6	89.8	88.7
45	82.7	76.4	73.3	71.7	70.6	69.8	69.2	68.5	67.8	67.4

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	103	103	...	...	...	...	...	...	...	...
4	172	171	...	...	...	...	...	...	...	...
5	201	199	...	...	...	...	...	...	...	...
6	201	199	...	...	...	...	...	...	...	...
7	201	199	...	...	...	...	...	...	...	...
8	201	199	...	...	...	...	...	...	...	...
9	258	257	...	...	...	...	...	...	...	...
10	86.9	85.3	83.8	82.4	81.0	79.6	78.1	76.3	74.1	...
11	86.7	85.1	83.6	82.2	80.9	79.5	77.9	76.1	74.0	...
12	86.7	85.1	83.6	82.2	80.9	79.5	77.9	76.1	74.0	...
13	86.7	85.1	83.6	82.2	80.9	79.5	77.9	76.1	74.0	...
14	83.4	82.4	81.5	80.9	...	...	...	...	...	...
15	100	98.8	97.7	97.1	...	...	...	...	...	...
16	112	110	109	108	...	...	...	...	...	...
17	112	110	109	108	...	...	...	...	...	...
18	100	98.8	97.7	97.1	...	...	...	...	...	...
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	100	98.8	97.7	97.1	...	...	...	...	...	...
23	100	98.8	97.7	97.1	...	...	...	...	...	...
24	299	297	295	293	...	...	...	...	...	...
25	299	297	295	293	...	...	...	...	...	...
26	83.4	82.4	81.5	80.9	...	...	...	...	...	...
27	100	98.8	97.7	97.1	...	...	...	...	...	...
28	100	98.8	97.7	97.1	...	...	...	...	...	...
29	100	98.8	97.7	97.1	...	...	...	...	...	...
30	112	110	109	108	...	...	...	...	...	...
31	112	110	109	108	...	...	...	...	...	...
32	112	110	109	108	...	...	...	...	...	...
33	100	98.8	97.7	97.1	...	...	...	...	...	...
34	100	98.8	97.7	97.1	...	...	...	...	...	...
35	100	98.8	97.7	97.1	...	...	...	...	...	...
36	100	98.8	97.7	97.1	...	...	...	...	...	...
37	100	98.8	97.7	97.1	...	...	...	...	...	...
38	100	98.8	97.7	97.1	...	...	...	...	...	...
39	299	297	295	293	...	...	...	...	...	...
40	299	297	295	293	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...
42	64.2	60.3	55.9	...	...	...	...	...	...	...
43	87.9	87.9	87.9	...	...	...	...	...	...	...
44	87.9	87.9	87.9	...	...	...	...	...	...	...
45	67.4	...	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
(25)	Nonferrous Materials (Cont'd)					
1	...	Castings	SB-148	...	C95200	M01
2	...	Castings	SB-271	...	C95200	M02
3	...	Castings	SB-505	...	C95200	M07
4	...	Castings	SB-148	...	C95400	M01
5	...	Castings	SB-271	...	C95400	M02
6	...	Castings	SB-148	...	C95800	M01
7	...	Castings	SB-148	...	C95820	M01
8	...	Castings	SB-369	...	C96200	M01
9	...	Castings	SB-584	...	C97600	M01
10	99Ni	Bolting	SB-160	...	N02200	Annealed
11	99Ni	Plate, sheet, strip	SB-162	...	N02200	As rolled
12	99Ni	Bolting	SB-160	...	N02200	Hot fin./ann.
13	99Ni	Bolting	SB-160	...	N02200	Cold drawn
14	99Ni	Smls. pipe & tube	SB-161	...	N02200	Stress rel.
15	99Ni	Smls. tube	SB-163	...	N02200	Stress rel.
16	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
17	99Ni-Low C	Smls. & wld. fittings	SB-366	...	N02201	Annealed
18	99Ni-Low C	Bar, rod	SB-160	...	N02201	Hot rolled/ann.
19	99Ni-Low C	Smls. pipe & tube	SB-161	...	N02201	Annealed
20	99Ni-Low C	Smls. tube	SB-163	...	N02201	Annealed
21	99Ni-Low C	Plate, sheet, strip	SB-162	...	N02201	Hot rolled/ann.
22	67Ni-30Cu	Bar	SB-164	...	N04400	Annealed
23	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
24	67Ni-30Cu	Forgings	SB-564	...	N04400	Annealed
25	67Ni-30Cu	Plate	SB-127	...	N04400	Annealed
26	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Annealed
27	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Annealed
28	67Ni-30Cu	Smls. & wld. fittings	SB-366	...	N04400	Annealed
29	67Ni-30Cu	Plate	SB-127	...	N04400	As rolled
30	67Ni-30Cu	Rounds	SB-164	...	N04400	Hot worked
31	67Ni-30Cu	Rounds	SB-164	...	N04400	Hot worked
32	67Ni-30Cu	Rounds	SB-164	...	N04400	CW & SR
33	67Ni-30Cu	Rounds	SB-164	...	N04400	CW & SR
34	67Ni-30Cu	Smls. tube	SB-163	...	N04400	Stress rel.
35	67Ni-30Cu	Smls. pipe & tube	SB-165	...	N04400	Stress rel.
36	67Ni-30Cu	Rounds	SB-164	...	N04400	CW & SR
37	67Ni-30Cu	Rounds	SB-164	...	N04400	Cold worked
38	67Ni-30Cu-S	Bar	SB-164	...	N04405	Annealed
39	67Ni-30Cu-S	Bar	SB-164	...	N04405	Hot worked
40	67Ni-28Cu-3Al	Bolting	SF-468	...	N05500	Ann./aged
41	67Ni-28Cu-3Al	Bolting	SF-468	...	N05500	Ann./aged
42	47Ni-22Cr-9Mo-18Fe	Plate	SB-435	...	N06002	Annealed
43	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...	N06002	Solution ann.
44	47Ni-22Cr-9Mo-18Fe	Rod	SB-572	...	N06002	Annealed
45	47Ni-22Cr-9Mo-18Fe	Smls. & wld. fittings	SB-366	...	N06002	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	...	450	170	...
2	...	450	170	...
3	...	469	179	...
4	...	515	205	...
5	...	515	205	...
6	...	585	240	...
7	...	650	270	...
8	...	310	170	...
9	...	276	117	...
10	...	380	100	...
11	...	380	140	...
12	...	415	100	...
13	...	450	275	...
14	...	450	275	...
15	...	450	275	...
16	>125 O.D.	345	69	...
17	...	345	69	...
18	...	345	69	...
19	≤125 O.D.	345	83	...
20	...	345	83	...
21	...	345	83	...
22	...	485	170	...
23	>125 O.D.	485	170	...
24	...	485	170	...
25	...	485	195	...
26	≤75	485	195	...
27	≤125 O.D.	485	195	...
28	...	485	195	...
29	...	515	275	...
30	300 < t ≤ 350	515	275	...
31	≤300	550	275	...
32	<13	580	345	...
33	89 < t ≤ 100	580	380	...
34	...	585	380	...
35	...	585	380	...
36	13 < t ≤ 89	600	415	...
37	<13	760	585	...
38	...	485	170	...
39	...	515	240	...
40	25–38	895	585	...
41	6–22	895	620	...
42	>5	655	240	...
43	≤5	655	240	...
44	...	655	240	...
45	...	690	275	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	172	162	156	153	150	148	147	146	146	146
2	172	162	156	153	150	148	147	146	146	146
3	179	169	162	158	156	154	152	152	152	152
4	207	203	201	200	199	199	199	199	199	199
5	207	203	201	200	199	199	199	199	199	199
6	241	238	236	235	235	234	233	232	...	...
7	269	265	263	262	261	261	260	259	257	...
8	172	168	162	158	155	153	150	148	146	144
9	117	105	97.5	93.3	90.4	88.4	87.0	86.0	85.2	84.6
10	100	100	100	100	100	100	100	98.6	95.7	92.0
11	138	138	138	138	138	138	138	136	132	127
12	100	100	100	100	100	100	100	98.6	95.7	92.0
13	276	267	265	264	264	264	264	262	260	257
14	276	267	265	264	264	264	264	262	260	257
15	276	267	265	264	264	264	264	262	260	257
16	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
17	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
18	68.9	66.9	66.1	65.4	64.8	64.8	64.8	64.8	64.8	64.8
19	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
20	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
21	82.7	80.7	79.1	78.5	77.9	77.2	77.2	77.2	77.2	77.2
22	172	159	149	144	141	138	136	136	136	136
23	172	159	149	144	141	138	136	136	136	136
24	172	159	149	144	141	138	136	136	136	136
25	193	178	167	162	157	155	153	152	152	152
26	193	178	167	162	157	155	153	152	152	152
27	193	178	167	162	157	155	153	152	152	152
28	193	178	167	162	157	155	153	152	152	152
29	276	272	266	260	256	251	248	245	243	242
30	276	258	240	233	227	223	219	219	219	219
31	276	258	240	233	227	223	219	219	219	219
32	345	334	324	319	316	312	310	310	310	310
33	379	368	356	351	347	343	341	341	341	341
34	379	365	356	351	347	345	343	342	340	337
35	379	365	356	351	347	345	343	342	340	337
36	414	401	388	383	378	375	372	372	372	372
37	586	568	550	542	536	531	528	527	527	527
38	172	159	149	144	141	138	136	136	136	136
39	241	239	233	228	224	220	217	214	213	212
40	586	569	558	552	547	543	540	537	535	534
41	621	602	591	584	579	575	571	569	567	565
42	241	227	215	206	198	191	185	179	173	168
43	241	227	215	206	198	191	185	179	173	168
44	241	227	215	206	198	191	185	179	173	168
45	276	259	245	236	227	218	211	204	198	192

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	146	146	...	...	...	...	...	...	...	...
2	146	146	...	...	...	...	...	...	...	...
3	152	152	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...
8	143	143	143	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...
10	88.4	84.1	...	...	...	...	...	...	...	...
11	122	116	...	...	...	...	...	...	...	...
12	88.4	84.1	...	...	...	...	...	...	...	...
13	253	249	245	...	...	...	...	...	...	...
14	253	249	245	...	...	...	...	...	...	...
15	253	249	245	...	...	...	...	...	...	...
16	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3
17	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3
18	64.8	64.6	64.1	64.1	63.4	62.1	60.9	59.8	57.6	55.3
19	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4
20	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4
21	77.2	77.2	77.1	76.4	75.8	74.5	73.3	71.6	69.3	66.4
22	136	136	136	135	134	132	130	130	129	...
23	136	136	136	135	134	132	130	130	129	...
24	136	136	136	135	134	132	130	130	129	...
25	152	152	152	151	150	148	146	146	145	...
26	152	152	152	151	150	148	146	146	145	...
27	152	152	152	151	150	148	146	146	145	...
28	152	152	152	151	150	148	146	146	145	...
29	240	239	237	234	231	227	223	219	215	...
30	219	219	219	219	215	211	208	...	...	...
31	219	219	219	219	215	211	208	...	...	...
32	308	300	290	290	288	279	270	...	...	...
33	339	329	319	319	316	307	297	...	...	...
34	334	330	325	318	312	306	301	...	...	...
35	334	330	325	318	312	306	301	...	...	...
36	369	359	348	348	345	335	325	...	...	...
37	523	508	493	493	489	475	460	...	...	...
38	136	136	136	135	134	132	130	130	129	...
39	210	208	207	205	202	199	195	192	189	...
40	532	531	530	529	...	...	...	...	...	...
41	564	562	561	560	...	...	...	...	...	...
42	164	161	158	155	154	152	151	150	149	149
43	164	161	158	155	154	152	151	150	149	149
44	164	161	158	155	154	152	151	150	149	149
45	188	184	180	178	176	174	173	172	171	170

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
1	Nonferrous Materials (Cont'd)														
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	54.1	52.3	50.5	48.6	46.7	...	...	...	...	...	...	...	...	...	...
17	54.1	52.3	50.5	48.6	46.7	...	...	...	...	...	...	...	...	...	...
18	54.1	52.3	50.5	48.6	46.7	...	...	...	...	...	...	...	...	...	...
19	65.0	62.9	60.7	58.4	56.1	...	...	...	...	...	...	...	...	...	...
20	65.0	62.9	60.7	58.4	56.1	...	...	...	...	...	...	...	...	...	...
21	65.0	62.9	60.7	58.4	56.1	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	148	147	146	144	143	141	139	136	132	129	124	119	113	106	98.0
43	148	147	146	144	143	141	139	136	132	129	124	119	113	106	98.0
44	148	147	146	144	143	141	139	136	132	129	124	119	113	106	98.0
45	169	168	167	165	164	161	159	156	152	147	142	136	129	121	113

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	47Ni-22Cr-9Mo-18Fe	Sheet	SB-435	...	N06002	Annealed
2	47Ni-22Cr-9Mo-18Fe	Wld. pipe	SB-619	...	N06002	Solution ann.
3	47Ni-22Cr-9Mo-18Fe	Smls. pipe & tube	SB-622	...	N06002	Solution ann.
4	47Ni-22Cr-9Mo-18Fe	Wld. tube	SB-626	...	N06002	Solution ann.
5	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
6	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
7	47Ni-22Cr-19Fe-6Mo	Smls. & wld. fittings	SB-366	...	N06007	Annealed
8	47Ni-22Cr-19Fe-6Mo	Rod	SB-581	...	N06007	Solution ann.
9	47Ni-22Cr-19Fe-6Mo	Plate, sheet, strip	SB-582	...	N06007	Solution ann.
10	47Ni-22Cr-19Fe-6Mo	Wld. pipe	SB-619	...	N06007	Solution ann.
11	47Ni-22Cr-19Fe-6Mo	Smls. pipe & tube	SB-622	...	N06007	Solution ann.
12	47Ni-22Cr-19Fe-6Mo	Wld. tube	SB-626	...	N06007	Solution ann.
13	55Ni-21Cr-13.5Mo	Smls. & wld. fittings	SB-366	...	N06022	Solution ann.
14	55Ni-21Cr-13.5Mo	Forgings	SB-462	...	N06022	Solution ann.
15	55Ni-21Cr-13.5Mo	Forgings	SB-564	...	N06022	Solution ann.
16	55Ni-21Cr-13.5Mo	Rod	SB-574	...	N06022	Solution ann.
17	55Ni-21Cr-13.5Mo	Plate, sheet, strip	SB-575	...	N06022	Solution ann.
18	55Ni-21Cr-13.5Mo	Wld. pipe	SB-619	...	N06022	Solution ann.
19	55Ni-21Cr-13.5Mo	Smls. pipe & tube	SB-622	...	N06022	Solution ann.
20	55Ni-21Cr-13.5Mo	Wld. tube	SB-626	...	N06022	Solution ann.
21	60Ni-25Cr-9.5Fe-2.1Al	Smls. tube	SB-163	...	N06025	Annealed
22	60Ni-25Cr-9.5Fe-2.1Al	Plate, sheet, strip	SB-168	...	N06025	Annealed
23	60Ni-25Cr-9.5Fe-2.1Al	Wrought fittings	SB-366	...	N06025	Annealed
24	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-462	...	N06025	Annealed
25	60Ni-25Cr-9.5Fe-2.1Al	Wld. tube	SB-516	...	N06025	Annealed
26	60Ni-25Cr-9.5Fe-2.1Al	Wld. pipe	SB-517	...	N06025	Annealed
27	60Ni-25Cr-9.5Fe-2.1Al	Forgings	SB-564	...	N06025	Annealed
28	60Ni-25Cr-9.5Fe-2.1Al	Bar	SB-166	...	N06025	HW or CW ann.
29	60Ni-25Cr-9.5Fe-2.1Al	Smls. pipe & tube	SB-167	...	N06025	HW or CW ann.
30	40Ni-29Cr-15Fe-5Mo	Smls. & wld. fittings	SB-366	...	N06030	Solution ann.
31	40Ni-29Cr-15Fe-5Mo	Forgings	SB-462	...	N06030	Solution ann.
32	40Ni-29Cr-15Fe-5Mo	Rod	SB-581	...	N06030	Solution ann.
33	40Ni-29Cr-15Fe-5Mo	Plate, sheet, strip	SB-582	...	N06030	Solution ann.
34	40Ni-29Cr-15Fe-5Mo	Wld. pipe	SB-619	...	N06030	Solution ann.
35	40Ni-29Cr-15Fe-5Mo	Smls. pipe & tube	SB-622	...	N06030	Solution ann.
36	40Ni-29Cr-15Fe-5Mo	Wld. tube	SB-626	...	N06030	Solution ann.
37	58Ni-33Cr-8Mo	Smls. & wld. fittings	SB-366	...	N06035	Solution ann.
38	58Ni-33Cr-8Mo	Forgings	SB-462	...	N06035	Solution ann.
39	58Ni-33Cr-8Mo	Forgings	SB-564	...	N06035	Solution ann.
40	58Ni-33Cr-8Mo	Rod	SB-574	...	N06035	Solution ann.
41	58Ni-33Cr-8Mo	Plate, sheet, strip	SB-575	...	N06035	Solution ann.
42	58Ni-33Cr-8Mo	Wld. pipe	SB-619	...	N06035	Solution ann.
43	58Ni-33Cr-8Mo	Smls. pipe & tube	SB-622	...	N06035	Solution ann.
44	58Ni-33Cr-8Mo	Wld. tube	SB-626	...	N06035	Solution ann.
45	46Ni-27Cr-23Fe-2.75Si	Rod	SB-166	...	N06045	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	$1.5 < t \leq 5$	690	275	...
2	...	690	275	...
3	...	690	275	...
4	...	690	275	...
5	>19	585	205	...
6	>19	585	205	...
7	...	620	240	...
8	≤ 19	620	240	...
9	≤ 19	620	240	...
10	...	620	240	...
11	...	620	240	...
12	...	620	240	...
13	...	690	310	...
14	...	690	310	...
15	...	690	310	...
16	...	690	310	...
17	...	690	310	...
18	...	690	310	...
19	...	690	310	...
20	...	690	310	...
21	...	676	269	...
22	...	676	269	...
23	...	676	269	...
24	$t \leq 102$	676	269	...
25	...	676	269	...
26	...	676	269	...
27	$t \leq 102$	676	269	...
28	$t \leq 102$	676	269	...
29	...	676	269	...
30	...	585	240	...
31	...	585	240	...
32	...	585	240	...
33	...	585	240	...
34	...	585	240	...
35	...	585	240	...
36	...	585	240	...
37	...	586	241	...
38	...	586	241	...
39	...	586	241	...
40	...	586	241	...
41	...	586	241	...
42	...	586	241	...
43	...	586	241	...
44	...	586	241	...
45	...	620	240	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	276	259	245	236	227	218	211	204	198	192
2	276	259	245	236	227	218	211	204	198	192
3	276	259	245	236	227	218	211	204	198	192
4	276	259	245	236	227	218	211	204	198	192
5	207	194	184	178	172	167	163	159	156	153
6	207	194	184	178	172	167	163	159	156	153
7	241	226	214	207	201	195	190	185	181	178
8	241	226	214	207	201	195	190	185	181	178
9	241	226	214	207	201	195	190	185	181	178
10	241	226	214	207	201	195	190	185	181	178
11	241	226	214	207	201	195	190	185	181	178
12	241	226	214	207	201	195	190	185	181	178
13	310	290	274	263	254	245	238	231	224	219
14	310	290	274	263	254	245	238	231	224	219
15	310	290	274	263	254	245	238	231	224	219
16	310	290	274	263	254	245	238	231	224	219
17	310	290	274	263	254	245	238	231	224	219
18	310	290	274	263	254	245	238	231	224	219
19	310	290	274	263	254	245	238	231	224	219
20	310	290	274	263	254	245	238	231	224	219
21	269	269	266	262	257	251	246	240	235	230
22	269	269	266	262	257	251	246	240	235	230
23	269	269	266	262	257	251	246	240	235	230
24	269	269	266	262	257	251	246	240	235	230
25	269	269	266	262	257	251	246	240	235	230
26	269	269	266	262	257	251	246	240	235	230
27	269	269	266	262	257	251	246	240	235	230
28	269	269	266	262	257	251	246	240	235	230
29	269	269	266	262	257	251	246	240	235	230
30	241	219	205	196	189	184	179	174	171	168
31	241	219	205	196	189	184	179	174	171	168
32	241	219	205	196	189	184	179	174	171	168
33	241	219	205	196	189	184	179	174	171	168
34	241	219	205	196	189	184	179	174	171	168
35	241	219	205	196	189	184	179	174	171	168
36	241	219	205	196	189	184	179	174	171	168
37	241	224	208	198	188	179	172	165	160	156
38	241	224	208	198	188	179	172	165	160	156
39	241	224	208	198	188	179	172	165	160	156
40	241	224	208	198	188	179	172	165	160	156
41	241	224	208	198	188	179	172	165	160	156
42	241	224	208	198	188	179	172	165	160	156
43	241	224	208	198	188	179	172	165	160	156
44	241	224	208	198	188	179	172	165	160	156
45	241	228	214	206	199	193	188	184	180	178

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	188	184	180	178	176	174	173	172	171	170
2	188	184	180	178	176	174	173	172	171	170
3	188	184	180	178	176	174	173	172	171	170
4	188	184	180	178	176	174	173	172	171	170
5	150	148	146	145	144	143	143	142	142	141
6	150	148	146	145	144	143	143	142	142	141
7	175	173	171	169	168	167	166	166	165	164
8	175	173	171	169	168	167	166	166	165	164
9	175	173	171	169	168	167	166	166	165	164
10	175	173	171	169	168	167	166	166	165	164
11	175	173	171	169	168	167	166	166	165	164
12	175	173	171	169	168	167	166	166	165	164
13	214	209	206	202	200	197	195	193	191	190
14	214	209	206	202	200	197	195	193	191	190
15	214	209	206	202	200	197	195	193	191	190
16	214	209	206	202	200	197	195	193	191	190
17	214	209	206	202	200	197	195	193	191	190
18	214	209	206	202	200	197	195	193	191	190
19	214	209	206	202	200	197	195	193	191	190
20	214	209	206	202	200	197	195	193	191	190
21	225	221	217	214	211	209	208	206	205	204
22	225	221	217	214	211	209	208	206	205	204
23	225	221	217	214	211	209	208	206	205	204
24	225	221	217	214	211	209	208	206	205	204
25	225	221	217	214	211	209	208	206	205	204
26	225	221	217	214	211	209	208	206	205	204
27	225	221	217	214	211	209	208	206	205	204
28	225	221	217	214	211	209	208	206	205	204
29	225	221	217	214	211	209	208	206	205	204
30	165	162	159	157	154	151	149	146	145	143
31	165	162	159	157	154	151	149	146	145	143
32	165	162	159	157	154	151	149	146	145	143
33	165	162	159	157	154	151	149	146	145	143
34	165	162	159	157	154	151	149	146	145	143
35	165	162	159	157	154	151	149	146	145	143
36	165	162	159	157	154	151	149	146	145	143
37	153	150	148	147	145	144	142	140	137	135
38	153	150	148	147	145	144	142	140	137	135
39	153	150	148	147	145	144	142	140	137	135
40	153	150	148	147	145	144	142	140	137	135
41	153	150	148	147	145	144	142	140	137	135
42	153	150	148	147	145	144	142	140	137	135
43	153	150	148	147	145	144	142	140	137	135
44	153	150	148	147	145	144	142	140	137	135
45	176	175	174	173	172	172	171	169	168	166

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	169	168	167	165	164	161	159	156	152	147	142	136	129	121	113
2	169	168	167	165	164	161	159	156	152	147	142	136	129	121	113
3	169	168	167	165	164	161	159	156	152	147	142	136	129	121	113
4	169	168	167	165	164	161	159	156	152	147	142	136	129	121	113
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
14	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
15	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
16	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
17	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
18	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
19	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
20	187	186	184	183	182	181	179	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	46Ni-27Cr-23Fe-2.75Si	Smls. pipe & tube	SB-167	...	N06045	Solution ann.
2	46Ni-27Cr-23Fe-2.75Si	Plate, sheet, strip	SB-168	...	N06045	Solution ann.
3	46Ni-27Cr-23Fe-2.75Si	Smls. & wld. fittings	SB-366	...	N06045	Solution ann.
4	46Ni-27Cr-23Fe-2.75Si	Wld. tube	SB-516	...	N06045	Solution ann.
5	46Ni-27Cr-23Fe-2.75Si	Wld. pipe	SB-517	...	N06045	Solution ann.
6	46Ni-27Cr-23Fe-2.75Si	Forgings	SB-564	...	N06045	Solution ann.
7	59Ni-23Cr-16Mo	Fittings	SB-366	CR5923	N06059	Annealed
8	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923	N06059	Annealed
9	59Ni-23Cr-16Mo	Wld. fittings	SB-366	WP5923W	N06059	Annealed
10	59Ni-23Cr-16Mo	Fittings	SB-366	WP5923WX	N06059	Annealed
11	59Ni-23Cr-16Mo	Forged fittings	SB-462	...	N06059	Solution ann.
12	59Ni-23Cr-16Mo	Forgings	SB-564	...	N06059	Solution ann.
13	59Ni-23Cr-16Mo	Rod	SB-574	...	N06059	Solution ann.
14	59Ni-23Cr-16Mo	Plate, sheet, strip	SB-575	...	N06059	Solution ann.
15	59Ni-23Cr-16Mo	Wld. pipe	SB-619	...	N06059	Solution ann.
16	59Ni-23Cr-16Mo	Smls. pipe & tube	SB-622	...	N06059	Solution ann.
17	59Ni-23Cr-16Mo	Wld. tube	SB-626	...	N06059	Solution ann.
18	59Ni-23Cr-16Mo-1.6Cu	Fittings	SB-366	...	N06200	Solution ann.
19	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-462	...	N06200	Solution ann.
20	59Ni-23Cr-16Mo-1.6Cu	Forgings	SB-564	...	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	Wld. pipe	SB-619	...	N06200	Solution ann.
24	59Ni-23Cr-16Mo-1.6Cu	Smls. pipe & tube	SB-622	...	N06200	Solution ann.
25	59Ni-23Cr-16Mo-1.6Cu	Wld. tube	SB-626	...	N06200	Solution ann.
26	60Ni-19Cr-19Mo-1.8Ta	Smls. & wld. fittings	SB-366	...	N06210	Solution ann.
27	60Ni-19Cr-19Mo-1.8Ta	Forgings	SB-564	...	N06210	Solution ann.
28	60Ni-19Cr-19Mo-1.8Ta	Rod	SB-574	...	N06210	Solution ann.
29	60Ni-19Cr-19Mo-1.8Ta	Plate, sheet, strip	SB-575	...	N06210	Solution ann.
30	60Ni-19Cr-19Mo-1.8Ta	Wld. pipe	SB-619	...	N06210	Solution ann.
31	60Ni-19Cr-19Mo-1.8Ta	Smls. pipe & tube	SB-622	...	N06210	Solution ann.
32	60Ni-19Cr-19Mo-1.8Ta	Wld. tube	SB-626	...	N06210	Solution ann.
33	57Ni-22Cr-14W-2Mo-La	Plate, sheet, strip	SB-435	...	N06230	Solution ann.
34	57Ni-22Cr-14W-2Mo-La	Forgings	SB-564	...	N06230	Solution ann.
35	57Ni-22Cr-14W-2Mo-La	Bar	SB-572	...	N06230	Solution ann.
36	57Ni-22Cr-14W-2Mo-La	Wld. pipe	SB-619	...	N06230	Solution ann.
37	57Ni-22Cr-14W-2Mo-La	Smls. pipe & tube	SB-622	...	N06230	Solution ann.
38	57Ni-22Cr-14W-2Mo-La	Wld. tube	SB-626	...	N06230	Solution ann.
39	61Ni-16Mo-16Cr	Smls. & wld. fittings	SB-366	...	N06455	Annealed
40	61Ni-16Mo-16Cr	Rod	SB-574	...	N06455	Solution ann.
41	61Ni-16Mo-16Cr	Plate, sheet, strip	SB-575	...	N06455	Solution ann.
42	61Ni-16Mo-16Cr	Wld. pipe	SB-619	...	N06455	Solution ann.
43	61Ni-16Mo-16Cr	Smls. pipe & tube	SB-622	...	N06455	Solution ann.
44	61Ni-16Mo-16Cr	Wld. tube	SB-626	...	N06455	Solution ann.
45	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./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	...	620	240	...
2	...	620	240	...
3	...	620	240	...
4	...	620	240	...
5	...	620	240	...
6	...	620	240	...
7	...	690	310	...
8	...	690	310	...
9	...	690	310	...
10	...	690	310	...
11	...	690	310	...
12	...	690	310	...
13	...	690	310	...
14	...	690	310	...
15	...	690	310	...
16	...	690	310	...
17	...	690	310	...
18	...	690	310	...
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	...	760	310	...
34	...	760	310	...
35	...	760	310	...
36	...	760	310	...
37	...	760	310	...
38	...	760	310	...
39	...	690	275	...
40	...	690	275	...
41	...	690	275	...
42	...	690	275	...
43	...	690	275	...
44	...	690	275	...
45	>125	515	170	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	241	228	214	206	199	193	188	184	180	178
2	241	228	214	206	199	193	188	184	180	178
3	241	228	214	206	199	193	188	184	180	178
4	241	228	214	206	199	193	188	184	180	178
5	241	228	214	206	199	193	188	184	180	178
6	241	228	214	206	199	193	188	184	180	178
7	310	295	276	268	260	255	248	242	236	230
8	310	295	276	268	260	255	248	242	236	230
9	310	295	276	268	260	255	248	242	236	230
10	310	295	276	268	260	255	248	242	236	230
11	310	295	276	268	260	255	248	242	236	230
12	310	295	276	268	260	255	248	242	236	230
13	310	295	276	268	260	255	248	242	236	230
14	310	295	276	268	260	255	248	242	236	230
15	310	295	276	268	260	255	248	242	236	230
16	310	295	276	268	260	255	248	242	236	230
17	310	295	276	268	260	255	248	242	236	230
18	310	...	276	...	256	...	238	...	222	...
19	310	...	276	...	256	...	238	...	222	...
20	310	...	276	...	256	...	238	...	222	...
21	310	...	276	...	256	...	238	...	222	...
22	310	...	276	...	256	...	238	...	222	...
23	310	...	276	...	256	...	238	...	222	...
24	310	...	276	...	256	...	238	...	222	...
25	310	...	276	...	256	...	238	...	222	...
26	310	287	273	263	253	...	236	...	220	...
27	310	287	273	263	253	...	236	...	220	...
28	310	287	273	263	253	...	236	...	220	...
29	310	287	273	263	253	...	236	...	220	...
30	310	287	273	263	253	...	236	...	220	...
31	310	287	273	263	253	...	236	...	220	...
32	310	287	273	263	253	...	236	...	220	...
33	310	301	289	281	273	264	256	249	242	235
34	310	301	289	281	273	264	256	249	242	235
35	310	301	289	281	273	264	256	249	242	235
36	310	301	289	281	273	264	256	249	242	235
37	310	301	289	281	273	264	256	249	242	235
38	310	301	289	281	273	264	256	249	242	235
39	276	264	252	244	238	231	226	221	217	213
40	276	264	252	244	238	231	226	221	217	213
41	276	264	252	244	238	231	226	221	217	213
42	276	264	252	244	238	231	226	221	217	213
43	276	264	252	244	238	231	226	221	217	213
44	276	264	252	244	238	231	226	221	217	213
45	172	168	163	160	157	154	151	148	146	143

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	176	175	174	173	172	172	171	169	168	166
2	176	175	174	173	172	172	171	169	168	166
3	176	175	174	173	172	172	171	169	168	166
4	176	175	174	173	172	172	171	169	168	166
5	176	175	174	173	172	172	171	169	168	166
6	176	175	174	173	172	172	171	169	168	166
7	225	219	214	208	202	198	193	188	183	179
8	225	219	214	208	202	198	193	188	183	179
9	225	219	214	208	202	198	193	188	183	179
10	225	219	214	208	202	198	193	188	183	179
11	225	219	214	208	202	198	193	188	183	179
12	225	219	214	208	202	198	193	188	183	179
13	225	219	214	208	202	198	193	188	183	179
14	225	219	214	208	202	198	193	188	183	179
15	225	219	214	208	202	198	193	188	183	179
16	225	219	214	208	202	198	193	188	183	179
17	225	219	214	208	202	198	193	188	183	179
18	209	204	200	197	195	193	192	191	189	185
19	209	204	200	197	195	193	192	191	189	185
20	209	204	200	197	195	193	192	191	189	185
21	209	204	200	197	195	193	192	191	189	185
22	209	204	200	197	195	193	192	191	189	185
23	209	204	200	197	195	193	192	191	189	185
24	209	204	200	197	195	193	192	191	189	185
25	209	204	200	197	195	193	192	191	189	185
26	206	200	194	189	185	181	177	175	173	171
27	206	200	194	189	185	181	177	175	173	171
28	206	200	194	189	185	181	177	175	173	171
29	206	200	194	189	185	181	177	175	173	171
30	206	200	194	189	185	181	177	175	173	171
31	206	200	194	189	185	181	177	175	173	171
32	206	200	194	189	185	181	177	175	173	171
33	230	225	222	220	218	217	216	216	216	216
34	230	225	222	220	218	217	216	216	216	216
35	230	225	222	220	218	217	216	216	216	216
36	230	225	222	220	218	217	216	216	216	216
37	230	225	222	220	218	217	216	216	216	216
38	230	225	222	220	218	217	216	216	216	216
39	210	207	205	202	200	198	196	193	191	189
40	210	207	205	202	200	198	196	193	191	189
41	210	207	205	202	200	198	196	193	191	189
42	210	207	205	202	200	198	196	193	191	189
43	210	207	205	202	200	198	196	193	191	189
44	210	207	205	202	200	198	196	193	191	189
45	141	139	137	135	133	132	130	129	127	125

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	123	121	119	117	114	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
2	72Ni-15Cr-8Fe	Smls. & wld. fittings	SB-366	...	N06600	Annealed
3	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
4	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Hot fin./ann.
5	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	Annealed
6	72Ni-15Cr-8Fe	Bar	SB-166	...	N06600	Annealed
7	72Ni-15Cr-8Fe	Plate	SB-168	...	N06600	Annealed
8	72Ni-15Cr-8Fe	Wld. tube	SB-516	...	N06600	Annealed
9	72Ni-15Cr-8Fe	Forgings	SB-564	...	N06600	...
10	72Ni-15Cr-8Fe	Smls. pipe & tube	SB-167	...	N06600	Cold drawn/ann.
11	72Ni-15Cr-8Fe	Wld. pipe	SB-517	...	N06600	Cold drawn/ann.
12	72Ni-15Cr-8Fe	Smls. tube	SB-163	...	N06600	...
13	72Ni-15Cr-8Fe	Bar, rod	SB-166	...	N06600	Hot worked
14	72Ni-15Cr-8Fe	Plate, sheet, strip	SB-168	...	N06600	Hot rolled
15	72Ni-15Cr-8Fe	Rounds	SB-166	...	N06600	Hot worked
16	72Ni-15Cr-8Fe	Rounds	SB-166	...	N06600	Hot worked
17	60Ni-23Cr-Fe	Smls. tube	SB-163	...	N06601	Annealed
18	60Ni-23Cr-Fe	Bar	SB-166	...	N06601	Annealed
19	60Ni-23Cr-Fe	Smls. pipe & tube	SB-167	...	N06601	Annealed
20	60Ni-23Cr-Fe	Plate, sheet, strip	SB-168	...	N06601	Annealed
21	52Ni-22Cr-13Co-9Mo	Bar, rod	SB-166	...	N06617	Annealed
22	52Ni-22Cr-13Co-9Mo	Smls. pipe & tube	SB-167	...	N06617	Annealed
23	52Ni-22Cr-13Co-9Mo	Plate, sheet, strip	SB-168	...	N06617	Annealed
24	52Ni-22Cr-13Co-9Mo	Forgings	SB-564	...	N06617	Annealed
25	52Ni-22Cr-13Co-9Mo	Wld. tube	SB-626	...	N06617	Solution ann.
26	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet, strip	SB-443	2	N06625	Solution ann.
27	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet	SB-443	2	N06625	Hot rolled/sol. 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	Smls. & wld. fittings	SB-366	...	N06625	Annealed
(25) 31	60Ni-22Cr-9Mo-3.5Cb	Bar	SB-446	1	N06625	Annealed
32	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1	N06625	Annealed
33	60Ni-22Cr-9Mo-3.5Cb	Plate	SB-443	1	N06625	Cold rolled/annealed
34	60Ni-22Cr-9Mo-3.5Cb	Plate, sheet, strip	SB-443	1	N06625	Hot rolled/ann.
35	60Ni-22Cr-9Mo-3.5Cb	Sheet, strip	SB-443	1	N06625	Cold rolled/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
(25) 38	60Ni-22Cr-9Mo-3.5Cb	Forgings	SB-564	1	N06625	Annealed
39	60Ni-22Cr-9Mo-3.5Cb	Wld. tube	SB-704	...	N06625	Annealed
40	60Ni-22Cr-9Mo-3.5Cb	Wld. pipe	SB-705	...	N06625	Annealed
41	Ni-Cr-Mo-W	Forgings	SB-564	...	N06686	Solution ann.
42	Ni-Cr-Mo-W	Rod	SB-574	...	N06686	Solution ann.
43	Ni-Cr-Mo-W	Plate, sheet, strip	SB-575	...	N06686	Solution ann.
44	Ni-Cr-Mo-W	Wld. pipe	SB-619	...	N06686	Solution ann.
45	Ni-Cr-Mo-W	Smls. pipe & tube	SB-622	...	N06686	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	>125	550	205	...
2	...	550	205	...
3	>125	550	205	...
4	≤125	550	205	...
5	≤75	550	240	...
6	...	550	240	...
7	...	550	240	...
8	...	550	240	...
9	...	550	240	...
10	≤125	550	240	...
11	...	550	240	...
12	...	550	275	...
13	>75	585	240	...
14	...	585	240	...
15	$13 < t \leq 75$	620	275	...
16	$6 < t \leq 13$	655	310	...
17	≤75 O.D.	552	207	...
18	...	552	207	...
19	...	552	207	...
20	...	552	207	...
21	...	655	240	...
22	...	655	240	...
23	...	655	240	...
24	...	655	240	...
25	...	655	240	...
26	...	690	275	...
27	...	690	276	...
28	...	690	275	...
29	...	690	275	...
30	...	760	345	...
31	$100 < t \leq 250$	760	345	...
32	$100 < t \leq 250$	760	345	...
33	≤9.5	758	379	...
34	≤70	758	379	...
35	...	827	414	...
36	...	825	415	...
37	≤100	825	415	...
38	≤100	825	415	...
39	...	825	415	...
40	...	825	415	...
41	...	689	310	...
42	...	689	310	...
43	...	689	310	...
44	≤203.2	689	310	...
45	...	689	310	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	207	201	196	192	189	185	181	178	175	172
2	207	201	196	192	189	185	181	178	175	172
3	207	201	196	192	189	185	181	178	175	172
4	207	201	196	192	189	185	181	178	175	172
5	241	226	220	217	215	213	212	211	209	208
6	241	226	220	217	215	213	212	211	209	208
7	241	226	220	217	215	213	212	211	209	208
8	241	226	220	217	215	213	212	211	209	208
9	241	226	220	217	215	213	212	211	209	208
10	241	226	220	217	215	213	212	211	209	208
11	241	226	220	217	215	213	212	211	209	208
12	276	263	251	247	245	244	242	241	240	238
13	241	233	228	225	223	221	220	220	220	220
14	241	233	228	225	223	221	220	220	220	220
15	276	268	261	258	255	253	251	251	251	251
16	310	302	294	290	287	285	283	282	282	282
17	207	192	183	177	171	166	161	157	154	151
18	207	192	183	177	171	166	161	157	154	151
19	207	192	183	177	171	166	161	157	154	151
20	207	192	183	177	171	166	161	157	154	151
21	241	227	212	205	199	193	188	183	180	177
22	241	227	212	205	199	193	188	183	180	177
23	241	227	212	205	199	193	188	183	180	177
24	241	227	212	205	199	193	188	183	180	177
25	241	227	212	205	199	193	188	183	180	177
26	276	259	248	241	235	229	224	219	215	211
27	276	262	253	247	242	237	233	229	225	222
28	276	259	248	241	235	229	224	219	215	211
29	276	259	248	241	235	229	224	219	215	211
30	345	315	295	283	273	265	258	253	248	245
31	345	315	295	283	273	265	258	253	248	245
32	345	315	295	283	273	265	258	253	248	245
33	379	347	325	312	301	292	284	278	274	270
34	379	371	364	359	354	350	345	340	336	332
35	414	379	355	341	329	319	311	304	299	295
36	414	379	355	341	329	319	311	304	299	295
37	414	379	355	341	329	319	311	304	299	295
38	414	379	355	341	329	319	311	304	299	295
39	414	379	355	341	329	319	311	304	299	295
40	414	379	355	341	329	319	311	304	299	295
41	310	272	255	...	241	...	233	...	225	...
42	310	272	255	...	241	...	233	...	225	...
43	310	272	255	...	241	...	233	...	225	...
44	310	272	255	...	241	...	233	...	225	...
45	310	272	255	...	241	...	233	...	225	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	169	167	164	162	160	158	156	154	152	151
2	169	167	164	162	160	158	156	154	152	151
3	169	167	164	162	160	158	156	154	152	151
4	169	167	164	162	160	158	156	154	152	151
5	207	206	204	202	201	198	195	190	185	176
6	207	206	204	202	201	198	195	190	185	176
7	207	206	204	202	201	198	195	190	185	176
8	207	206	204	202	201	198	195	190	185	176
9	207	206	204	202	201	198	195	190	185	176
10	207	206	204	202	201	198	195	190	185	176
11	207	206	204	202	201	198	195	190	185	176
12	237	235	233	231	229	226	224	...	...	...
13	220	219	218	217	215	212	208	204	201	197
14	220	219	218	217	215	212	208	204	201	197
15	251	250	249	247	244	240	236	...	...	...
16	282	281	280	278	274	270	266	...	...	...
17	148	146	145	144	143	143	142	142	142	142
18	148	146	145	144	143	143	142	142	142	142
19	148	146	145	144	143	143	142	142	142	142
20	148	146	145	144	143	143	142	142	142	142
21	174	171	169	167	166	164	164	162	162	161
22	174	171	169	167	166	164	164	162	162	161
23	174	171	169	167	166	164	164	162	162	161
24	174	171	169	167	166	164	164	162	162	161
25	174	171	169	167	166	164	164	162	162	161
26	208	206	204	202	201	200	199	199	198	198
27	219	217	214	212	210	208	207	205	204	203
28	208	206	204	202	201	200	199	199	198	198
29	208	206	204	202	201	200	199	199	198	198
30	243	242	242	242	242	242	242	242	242	242
31	243	242	242	242	242	242	242	242	242	242
32	243	242	242	242	242	242	242	242	242	242
33	268	267	266	266	266	266	266	266	266	266
34	328	324	320	317	314	312	309	307	306	304
35	293	291	291	291	291	291	291	291	291	291
36	293	291	291	291	291	291	291	291	291	291
37	293	291	291	291	291	291	291	291	291	291
38	293	291	291	291	291	291	291	291	291	291
39	293	291	291	291	291	291	291	291	291	291
40	293	291	291	291	291	291	291	291	291	291
41	217	214	210	208	206	205	205	205	205	205
42	217	214	210	208	206	205	205	205	205	205
43	217	214	210	208	206	205	205	205	205	205
44	217	214	210	208	206	205	205	205	205	205
45	217	214	210	208	206	205	205	205	205	205

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	149	146	144	141	137	...	...	...	...	...	...	...	...	...	...
2	149	146	144	141	137	...	...	...	...	...	...	...	...	...	...
3	149	146	144	141	137	...	...	...	...	...	...	...	...	...	...
4	149	146	144	141	137	...	...	...	...	...	...	...	...	...	...
5	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
6	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
7	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
8	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
9	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
10	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
11	170	164	157	149	140	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	191	186	181	175	167	...	...	...	...	...	...	...	...	...	...
14	191	186	181	175	167	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	198	198	197	197	196	195	194	192	189	186	182	178	172	166	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	198	198	197	197	196	195	194	192	189	186	182	178	172	166	...
29	198	198	197	197	196	195	194	192	189	186	182	178	172	166	...
30	242	242	242	242	242	242	242	242	240	235	227	218	208	196	...
31	242	242	242	242	242	242	242	242	240	235	227	218	208	196	...
32	242	242	242	242	242	242	242	242	240	235	227	218	208	196	...
33	266	266	266	266	266	266	266	266	265	258	250	241	229	215	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
36	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
37	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
38	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
39	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
40	291	291	291	291	291	291	291	291	289	282	273	263	250	235	...
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	Ni-Cr-Mo-W	Wld. tube	SB-626	...	N06686	Solution ann.
2	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Hot worked/ann.
3	58Ni-29Cr-9Fe	Smls. tube	SB-163	...	N06690	Annealed
4	58Ni-29Cr-9Fe	Bar, rod	SB-166	...	N06690	Annealed
5	58Ni-29Cr-9Fe	Plate, sheet, strip	SB-168	...	N06690	Annealed
6	58Ni-29Cr-9Fe	Forgings	SB-564	...	N06690	Annealed
7	58Ni-29Cr-9Fe	Smls. tube	SB-163	...	N06690	Annealed
8	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold worked/ann.
9	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Hot worked/ann.
10	58Ni-29Cr-9Fe	Smls. pipe & tube	SB-167	...	N06690	Cold worked/ann.
11	49Ni-25Cr-18Fe-6Mo	Bolting	SB-581	...	N06975	Solution ann.
12	49Ni-25Cr-18Fe-6Mo	Plate, sheet, strip	SB-582	...	N06975	Solution ann.
13	49Ni-25Cr-18Fe-6Mo	Wld. pipe	SB-619	...	N06975	Solution ann.
14	49Ni-25Cr-18Fe-6Mo	Smls. pipe & tube	SB-622	...	N06975	Solution ann.
15	49Ni-25Cr-18Fe-6Mo	Wld. tube	SB-626	...	N06975	Solution ann.
16	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
17	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
18	47Ni-22Cr-20Fe-7Mo	Smls. & wld. fittings	SB-366	...	N06985	Annealed
19	47Ni-22Cr-20Fe-7Mo	Rod	SB-581	...	N06985	Annealed
20	47Ni-22Cr-20Fe-7Mo	Plate, sheet, strip	SB-582	...	N06985	Annealed
21	47Ni-22Cr-20Fe-7Mo	Wld. pipe	SB-619	...	N06985	Annealed
22	47Ni-22Cr-20Fe-7Mo	Smls. pipe & tube	SB-622	...	N06985	Annealed
23	47Ni-22Cr-20Fe-7Mo	Wld. tube	SB-626	...	N06985	Annealed
24	35Ni-35Fe-20Cr-Cb	Forgings	SB-462	...	N08020	Annealed
25	35Ni-35Fe-20Cr-Cb	Plate	SB-463	...	N08020	Annealed
26	35Ni-35Fe-20Cr-Cb	Bar	SB-473	...	N08020	Annealed
27	35Ni-35Fe-20Cr-Cb	Smls. pipe & tube	SB-729	...	N08020	Annealed
28	35Ni-35Fe-20Cr-Cb	Wld. pipe	SB-464	...	N08020	Wld. ann.
29	35Ni-35Fe-20Cr-Cb	Wld. tube	SB-468	...	N08020	Wld. ann.
30	35Ni-35Fe-20Cr-Cb	Smls. & wld. fittings	SB-366	...	N08020	Annealed
31	37Ni-33Fe-23Cr-4Mo-Cu	Wld. pipe	SB-464	...	N08024	Wld. ann.
32	37Ni-33Fe-23Cr-4Mo-Cu	Wld. tube	SB-468	...	N08024	Wld. ann.
33	35Ni-30Fe-24Cr-6Mo-Cu	Wld. pipe	SB-464	...	N08026	Wld. ann.
34	35Ni-30Fe-24Cr-6Mo-Cu	Wld. tube	SB-468	...	N08026	Wld. ann.
35	31Ni-31Fe-29Cr-Mo	Smls. tube	SB-668	...	N08028	Annealed
36	31Ni-31Fe-29Cr-Mo	Plate, sheet, strip	SB-709	...	N08028	Annealed
37	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Smls. & wld. fittings	SB-366	...	N08031	Solution ann.
38	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Forgings	SB-564	...	N08031	Solution ann.
39	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Rod	SB-581	...	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	Plate, sheet, strip	SB-625	...	N08031	Solution ann.
43	31Ni-33Fe-27Cr-6.5Mo-Cu-N	Wld. tube	SB-626	...	N08031	Solution ann.
44	37Ni-33Fe-25Cr	Condenser tubes	SB-163	...	N08120	Solution ann.
45	37Ni-33Fe-25Cr	Smls. & wld. fittings	SB-366	...	N08120	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	≤88.9	689	310	...
2	>127 O.D.	515	170	...
3	...	585	240	...
4	...	585	240	...
5	...	585	240	...
6	...	585	240	...
7	...	585	275	...
8	>127 O.D.	586	205	...
9	≤127 O.D.	586	205	...
10	≤127 O.D.	586	240	...
11	...	585	220	...
12	...	585	220	...
13	...	585	220	...
14	...	585	220	...
15	...	585	220	...
16	>19	585	205	...
17	>19	585	205	...
18	...	620	240	...
19	≤19	620	240	...
20	≤19	620	240	...
21	...	620	240	...
22	...	620	240	...
23	...	620	240	...
24	...	550	240	...
25	...	550	240	...
26	...	550	240	...
27	...	550	240	...
28	...	550	240	...
29	...	550	240	...
30	...	585	275	...
31	...	550	240	...
32	...	550	240	...
33	...	550	240	...
34	...	550	240	...
35	...	505	215	...
36	...	505	215	...
37	...	650	275	...
38	...	650	275	...
39	...	650	275	...
40	...	650	275	...
41	...	650	275	...
42	...	650	275	...
43	...	650	275	...
44	...	621	276	...
45	...	621	276	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	310	272	255	...	241	...	233	...	225	...
2	172	163	155	151	147	144	141	139	138	137
3	241	227	217	211	205	201	198	195	193	192
4	241	227	217	211	205	201	198	195	193	192
5	241	227	217	211	205	201	198	195	193	192
6	241	227	217	211	205	201	198	195	193	192
7	276	262	247	240	235	230	226	223	221	219
8	207	195	187	181	176	172	169	167	165	164
9	207	195	187	181	176	172	169	167	165	164
10	241	228	218	211	206	201	197	195	193	191
11	221	208	201	196	191	186	182	177	173	168
12	221	208	201	196	191	186	182	177	173	168
13	221	208	201	196	191	186	182	177	173	168
14	221	208	201	196	191	186	182	177	173	168
15	221	208	201	196	191	186	182	177	173	168
16	207	193	182	175	167	161	155	150	145	141
17	207	193	182	175	167	161	155	150	145	141
18	241	226	213	203	195	188	181	175	169	165
19	241	226	213	203	195	188	181	175	169	165
20	241	226	213	203	195	188	181	175	169	165
21	241	226	213	203	195	188	181	175	169	165
22	241	226	213	203	195	188	181	175	169	165
23	241	226	213	203	195	188	181	175	169	165
24	241	221	212	208	204	200	196	193	189	186
25	241	221	212	208	204	200	196	193	189	186
26	241	221	212	208	204	200	196	193	189	186
27	241	221	212	208	204	200	196	193	189	186
28	241	221	212	208	204	200	196	193	189	186
29	241	221	212	208	204	200	196	193	189	186
30	276	253	243	237	233	228	225	221	217	213
31	241	222	211	204	198	193	188	183	178	173
32	241	222	211	204	198	193	188	183	178	173
33	241	225	212	203	195	189	182	176	170	166
34	241	225	212	203	195	189	182	176	170	166
35	214	203	194	188	182	177	172	166	162	157
36	214	203	194	188	182	177	172	166	162	157
37	276	250	224	212	204	197	190	184	180	176
38	276	250	224	212	204	197	190	184	180	176
39	276	250	224	212	204	197	190	184	180	176
40	276	250	224	212	204	197	190	184	180	176
41	276	250	224	212	204	197	190	184	180	176
42	276	250	224	212	204	197	190	184	180	176
43	276	250	224	212	204	197	190	184	180	176
44	276	258	242	232	223	215	207	200	195	189
45	276	258	242	232	223	215	207	200	195	189

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	217	214	210	208	206	205	205	205	205	205
2	136	136	136	136	136	136	135	135	135	134
3	191	190	190	190	190	190	190	190	189	188
4	191	190	190	190	190	190	190	190	189	188
5	191	190	190	190	190	190	190	190	189	188
6	191	190	190	190	190	190	190	190	189	188
7	218	217	217	217	217	217	217	...	...	...
8	163	163	163	163	163	163	163	162	162	161
9	163	163	163	163	163	163	163	162	162	161
10	190	190	190	190	190	190	190	189	189	188
11	164	160	157	155	153	152	151	151	151	151
12	164	160	157	155	153	152	151	151	151	151
13	164	160	157	155	153	152	151	151	151	151
14	164	160	157	155	153	152	151	151	151	151
15	164	160	157	155	153	152	151	151	151	151
16	138	135	132	129	127	124	122	120	118	116
17	138	135	132	129	127	124	122	120	118	116
18	161	157	154	151	147	145	142	140	137	135
19	161	157	154	151	147	145	142	140	137	135
20	161	157	154	151	147	145	142	140	137	135
21	161	157	154	151	147	145	142	140	137	135
22	161	157	154	151	147	145	142	140	137	135
23	161	157	154	151	147	145	142	140	137	135
24	184	182	180	179	178	174	170	...	...	...
25	184	182	180	179	178	174	170	...	...	...
26	184	182	180	179	178	174	170	...	...	...
27	184	182	180	179	178	174	170	...	...	...
28	184	182	180	179	178	174	170	...	...	...
29	184	182	180	179	178	174	170	...	...	...
30	210	208	207	205	203	199	195	...	...	...
31	169	164	160	156	153	150	149	147	146	144
32	169	164	160	156	153	150	149	147	146	144
33	161	157	153	150	147	144	142	140	139	138
34	161	157	153	150	147	144	142	140	139	138
35	152	148	144	139	136	132	129	126	123	120
36	152	148	144	139	136	132	129	126	123	120
37	173	169	165	162	160	157	155	153	152	...
38	173	169	165	162	160	157	155	153	152	...
39	173	169	165	162	160	157	155	153	152	...
40	173	169	165	162	160	157	155	153	152	...
41	173	169	165	162	160	157	155	153	152	...
42	173	169	165	162	160	157	155	153	152	...
43	173	169	165	162	160	157	155	153	152	...
44	185	181	178	176	174	172	171	170	170	169
45	185	181	178	176	174	172	171	170	170	169

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	37Ni-33Fe-25Cr	Smls. pipe & tube	SB-407	...	N08120	Solution ann.
2	37Ni-33Fe-25Cr	Bar, rod	SB-408	...	N08120	Solution ann.
3	37Ni-33Fe-25Cr	Plate, sheet, strip	SB-409	...	N08120	Solution ann.
4	37Ni-33Fe-25Cr	Wld. pipe	SB-514	...	N08120	Solution ann.
5	37Ni-33Fe-25Cr	Wld. tube	SB-515	...	N08120	Solution ann.
6	37Ni-33Fe-25Cr	Forgings	SB-564	...	N08120	Solution ann.
7	26Ni-43Fe-22Cr-5Mo	Wld. pipe	SB-619	...	N08320	Solution ann.
8	26Ni-43Fe-22Cr-5Mo	Plate, sheet, strip	SB-620	...	N08320	Solution ann.
9	26Ni-43Fe-22Cr-5Mo	Rod	SB-621	...	N08320	Solution ann.
10	26Ni-43Fe-22Cr-5Mo	Smls. pipe & tube	SB-622	...	N08320	Solution ann.
11	26Ni-43Fe-22Cr-5Mo	Wld. tube	SB-626	...	N08320	Solution ann.
12	35Ni-19Cr-1 $\frac{1}{4}$ Si	Bar	SB-511	...	N08330	...
13	35Ni-19Cr-1 $\frac{1}{4}$ Si	Pipe	SB-535	...	N08330	...
14	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate	SB-536	...	N08330	...
15	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. fittings	SB-366	...	N08330	Annealed
16	35Ni-19Cr-1 $\frac{1}{4}$ Si	Smls. & wld. pipe	SB-535	...	N08330	Annealed
17	35Ni-19Cr-1 $\frac{1}{4}$ Si	Plate, sheet, strip	SB-536	...	N08330	Annealed
18	35Ni-19Cr-1 $\frac{1}{4}$ Si	Wld. pipe	SB-710	...	N08330	Annealed
19	35Ni-23Cr-7.5Mo-N	Plate, sheet, strip	SB-625	...	N08354	Solution ann.
20	35Ni-23Cr-7.5Mo-N	Bar, wire	SB-649	...	N08354	Solution ann.
21	35Ni-23Cr-7.5Mo-N	Wld. pipe	SB-673	...	N08354	Solution ann.
22	35Ni-23Cr-7.5Mo-N	Wld. tube	SB-674	...	N08354	Solution ann.
23	35Ni-23Cr-7.5Mo-N	Smls. pipe & tube	SB-677	...	N08354	Solution ann.
24	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-462	...	N08367	Solution ann.
25	46Fe-24Ni-21Cr-6Mo-N	Forgings	SB-564	...	N08367	Solution ann.
26	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
27	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
28	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
29	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
30	46Fe-24Ni-21Cr-6Mo-N	Bar, rod, wire	SB-691	...	N08367	Solution ann.
31	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.
32	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-675	...	N08367	Solution ann.
33	46Fe-24Ni-21Cr-6Mo-N	Wld. tube	SB-676	...	N08367	Solution ann.
34	46Fe-24Ni-21Cr-6Mo-N	Plate, sheet, strip	SB-688	...	N08367	Solution ann.
35	46Fe-24Ni-21Cr-6Mo-N	Smls. pipe & tube	SB-690	...	N08367	Solution ann.
36	46Fe-24Ni-21Cr-6Mo-N	Wld. pipe	SB-804	...	N08367	Solution ann.
37	46Fe-24Ni-21Cr-6Mo-N	Castings	SA-351	CN3MN	J94651	Solution ann.
38	25Ni-47Fe-21Cr-5Mo	Plate, sheet, strip	SB-599	...	N08700	Solution ann.
39	25Ni-47Fe-21Cr-5Mo	Bar, wire	SB-672	...	N08700	Solution ann.
40	32Ni-45Fe-20Cr-Cb	Castings	SA-351	CT15C	...	As cast
41	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08800	Annealed
42	33Ni-42Fe-21Cr	Smls. & wld. fittings	SB-366	...	N08800	Annealed
43	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08800	Annealed
44	33Ni-42Fe-21Cr	Bar	SB-408	...	N08800	Annealed
45	33Ni-42Fe-21Cr	Plate	SB-409	...	N08800	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	...	621	276	...
2	...	621	276	...
3	...	621	276	...
4	...	621	276	...
5	...	621	276	...
6	...	621	276	...
7	...	515	195	...
8	...	515	195	...
9	...	515	195	...
10	...	515	195	...
11	...	515	195	...
12	...	485	205	...
13	...	485	205	...
14	...	485	205	...
15	...	485	205	...
16	...	485	205	...
17	...	485	205	...
18	...	485	205	...
19	...	640	295	...
20	...	640	295	...
21	...	640	295	...
22	...	640	295	...
23	...	640	295	...
24	...	655	310	...
25	...	655	310	...
26	>5	655	310	...
27	>5	655	310	...
28	>5	655	310	...
29	>5	655	310	...
30	...	655	310	...
31	>5	655	310	...
32	≤5	690	310	...
33	≤5	690	310	...
34	≤5	690	310	...
35	≤5	690	310	...
36	≤5	690	310	...
37	...	550	260	...
38	...	550	240	...
39	...	550	240	...
40	...	435	170	...
41	...	515	205	...
42	...	515	205	...
43	...	515	205	...
44	...	515	205	...
45	...	515	205	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	276	258	242	232	223	215	207	200	195	189
2	276	258	242	232	223	215	207	200	195	189
3	276	258	242	232	223	215	207	200	195	189
4	276	258	242	232	223	215	207	200	195	189
5	276	258	242	232	223	215	207	200	195	189
6	276	258	242	232	223	215	207	200	195	189
7	193	184	177	173	169	164	160	156	152	148
8	193	184	177	173	169	164	160	156	152	148
9	193	184	177	173	169	164	160	156	152	148
10	193	184	177	173	169	164	160	156	152	148
11	193	184	177	173	169	164	160	156	152	148
12	207	191	181	175	170	165	161	157	153	150
13	207	191	181	175	170	165	161	157	153	150
14	207	191	181	175	170	165	161	157	153	150
15	207	191	181	175	170	165	161	157	153	150
16	207	191	181	175	170	165	161	157	153	150
17	207	191	181	175	170	165	161	157	153	150
18	207	191	181	175	170	165	161	157	153	150
19	295	267	249	237	228	...	213	...	204	...
20	295	267	249	237	228	...	213	...	204	...
21	295	267	249	237	228	...	213	...	204	...
22	295	267	249	237	228	...	213	...	204	...
23	295	267	249	237	228	...	213	...	204	...
24	310	285	268	256	246	236	228	221	215	209
25	310	285	268	256	246	236	228	221	215	209
26	310	285	268	256	246	236	228	221	215	209
27	310	285	268	256	246	236	228	221	215	209
28	310	285	268	256	246	236	228	221	215	209
29	310	285	268	256	246	236	228	221	215	209
30	310	285	268	256	246	236	228	221	215	209
31	310	285	268	256	246	236	228	221	215	209
32	310	285	268	256	246	236	228	221	215	209
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	262	237	217	205	194	184	176	169	164	160
38	241	228	215	205	196	189	184	181	178	176
39	241	228	215	205	196	189	184	181	178	176
40	172	166	162	160	158	157	155	153	151	149
41	207	197	190	186	183	181	178	176	174	172
42	207	197	190	186	183	181	178	176	174	172
43	207	197	190	186	183	181	178	176	174	172
44	207	197	190	186	183	181	178	176	174	172
45	207	197	190	186	183	181	178	176	174	172

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	185	181	178	176	174	172	171	170	170	169
2	185	181	178	176	174	172	171	170	170	169
3	185	181	178	176	174	172	171	170	170	169
4	185	181	178	176	174	172	171	170	170	169
5	185	181	178	176	174	172	171	170	170	169
6	185	181	178	176	174	172	171	170	170	169
7	145	142	139	136	134	132	130	...	...	...
8	145	142	139	136	134	132	130	...	...	...
9	145	142	139	136	134	132	130	...	...	...
10	145	142	139	136	134	132	130	...	...	...
11	145	142	139	136	134	132	130	...	...	...
12	147	144	141	138	136	133	131	128	126	124
13	147	144	141	138	136	133	131	128	126	124
14	147	144	141	138	136	133	131	128	126	124
15	147	144	141	138	136	133	131	128	126	124
16	147	144	141	138	136	133	131	128	126	124
17	147	144	141	138	136	133	131	128	126	124
18	147	144	141	138	136	133	131	128	126	124
19	197	194	192	189	186	183	181	179	179	179
20	197	194	192	189	186	183	181	179	179	179
21	197	194	192	189	186	183	181	179	179	179
22	197	194	192	189	186	183	181	179	179	179
23	197	194	192	189	186	183	181	179	179	179
24	204	199	196	192	189	186	184	181	179	...
25	204	199	196	192	189	186	184	181	179	...
26	204	199	196	192	189	186	184	181	179	...
27	204	199	196	192	189	186	184	181	179	...
28	204	199	196	192	189	186	184	181	179	...
29	204	199	196	192	189	186	184	181	179	...
30	204	199	196	192	189	186	184	181	179	...
31	204	199	196	192	189	186	184	181	179	...
32	204	199	196	192	189	186	184	181	179	...
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	156	153	151	150	148	148	146	146	145	145
38	173	168	163	...	...	...	...	...	...	...
39	173	168	163	...	...	...	...	...	...	...
40	147	145	144	142	140	137	135	134	132	130
41	170	168	166	164	162	160	158	157	155	153
42	170	168	166	164	162	160	158	157	155	153
43	170	168	166	164	162	160	158	157	155	153
44	170	168	166	164	162	160	158	157	155	153
45	170	168	166	164	162	160	158	157	155	153

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
13	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
14	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
15	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
16	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
17	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
18	122	120	117	115	112	109	106	102	98.6	94.4	89.8	84.7	79.2	73.1	66.5
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
42	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
43	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
44	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
45	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08800	Annealed
2	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08800	Annealed
3	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08800	Annealed
4	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08800	Annealed
5	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08800	Cold worked
6	32Ni-44Fe-21Cr	Smls. tube	SB-163	...	N08801	Ann./stabilized
7	32Ni-44Fe-21Cr	Smls. pipe & tube	SB-407	...	N08801	Ann./stabilized
8	33Ni-42Fe-21Cr	Smls. tube	SB-163	...	N08810	Annealed
9	33Ni-42Fe-21Cr	Smls. pipe & tube	SB-407	...	N08810	Annealed
10	33Ni-42Fe-21Cr	Bar	SB-408	...	N08810	Annealed
11	33Ni-42Fe-21Cr	Plate	SB-409	...	N08810	Annealed
12	33Ni-42Fe-21Cr	Wld. pipe	SB-514	...	N08810	Annealed
13	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08810	Annealed
14	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08810	Annealed
(25) 15	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC10	N08810	...
(25) 16	42Fe-33Ni-21Cr	Smls. tube	SA-213	800H	N08810	...
(25) 17	42Fe-33Ni-21Cr	Plate	SA-240	800H	N08810	...
(25) 18	42Fe-33Ni-21Cr	Wld. tube	SA-249	800H	N08810	...
(25) 19	42Fe-33Ni-21Cr	Bar	SA-276	800H	N08810	...
(25) 20	42Fe-33Ni-21Cr	Smls. pipe	SA-312	800H	N08810	...
(25) 21	42Fe-33Ni-21Cr	Wld. pipe	SA-312	800H	N08810	...
(25) 22	42Fe-33Ni-21Cr	Wld. pipe	SA-358	800H	N08810	...
(25) 23	42Fe-33Ni-21Cr	Bar	SA-479	800H	N08810	...
(25) 24	42Fe-33Ni-21Cr	Wld. tube	SA-688	800H	N08810	...
(25) 25	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC10	N08810	...
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	Bar	SB-408	...	N08811	Annealed
29	33Ni-42Fe-21Cr	Plate	SB-409	...	N08811	Annealed
30	33Ni-42Fe-21Cr	Wld. tube	SB-515	...	N08811	Annealed
31	33Ni-42Fe-21Cr	Forgings	SB-564	...	N08811	Annealed
(25) 32	42Fe-33Ni-21Cr	Forgings	SA-182	FNIC11	N08811	...
(25) 33	42Fe-33Ni-21Cr	Smls. tube	SA-213	...	N08811	...
(25) 34	42Fe-33Ni-21Cr	Plate	SA-240	...	N08811	...
(25) 35	42Fe-33Ni-21Cr	Wld. tube	SA-249	...	N08811	...
(25) 36	42Fe-33Ni-21Cr	Bar	SA-276	...	N08811	...
(25) 37	42Fe-33Ni-21Cr	Smls. pipe	SA-312	...	N08811	...
(25) 38	42Fe-33Ni-21Cr	Bar	SA-479	...	N08811	...
(25) 39	42Fe-33Ni-21Cr	Wld. tube	SA-688	...	N08811	...
(25) 40	42Fe-33Ni-21Cr	Forgings	SA-965	FNIC11	N08811	...
41	42Ni-21.5Cr-3Mo-2.3Cu	Smls. tube	SB-163	...	N08825	Annealed
42	42Ni-21.5Cr-3Mo-2.3Cu	Smls. & wld. fittings	SB-366	...	N08825	Annealed
43	42Ni-21.5Cr-3Mo-2.3Cu	Smls. pipe & tube	SB-423	...	N08825	Cold worked/ann.
44	42Ni-21.5Cr-3Mo-2.3Cu	Plate	SB-424	...	N08825	Annealed
45	42Ni-21.5Cr-3Mo-2.3Cu	Bar, rod	SB-425	...	N08825	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	...	515	205	...
2	...	515	205	...
3	...	515	205	...
4	...	515	275	...
5	...	570	325	...
6	...	450	170	...
7	...	450	170	...
8	...	450	170	...
9	...	450	170	...
10	...	450	170	...
11	...	450	170	...
12	...	450	170	...
13	...	450	170	...
14	...	450	170	...
15	...	450	170	...
16	...	450	170	...
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	...	450	170	...
27	...	450	170	...
28	...	450	170	...
29	...	450	170	...
30	...	450	170	...
31	...	450	170	...
32	...	450	170	...
33	...	450	170	...
34	...	450	170	...
35	...	450	170	...
36	...	450	170	...
37	...	450	170	...
38	...	450	170	...
39	...	450	170	...
40	...	450	170	...
41	...	585	240	...
42	...	585	240	...
43	...	585	240	...
44	...	585	240	...
45	...	585	240	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	207	197	190	186	183	181	178	176	174	172
2	207	197	190	186	183	181	178	176	174	172
3	207	197	190	186	183	181	178	176	174	172
4	276	265	253	248	245	241	238	235	232	229
5	324	311	297	292	287	283	279	276	273	270
6	172	164	157	153	149	145	141	138	134	131
7	172	164	157	153	149	145	141	138	134	131
8	172	164	157	153	149	145	141	138	134	131
9	172	164	157	153	149	145	141	138	134	131
10	172	164	157	153	149	145	141	138	134	131
11	172	164	157	153	149	145	141	138	134	131
12	172	164	157	153	149	145	141	138	134	131
13	172	164	157	153	149	145	141	138	134	131
14	172	164	157	153	149	145	141	138	134	131
15	172	164	157	153	149	145	141	138	134	131
16	172	164	157	153	149	145	141	138	134	131
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	172	164	157	153	149	145	141	138	134	131
27	172	164	157	153	149	145	141	138	134	131
28	172	164	157	153	149	145	141	138	134	131
29	172	164	157	153	149	145	141	138	134	131
30	172	164	157	153	149	145	141	138	134	131
31	172	164	157	153	149	145	141	138	134	131
32	172	164	157	153	149	145	141	138	134	131
33	172	164	157	153	149	145	141	138	134	131
34	172	164	157	153	149	145	141	138	134	131
35	172	164	157	153	149	145	141	138	134	131
36	172	164	157	153	149	145	141	138	134	131
37	172	164	157	153	149	145	141	138	134	131
38	172	164	157	153	149	145	141	138	134	131
39	172	164	157	153	149	145	141	138	134	131
40	172	164	157	153	149	145	141	138	134	131
41	241	228	220	214	210	205	201	197	193	189
42	241	228	220	214	210	205	201	197	193	189
43	241	228	220	214	210	205	201	197	193	189
44	241	228	220	214	210	205	201	197	193	189
45	241	228	220	214	210	205	201	197	193	189

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	170	168	166	164	162	160	158	157	155	153
2	170	168	166	164	162	160	158	157	155	153
3	170	168	166	164	162	160	158	157	155	153
4	226	224	221	219	216	214	211	...	...	...
5	268	267	267	...	...	...	...	...	...	...
6	128	125	123	120	118	115	113	112	110	108
7	128	125	123	120	118	115	113	112	110	108
8	128	125	123	120	118	115	113	112	110	108
9	128	125	123	120	118	115	113	112	110	108
10	128	125	123	120	118	115	113	112	110	108
11	128	125	123	120	118	115	113	112	110	108
12	128	125	123	120	118	115	113	112	110	108
13	128	125	123	120	118	115	113	112	110	108
14	128	125	123	120	118	115	113	112	110	108
15	128	125	123	120	118	115	113	112	110	108
16	128	125	123	120	118	115	113	112	110	108
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	128	125	123	120	118	115	113	112	110	108
27	128	125	123	120	118	115	113	112	110	108
28	128	125	123	120	118	115	113	112	110	108
29	128	125	123	120	118	115	113	112	110	108
30	128	125	123	120	118	115	113	112	110	108
31	128	125	123	120	118	115	113	112	110	108
32	128	125	123	120	118	115	113	112	110	108
33	128	125	123	120	118	115	113	112	110	108
34	128	125	123	120	118	115	113	112	110	108
35	128	125	123	120	118	115	113	112	110	108
36	128	125	123	120	118	115	113	112	110	108
37	128	125	123	120	118	115	113	112	110	108
38	128	125	123	120	118	115	113	112	110	108
39	128	125	123	120	118	115	113	112	110	108
40	128	125	123	120	118	115	113	112	110	108
41	186	183	181	179	177	177	175	175	174	172
42	186	183	181	179	177	177	175	175	174	172
43	186	183	181	179	177	177	175	175	174	172
44	186	183	181	179	177	177	175	175	174	172
45	186	183	181	179	177	177	175	175	174	172

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
2	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
3	151	147	143	139	134	128	121	113	104	94.2	83.3	71.1	...	...	...
4	202	198	192	186	179	171	162	151	140	126	112	95.4	...	...	...
5	239	234	227	220	212	202	191	179	165	149	132	113	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
9	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
10	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
11	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
12	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
13	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
14	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
15	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
16	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
17	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
18	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
19	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
20	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
21	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
22	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
23	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
24	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
25	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
26	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
27	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
28	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
29	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
30	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
31	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4
32	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
33	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
34	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
35	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
36	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
37	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
38	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
39	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
40	103	101	98.8	96.7	94.4	92.0	89.3	86.5	83.4	80.0	76.4	72.4	68.1	63.4	58.4 (25)
41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	42Ni-21.5Cr-3Mo-2.3Cu	Forgings	SB-564	...	N08825	Annealed
2	42Ni-21.5Cr-3Mo-2.3Cu	Wld. tube	SB-704	...	N08825	Annealed
3	42Ni-21.5Cr-3Mo-2.3Cu	Wld. pipe	SB-705	...	N08825	Annealed
4	44Fe-25Ni-21Cr-Mo	Forgings	SA-182	...	N08904	Annealed
5	44Fe-25Ni-21Cr-Mo	Smls. tube	SA-213	...	N08904	Annealed
6	44Fe-25Ni-21Cr-Mo	Plate, sheet, strip	SA-240	...	N08904	Annealed
7	44Fe-25Ni-21Cr-Mo	Wld. tube	SA-249	...	N08904	Annealed
8	44Fe-25Ni-21Cr-Mo	Smls. & wld. pipe	SA-312	...	N08904	Annealed
9	44Fe-25Ni-21Cr-Mo	Fittings	SA-403	...	N08904	Annealed
10	44Fe-25Ni-21Cr-Mo	Bar	SA-479	...	N08904	Annealed
11	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SB-625	...	N08925	Annealed
12	25Ni-20Cr-6Mo-Cu-N	Bar, wire	SB-649	...	N08925	Annealed
13	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SB-673	...	N08925	Annealed
14	25Ni-20Cr-6Mo-Cu-N	Wld. tube	SB-674	...	N08925	Annealed
15	25Ni-20Cr-6Mo-Cu-N	Smls. pipe & tube	SB-677	...	N08925	Annealed
(25)	25Ni-20Cr-6Mo-Cu-N	Plate, sheet, strip	SA-240	...	N08925	...
(25)	25Ni-20Cr-6Mo-Cu-N	Bar	SA-276	...	N08925	...
(25)	25Ni-20Cr-6Mo-Cu-N	Bar	SA-479	...	N08925	...
(25)	25Ni-20Cr-6Mo-Cu-N	Wld. pipe	SA-312	...	N08925	...
(25)	25Ni-20Cr-6Mo-Cu-N	Smls. pipe	SA-312	...	N08925	...
(25)	25Ni-20Cr-6Mo-Cu-N	Smls. tube	SA-213	...	N08925	...
22	62Ni-28Mo-5Fe	Plate	SB-333	...	N10001	Annealed
23	62Ni-28Mo-5Fe	Smls. & wld. fittings	SB-366	...	N10001	Annealed
24	62Ni-28Mo-5Fe	Wld. pipe	SB-619	...	N10001	Solution ann.
25	62Ni-28Mo-5Fe	Smls. pipe & tube	SB-622	...	N10001	Solution ann.
26	62Ni-28Mo-5Fe	Wld. tube	SB-626	...	N10001	Solution ann.
27	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
28	62Ni-28Mo-5Fe	Rod	SB-335	...	N10001	Annealed
29	62Ni-28Mo-5Fe	Sheet, strip	SB-333	...	N10001	Annealed
30	70Ni-16Mo-7Cr-5Fe	Smls. & wld. fittings	SB-366	...	N10003	Annealed
31	70Ni-16Mo-7Cr-5Fe	Plate, sheet, strip	SB-434	...	N10003	Annealed
32	70Ni-16Mo-7Cr-5Fe	Rod	SB-573	...	N10003	Annealed
33	62Ni-25Mo-8Cr-2Fe	Smls. & wld. fittings	SB-366	...	N10242	Annealed
34	62Ni-25Mo-8Cr-2Fe	Plate, sheet, strip	SB-434	...	N10242	Annealed
35	62Ni-25Mo-8Cr-2Fe	Forgings	SB-564	...	N10242	Annealed
36	62Ni-25Mo-8Cr-2Fe	Rod	SB-573	...	N10242	Annealed
37	62Ni-25Mo-8Cr-2Fe	Wld. pipe	SB-619	...	N10242	Solution ann.
38	62Ni-25Mo-8Cr-2Fe	Smls. pipe & tube	SB-622	...	N10242	Solution ann.
39	62Ni-25Mo-8Cr-2Fe	Wld. tube	SB-626	...	N10242	Solution ann.
40	54Ni-16Mo-15Cr	Smls. & wld. fittings	SB-366	...	N10276	Solution ann.
41	54Ni-16Mo-15Cr	Forgings	SB-462	...	N10276	Solution ann.
42	54Ni-16Mo-15Cr	Forgings	SB-564	...	N10276	Solution ann.
43	54Ni-16Mo-15Cr	Rod	SB-574	...	N10276	Solution ann.
44	54Ni-16Mo-15Cr	Plate, sheet, strip	SB-575	...	N10276	Solution ann.
45	54Ni-16Mo-15Cr	Wld. pipe	SB-619	...	N10276	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	...	490	215	...
5	...	490	215	...
6	...	490	215	...
7	...	490	215	...
8	...	490	215	...
9	...	490	215	...
10	...	490	215	...
11	...	600	295	...
12	...	600	295	...
13	...	600	295	...
14	...	600	295	...
15	...	600	295	...
16	...	600	295	...
17	...	600	295	...
18	...	600	295	...
19	...	600	295	...
20	...	600	295	...
21	...	600	295	...
22	...	690	310	...
23	...	690	310	...
24	...	690	310	...
25	...	690	310	...
26	...	690	310	...
27	>38.1	690	315	...
28	$7.94 < t \leq 38.1$	795	315	...
29	...	795	345	...
30	...	690	275	...
31	...	690	275	...
32	...	690	275	...
33	...	725	310	...
34	...	725	310	...
35	...	725	310	...
36	...	725	310	...
37	...	725	310	...
38	...	725	310	...
39	...	725	310	...
40	...	690	285	...
41	...	690	285	...
42	...	690	285	...
43	...	690	285	...
44	...	690	285	...
45	...	690	285	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	240	227	218	...	209	...	200	...	192	...
2	241	228	220	214	210	205	201	197	193	189
3	241	228	220	214	210	205	201	197	193	189
4	214	185	171	163	156	150	144	139	133	129
5	214	185	171	163	156	150	144	139	133	129
6	214	185	171	163	156	150	144	139	133	129
7	214	185	171	163	156	150	144	139	133	129
8	214	185	171	163	156	150	144	139	133	129
9	214	185	171	163	156	150	144	139	133	129
10	214	185	171	163	156	150	144	139	133	129
11	296	256	237	227	220	213	205	198	192	186
12	296	256	237	227	220	213	205	198	192	186
13	296	256	237	227	220	213	205	198	192	186
14	296	256	237	227	220	213	205	198	192	186
15	296	256	237	227	220	213	205	198	192	186
16	296	256	237	227	220	213	205	198	192	186
17	296	256	237	227	220	213	205	198	192	186
18	296	256	237	227	220	213	205	198	192	186
19	296	256	237	227	220	213	205	198	192	186
20	296	256	237	227	220	213	205	198	192	186
21	296	256	237	227	220	213	205	198	192	186
22	310	291	279	272	266	260	255	251	247	243
23	310	291	279	272	266	260	255	251	247	243
24	310	291	279	272	266	260	255	251	247	243
25	310	291	279	272	266	260	255	251	247	243
26	310	291	279	272	266	260	255	251	247	243
27	317	297	286	278	271	266	261	256	252	249
28	317	297	286	278	271	266	261	256	252	249
29	345	324	310	302	295	289	284	278	275	270
30	276	260	247	239	231	225	219	214	209	205
31	276	260	247	239	231	225	219	214	209	205
32	276	260	247	239	231	225	219	214	209	205
33	310	302	289	279	270	262	256	251	248	246
34	310	302	289	279	270	262	256	251	248	246
35	310	302	289	279	270	262	256	251	248	246
36	310	302	289	279	270	262	256	251	248	246
37	310	302	289	279	270	262	256	251	248	246
38	310	302	289	279	270	262	256	251	248	246
39	310	302	289	279	270	262	256	251	248	246
40	283	268	255	246	237	229	222	215	208	202
41	283	268	255	246	237	229	222	215	208	202
42	283	268	255	246	237	229	222	215	208	202
43	283	268	255	246	237	229	222	215	208	202
44	283	268	255	246	237	229	222	215	208	202
45	283	268	255	246	237	229	222	215	208	202

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	185	...	180	178	176	175	175	174	173	171
2	186	183	181	179	177	177	175	175	174	172
3	186	183	181	179	177	177	175	175	174	172
4	125	122	119	118	...	...	...	...	...	...
5	125	122	119	118	...	...	...	...	...	...
6	125	122	119	118	...	...	...	...	...	...
7	125	122	119	118	...	...	...	...	...	...
8	125	122	119	118	...	...	...	...	...	...
9	125	122	119	118	...	...	...	...	...	...
10	125	122	119	118	...	...	...	...	...	...
11	181	177	175	174	174	174	174	...	...	...
12	181	177	175	174	174	174	174	...	...	...
13	181	177	175	174	174	174	174	...	...	...
14	181	177	175	174	174	174	174	...	...	...
15	181	177	175	174	174	174	174	...	...	...
16	181	177	175	174	174	174	174	...	...	...
17	181	177	175	174	174	174	174	...	...	...
18	181	177	175	174	174	174	174	...	...	...
19	181	177	175	174	174	174	174	...	...	...
20	181	177	175	174	174	174	174	...	...	...
21	181	177	175	174	174	174	174	...	...	...
22	240	237	235	233	230	229	228	...	...	...
23	240	237	235	233	230	229	228	...	...	...
24	240	237	235	233	230	229	228	...	...	...
25	240	237	235	233	230	229	228	...	...	...
26	240	237	235	233	230	229	228	...	...	...
27	245	242	240	238	236	234	232	...	...	...
28	245	242	240	238	236	234	232	...	...	...
29	267	264	261	258	256	255	253	...	...	...
30	202	199	196	194	192	191	189	188	188	187
31	202	199	196	194	192	191	189	188	188	187
32	202	199	196	194	192	191	189	188	188	187
33	245	245	244	242	240	237	233	229	225	223
34	245	245	244	242	240	237	233	229	225	223
35	245	245	244	242	240	237	233	229	225	223
36	245	245	244	242	240	237	233	229	225	223
37	245	245	244	242	240	237	233	229	225	223
38	245	245	244	242	240	237	233	229	225	223
39	245	245	244	242	240	237	233	229	225	223
40	196	191	187	183	180	177	175	173	172	171
41	196	191	187	183	180	177	175	173	172	171
42	196	191	187	183	180	177	175	173	172	171
43	196	191	187	183	180	177	175	173	172	171
44	196	191	187	183	180	177	175	173	172	171
45	196	191	187	183	180	177	175	173	172	171

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(25)
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	186	185	185	184	183	182	181	179	178	175	173	170	166	...	...
31	186	185	185	184	183	182	181	179	178	175	173	170	166	...	...
32	186	185	185	184	183	182	181	179	178	175	173	170	166	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
40	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
41	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
42	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
43	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
44	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
45	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	54Ni-16Mo-15Cr	Smls. pipe & tube	SB-622	...	N10276	Solution ann.
2	54Ni-16Mo-15Cr	Wld. tube	SB-626	...	N10276	Solution ann.
3	62Ni-22Mo-15Cr	Smls. & wld. fittings	SB-366	...	N10362	Solution ann.
4	62Ni-22Mo-15Cr	Forgings	SB-462	...	N10362	Solution ann.
5	62Ni-22Mo-15Cr	Forgings	SB-564	...	N10362	Solution ann.
6	62Ni-22Mo-15Cr	Rod	SB-574	...	N10362	Solution ann.
7	62Ni-22Mo-15Cr	Plate, sheet, strip	SB-575	...	N10362	Solution ann.
8	62Ni-22Mo-15Cr	Wld. pipe	SB-619	...	N10362	Solution ann.
9	62Ni-22Mo-15Cr	Smls. pipe & tube	SB-622	...	N10362	Solution ann.
10	62Ni-22Mo-15Cr	Wld. tube	SB-626	...	N10362	Solution ann.
11	Ni-28Mo-3Fe-1.3Cr-0.25Al	Plate, sheet, strip	SB-333	...	N10629	Solution ann.
12	Ni-28Mo-3Fe-1.3Cr-0.25Al	Rod	SB-335	...	N10629	Solution ann.
13	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. & wld. fittings	SB-366	...	N10629	Solution ann.
14	Ni-28Mo-3Fe-1.3Cr-0.25Al	Forgings	SB-564	...	N10629	Solution ann.
15	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. pipe	SB-619	...	N10629	Solution ann.
16	Ni-28Mo-3Fe-1.3Cr-0.25Al	Smls. pipe & tube	SB-622	...	N10629	Solution ann.
17	Ni-28Mo-3Fe-1.3Cr-0.25Al	Wld. tube	SB-626	...	N10629	Solution ann.
18	65Ni-28Mo-2Fe	Smls. & wld. fittings	SB-366	...	N10665	Annealed
19	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Annealed
20	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Annealed
21	65Ni-28Mo-2Fe	Plate, sheet, strip	SB-333	...	N10665	Solution ann.
22	65Ni-28Mo-2Fe	Rod	SB-335	...	N10665	Solution ann.
23	65Ni-28Mo-2Fe	Forgings	SB-462	...	N10665	Solution ann.
24	65Ni-28Mo-2Fe	Forgings	SB-564	...	N10665	Solution ann.
25	65Ni-28Mo-2Fe	Wld. pipe	SB-619	...	N10665	Solution ann.
26	65Ni-28Mo-2Fe	Smls. pipe & tube	SB-622	...	N10665	Solution ann.
27	65Ni-28Mo-2Fe	Wld. tube	SB-626	...	N10665	Solution ann.
28	65Ni-29.5Mo-2Fe-2Cr	Plate, sheet, strip	SB-333	...	N10675	Solution ann.
29	65Ni-29.5Mo-2Fe-2Cr	Rod	SB-335	...	N10675	Solution ann.
30	65Ni-29.5Mo-2Fe-2Cr	Smls. & wld. fittings	SB-366	...	N10675	Solution ann.
31	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-462	...	N10675	Solution ann.
32	65Ni-29.5Mo-2Fe-2Cr	Forgings	SB-564	...	N10675	Solution ann.
33	65Ni-29.5Mo-2Fe-2Cr	Wld. pipe	SB-619	...	N10675	Solution ann.
34	65Ni-29.5Mo-2Fe-2Cr	Smls. pipe & tube	SB-622	...	N10675	Solution ann.
35	65Ni-29.5Mo-2Fe-2Cr	Wld. tube	SB-626	...	N10675	Solution ann.
36	37Ni-30Co-28Cr-2.7Si	Plate, sheet, strip	SB-435	...	N12160	Solution ann.
37	37Ni-30Co-28Cr-2.7Si	Forgings	SB-564	...	N12160	Solution ann.
38	37Ni-30Co-28Cr-2.7Si	Bar	SB-572	...	N12160	Solution ann.
39	37Ni-30Co-28Cr-2.7Si	Wld. pipe	SB-619	...	N12160	Solution ann.
40	37Ni-30Co-28Cr-2.7Si	Smls. pipe & tube	SB-622	...	N12160	Solution ann.
41	37Ni-30Co-28Cr-2.7Si	Wld. tube	SB-626	...	N12160	Solution ann.
42	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. & wld. fittings	SB-366	...	R20033	Solution ann.
43	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Forgings	SB-564	...	R20033	Solution ann.
44	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. pipe	SB-619	...	R20033	Solution ann.
45	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Smls. pipe & tube	SB-622	...	R20033	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	285	...
2	...	690	285	...
3	...	725	310	...
4	...	725	310	...
5	...	725	310	...
6	...	725	310	...
7	...	725	310	...
8	...	725	310	...
9	...	725	310	...
10	...	725	310	...
11	...	760	350	...
12	...	760	350	...
13	...	760	350	...
14	...	760	350	...
15	...	760	350	...
16	...	760	350	...
17	...	760	350	...
18	...	760	350	...
19	...	760	350	...
20	...	760	350	...
21	...	760	350	...
22	...	760	350	...
23	...	760	350	...
24	...	760	350	...
25	...	760	350	...
26	...	760	350	...
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	...	620	240	...
37	...	620	240	...
38	...	620	240	...
39	...	620	240	...
40	...	620	240	...
41	...	620	240	...
42	...	750	380	...
43	...	750	380	...
44	...	750	380	...
45	...	750	380	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	283	268	255	246	237	229	222	215	208	202
2	283	268	255	246	237	229	222	215	208	202
3	310	289	273	263	253	244	236	229	224	219
4	310	289	273	263	253	244	236	229	224	219
5	310	289	273	263	253	244	236	229	224	219
6	310	289	273	263	253	244	236	229	224	219
7	310	289	273	263	253	244	236	229	224	219
8	310	289	273	263	253	244	236	229	224	219
9	310	289	273	263	253	244	236	229	224	219
10	310	289	273	263	253	244	236	229	224	219
11	352	338	322	313	306	299	292	286	281	277
12	352	338	322	313	306	299	292	286	281	277
13	352	338	322	313	306	299	292	286	281	277
14	352	338	322	313	306	299	292	286	281	277
15	352	338	322	313	306	299	292	286	281	277
16	352	338	322	313	306	299	292	286	281	277
17	352	338	322	313	306	299	292	286	281	277
18	352	339	328	320	313	306	300	295	291	287
19	352	339	328	320	313	306	300	295	291	287
20	352	339	328	320	313	306	300	295	291	287
21	352	339	328	320	313	306	300	295	291	287
22	352	339	328	320	313	306	300	295	291	287
23	352	339	328	320	313	306	300	295	291	287
24	352	339	328	320	313	306	300	295	291	287
25	352	339	328	320	313	306	300	295	291	287
26	352	339	328	320	313	306	300	295	291	287
27	352	339	328	320	313	306	300	295	291	287
28	352	340	327	320	313	306	299	292	286	280
29	352	340	327	320	313	306	299	292	286	280
30	352	340	327	320	313	306	299	292	286	280
31	352	340	327	320	313	306	300	292	286	280
32	352	340	327	320	313	306	299	292	286	280
33	352	340	327	320	313	306	299	292	286	280
34	352	340	327	320	313	306	299	292	286	280
35	352	340	327	320	313	306	299	292	286	280
36	241	227	209	199	189	180	172	164	157	152
37	241	227	209	199	189	180	172	164	157	152
38	241	227	209	199	189	180	172	164	157	152
39	241	227	209	199	189	180	172	164	157	152
40	241	227	209	199	189	180	172	164	157	152
41	241	227	209	199	189	180	172	164	157	152
42	379	347	314	300	290	280	272	264	258	253
43	379	347	314	300	290	280	272	264	258	253
44	379	347	314	300	290	280	272	264	258	253
45	379	347	314	300	290	280	272	264	258	253

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	196	191	187	183	180	177	175	173	172	171
2	196	191	187	183	180	177	175	173	172	171
3	215	211	209	206	205	203	200	...	...	...
4	215	211	209	206	205	203	200	...	...	...
5	215	211	209	206	205	203	200	...	...	...
6	215	211	209	206	205	203	200	...	...	...
7	215	211	209	206	205	203	200	...	...	...
8	215	211	209	206	205	203	200	...	...	...
9	215	211	209	206	205	203	200	...	...	...
10	215	211	209	206	205	203	200	...	...	...
11	273	269	266	264	261	260	258	257	256	255
12	273	269	266	264	261	260	258	257	256	255
13	273	269	266	264	261	260	258	257	256	255
14	273	269	266	264	261	260	258	257	256	255
15	273	269	266	264	261	260	258	257	256	255
16	273	269	266	264	261	260	258	257	256	255
17	273	269	266	264	261	260	258	257	256	255
18	283	280	277	274	271	267	263	258	254	249
19	283	280	277	274	271	267	263	258	254	249
20	283	280	277	274	271	267	263	258	254	249
21	283	280	277	274	271	267	263	258	254	249
22	283	280	277	274	271	267	263	258	254	249
23	283	280	277	274	271	267	263	258	254	249
24	283	280	277	274	271	267	263	258	254	249
25	283	280	277	274	271	267	263	258	254	249
26	283	280	277	274	271	267	263	258	254	249
27	283	280	277	274	271	267	263	258	254	249
28	275	270	266	262	259	257	255	254	253	251
29	275	270	266	262	259	257	255	254	253	251
30	275	270	266	262	259	257	255	254	253	251
31	275	270	266	262	259	257	255	254	253	251
32	275	270	266	262	259	257	255	254	253	251
33	275	270	266	262	259	257	255	254	253	251
34	275	270	266	262	259	257	255	254	253	251
35	275	270	266	262	259	257	255	254	253	251
36	148	144	142	140	140	140	140	140	140	140
37	148	144	142	140	140	140	140	140	140	140
38	148	144	142	140	140	140	140	140	140	140
39	148	144	142	140	140	140	140	140	140	140
40	148	144	142	140	140	140	140	140	140	140
41	148	144	142	140	140	140	140	140	140	140
42	248	245	242	239	236	234	232	230	227	...
43	248	245	242	239	236	234	232	230	227	...
44	248	245	242	239	236	234	232	230	227	...
45	248	245	242	239	236	234	232	230	227	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	550	575	600	625	650	675	700	725	750	775	800	825	850	875	900
	Nonferrous Materials (Cont'd)														
1	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
2	171	171	171	170	170	169	169	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Plate, sheet, strip	SB-625	...	R20033	Solution ann.
2	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Wld. tube	SB-626	...	R20033	Solution ann.
3	33Cr-31Ni-32Fe-1.5Mo-0.6Cu-N	Rod	SB-649	...	R20033	Solution ann.
4	21Ni-30Fe-22Cr-18Co-3Mo-3W	Plate, sheet, strip	SB-435	...	R30556	Annealed
5	21Ni-30Fe-22Cr-18Co-3Mo-3W	Rod	SB-572	...	R30556	Annealed
6	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. pipe	SB-619	...	R30556	Annealed
7	21Ni-30Fe-22Cr-18Co-3Mo-3W	Smls. pipe & tube	SB-622	...	R30556	Annealed
8	21Ni-30Fe-22Cr-18Co-3Mo-3W	Wld. tube	SB-626	...	R30556	Annealed
9	Co-26Cr-9Ni-5Mo-3Fe-2W	Rod	SB-815	...	R31233	Solution ann.
10	Co-26Cr-9Ni-5Mo-3Fe-2W	Plate, sheet, strip	SB-818	...	R31233	Solution ann.
11	Ti	Plate, sheet, strip	SB-265	1	R50250	Annealed
12	Ti	Smls. & wld. tube	SB-338	1	R50250	Annealed
13	Ti	Bar, billet	SB-348	1	R50250	Annealed
14	Ti	Forgings	SB-381	F-1	R50250	Annealed
15	Ti	Smls. pipe	SB-861	1	R50250	Annealed
16	Ti	Wld. pipe	SB-862	1	R50250	Annealed
17	Ti	Castings	SB-367	C-2	R50400	...
18	Ti	Plate, sheet, strip	SB-265	2	R50400	Annealed
19	Ti	Smls. & wld. tube	SB-338	2	R50400	Annealed
20	Ti	Bar, billet	SB-348	2	R50400	Annealed
21	Ti	Forgings	SB-381	F-2	R50400	Annealed
22	Ti	Smls. pipe	SB-861	2	R50400	Annealed
23	Ti	Wld. pipe	SB-862	2	R50400	Annealed
24	Ti	Plate, sheet, strip	SB-265	2H	R50400	Annealed
25	Ti	Smls. & wld. tube	SB-338	2H	R50400	Annealed
26	Ti	Bar, billet	SB-348	2H	R50400	Annealed
27	Ti	Smls. fittings	SB-363	WPT2H	R50400	Annealed
28	Ti	Wld. fittings	SB-363	WPT2HW	R50400	Annealed
29	Ti	Forgings	SB-381	F-2H	R50400	Annealed
30	Ti	Smls. pipe	SB-861	2H	R50400	Annealed
31	Ti	Wld. pipe	SB-862	2H	R50400	Annealed
32	Ti	Plate, sheet, strip	SB-265	3	R50550	Annealed
33	Ti	Smls. & wld. tube	SB-338	3	R50550	Annealed
34	Ti	Bar, billet	SB-348	3	R50550	Annealed
35	Ti	Castings	SB-367	C-3	R50550	Annealed
36	Ti	Forgings	SB-381	F-3	R50550	Annealed
37	Ti	Smls. pipe	SB-861	3	R50550	Annealed
38	Ti	Wld. pipe	SB-862	3	R50550	Annealed
39	Ti-Pd	Plate, sheet, strip	SB-265	11	R52250	Annealed
40	Ti-Pd	Plate, sheet, strip	SB-265	17	R52252	Annealed
41	Ti-Ru	Plate, sheet, strip	SB-265	27	R52254	Annealed
42	Ti-Pd	Plate, sheet, strip	SB-265	7	R52400	Annealed
43	Ti-Pd	Smls. & wld. tube	SB-338	7	R52400	Annealed
44	Ti-Pd	Bar, billet	SB-348	7	R52400	Annealed
45	Ti-Pd	Forgings	SB-381	F-7	R52400	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	...	750	380	...
2	...	750	380	...
3	...	750	380	...
4	...	690	310	...
5	...	690	310	...
6	...	690	310	...
7	...	690	310	...
8	...	690	310	...
9	...	896	379	...
10	...	896	379	...
11	...	240	138	...
12	...	240	138	...
13	...	240	138	...
14	...	240	138	...
15	...	240	138	...
16	...	240	138	...
17	...	345	275	...
18	...	345	275	...
19	...	345	275	...
20	...	345	275	...
21	...	345	275	...
22	...	345	275	...
23	...	345	275	...
24	...	400	275	...
25	...	400	275	...
26	...	400	275	...
27	...	400	275	...
28	...	400	275	...
29	...	400	275	...
30	...	400	275	...
31	...	400	275	...
32	...	450	380	...
33	...	450	380	...
34	...	450	380	...
35	...	450	380	...
36	...	450	380	...
37	...	450	380	...
38	...	450	380	...
39	...	240	138	...
40	...	240	138	...
41	...	240	138	...
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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
Nonferrous Materials (Cont'd)										
1	379	347	314	300	290	280	272	264	258	253
2	379	347	314	300	290	280	272	264	258	253
3	379	347	314	300	290	280	272	264	258	253
4	310	282	261	249	239	229	222	215	210	206
5	310	282	261	249	239	229	222	215	210	206
6	310	282	261	249	239	229	222	215	210	206
7	310	282	261	249	239	229	222	215	210	206
8	310	282	261	249	239	229	222	215	210	206
9	379	352	328	...	294	...	266	...	245	...
10	379	352	328	...	294	...	266	...	245	...
11	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
12	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
13	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
14	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
15	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
16	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
17	276	238	213	194	176	157	138	121	108	93.3
18	276	238	213	194	176	157	138	121	108	93.3
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	212	194	176	157	139	122	107	95.1
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	379	334	297	270	245	222	201	181	162	145
33	379	334	297	270	245	222	201	181	162	145
34	379	334	297	270	245	222	201	181	162	145
35	379	334	297	270	245	222	201	181	162	145
36	379	334	297	270	245	222	201	181	162	145
37	379	334	297	270	245	222	201	181	162	145
38	379	334	297	270	245	222	201	181	162	145
39	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
40	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
41	138	111	93.6	83.2	74.1	65.1	57.5	50.8	45.4	41.0
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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	248	245	242	239	236	234	232	230	227	...
2	248	245	242	239	236	234	232	230	227	...
3	248	245	242	239	236	234	232	230	227	...
4	201	198	195	193	190	188	187	185	183	182
5	201	198	195	193	190	188	187	185	183	182
6	201	198	195	193	190	188	187	185	183	182
7	201	198	195	193	190	188	187	185	183	182
8	201	198	195	193	190	188	187	185	183	182
9	231	226	222	219	216	213	209	204	198	190
10	231	226	222	219	216	213	209	204	198	190
11	37.8	35.5	...	...	...	...	...	...	...	...
12	37.8	35.5	...	...	...	...	...	...	...	...
13	37.8	35.5	...	...	...	...	...	...	...	...
14	37.8	35.5	...	...	...	...	...	...	...	...
15	37.8	35.5	...	...	...	...	...	...	...	...
16	37.8	35.5	...	...	...	...	...	...	...	...
17	82.6	76.0	...	...	...	...	...	...	...	...
18	82.6	76.0	...	...	...	...	...	...	...	...
19	82.6	76.0	...	...	...	...	...	...	...	...
20	82.6	76.0	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	82.6	76.0	...	...	...	...	...	...	...	...
23	82.6	76.0	...	...	...	...	...	...	...	...
24	86.6	80.8	...	...	...	...	...	...	...	...
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	128	112	...	...	...	...	...	...	...	...
33	128	112	...	...	...	...	...	...	...	...
34	128	112	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
36	128	112	...	...	...	...	...	...	...	...
37	128	112	...	...	...	...	...	...	...	...
38	128	112	...	...	...	...	...	...	...	...
39	37.8	35.5	...	...	...	...	...	...	...	...
40	37.8	35.5	...	...	...	...	...	...	...	...
41	37.8	35.5	...	...	...	...	...	...	...	...
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

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	Ti-Pd	Smls. pipe	SB-861	7	R52400	Annealed
2	Ti-Pd	Wld. pipe	SB-862	7	R52400	Annealed
3	Ti-0.15Pd	Plate, sheet, strip	SB-265	7H	R52400	Annealed
4	Ti-0.15Pd	Smls. & wld. tube	SB-338	7H	R52400	Annealed
5	Ti-0.15Pd	Bar, billet	SB-348	7H	R52400	Annealed
6	Ti-0.15Pd	Smls. fittings	SB-363	WPT7H	R52400	Annealed
7	Ti-0.15Pd	Wld. fittings	SB-363	WPT7HW	R52400	Annealed
8	Ti-0.15Pd	Forgings	SB-381	F-7H	R52400	Annealed
9	Ti-0.15Pd	Smls. pipe	SB-861	7H	R52400	Annealed
10	Ti-0.15Pd	Wld. pipe	SB-862	7H	R52400	Annealed
11	Ti-0.05Pd	Plate, sheet, strip	SB-265	16H	R52402	Annealed
12	Ti-0.05Pd	Smls. & wld. tube	SB-338	16H	R52402	Annealed
13	Ti-0.05Pd	Bar, billet	SB-348	16H	R52402	Annealed
14	Ti-0.05Pd	Smls. fittings	SB-363	WPT16H	R52402	Annealed
15	Ti-0.05Pd	Wld. fittings	SB-363	WPT16HW	R52402	Annealed
16	Ti-0.05Pd	Forgings	SB-381	F-16H	R52402	Annealed
17	Ti-0.05Pd	Smls. pipe	SB-861	16H	R52402	Annealed
18	Ti-0.05Pd	Wld. pipe	SB-862	16H	R52402	Annealed
19	Ti-Ru	Plate, sheet, strip	SB-265	26	R52404	Annealed
20	Ti-Ru	Smls. & wld. tube	SB-338	26	R52404	Annealed
21	Ti-Ru	Bar, billet	SB-348	26	R52404	Annealed
22	Ti-Ru	Smls. fittings	SB-363	WPT26	R52404	Annealed
23	Ti-Ru	Wld. fittings	SB-363	WPT26W	R52404	Annealed
24	Ti-Ru	Forgings	SB-381	F-26	R52404	Annealed
25	Ti-Ru	Smls. pipe	SB-861	26	R52404	Annealed
26	Ti-Ru	Wld. pipe	SB-862	26	R52404	Annealed
27	Ti-0.10Ru	Plate, sheet, strip	SB-265	26H	R52404	Annealed
28	Ti-0.10Ru	Smls. & wld. tube	SB-338	26H	R52404	Annealed
29	Ti-0.10Ru	Bar, billet	SB-348	26H	R52404	Annealed
30	Ti-0.10Ru	Smls. fittings	SB-363	WPT26H	R52404	Annealed
31	Ti-0.10Ru	Wld. fittings	SB-363	WPT26HW	R52404	Annealed
32	Ti-0.10Ru	Forgings	SB-381	F-26H	R52404	Annealed
33	Ti-0.10Ru	Smls. pipe	SB-861	26H	R52404	Annealed
34	Ti-0.10Ru	Wld. pipe	SB-862	26H	R52404	Annealed
35	Ti-0.3Mo-0.8Ni	Plate, sheet, strip	SB-265	12	R53400	Annealed
36	Ti-0.3Mo-0.8Ni	Smls. & wld. tube	SB-338	12	R53400	Annealed
37	Ti-0.3Mo-0.8Ni	Bar, billet	SB-348	12	R53400	Annealed
38	Ti-0.3Mo-0.8Ni	Forgings	SB-381	F-12	R53400	Annealed
39	Ti-0.3Mo-0.8Ni	Smls. pipe	SB-861	12	R53400	Annealed
40	Ti-0.3Mo-0.8Ni	Wld. pipe	SB-862	12	R53400	Annealed
41	Ti-4Al-2.5V-1.5Fe	Plate, sheet, strip	SB-265	38	R54250	Annealed
42	Ti-4Al-2.5V-1.5Fe	Smls. tube	SB-338	38	R54250	Annealed
43	Ti-4Al-2.5V-1.5Fe	Wld. tube	SB-338	38	R54250	Annealed
44	Ti-4Al-2.5V-1.5Fe	Bar, billet	SB-348	38	R54250	Annealed
45	Ti-4Al-2.5V-1.5Fe	Smls. fittings	SB-363	WPT38	R54250	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	...	400	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	...	400	275	...
13	...	400	275	...
14	...	400	275	...
15	...	400	275	...
16	...	400	275	...
17	...	400	275	...
18	...	400	275	...
19	...	345	275	...
20	...	345	275	...
21	...	345	275	...
22	...	345	275	...
23	...	345	275	...
24	...	345	275	...
25	...	345	275	...
26	...	345	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	...	485	345	...
36	...	485	345	...
37	...	485	345	...
38	...	485	345	...
39	...	485	345	...
40	...	485	345	...
41	...	895	794	...
42	...	895	794	...
43	...	895	794	...
44	...	895	794	...
45	...	895	794	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	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	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	276	238	212	194	176	157	139	122	107	95.1
13	276	238	212	194	176	157	139	122	107	95.1
14	276	238	212	194	176	157	139	122	107	95.1
15	276	238	212	194	176	157	139	122	107	95.1
16	276	238	212	194	176	157	139	122	107	95.1
17	276	238	212	194	176	157	139	122	107	95.1
18	276	238	212	194	176	157	139	122	107	95.1
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	213	194	176	157	138	121	108	93.3
26	276	238	213	194	176	157	138	121	108	93.3
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	345	311	281	259	241	223	205	194	183	174
36	345	311	281	259	241	223	205	194	183	174
37	345	311	281	259	241	223	205	194	183	174
38	345	311	281	259	241	223	205	194	183	174
39	345	311	281	259	241	223	205	194	183	174
40	345	311	281	259	241	223	205	194	183	174
41	793	735	686	652	621	592	566	542	522	504
42	793	735	686	652	621	592	566	542	522	504
43	793	735	686	652	621	592	566	542	522	504
44	793	735	686	652	621	592	566	542	522	504
45	793	735	686	652	621	592	566	542	522	504

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	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	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	86.6	80.8	...	...	...	...	...	...	...	...
10	86.6	80.8	...	...	...	...	...	...	...	...
11	86.6	80.8	...	...	...	...	...	...	...	...
12	86.6	80.8	...	...	...	...	...	...	...	...
13	86.6	80.8	...	...	...	...	...	...	...	...
14	86.6	80.8	...	...	...	...	...	...	...	...
15	86.6	80.8	...	...	...	...	...	...	...	...
16	86.6	80.8	...	...	...	...	...	...	...	...
17	86.6	80.8	...	...	...	...	...	...	...	...
18	86.6	80.8	...	...	...	...	...	...	...	...
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	82.6	76.0	...	...	...	...	...	...	...	...
26	82.6	76.0	...	...	...	...	...	...	...	...
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	168	164	...	...	...	...	...	...	...	...
36	168	164	...	...	...	...	...	...	...	...
37	168	164	...	...	...	...	...	...	...	...
38	168	164	...	...	...	...	...	...	...	...
39	168	164	...	...	...	...	...	...	...	...
40	168	164	...	...	...	...	...	...	...	...
41	488	474	460	...	...	...	...	...	...	...
42	488	474	460	...	...	...	...	...	...	...
43	488	474	460	...	...	...	...	...	...	...
44	488	474	460	...	...	...	...	...	...	...
45	488	474	460	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

INTENTIONALLY LEFT BLANK

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 Desig./UNS No.	Class/Condition/ Temper
Nonferrous Materials (Cont'd)						
1	Ti-4Al-2.5V-1.5Fe	Wld. fittings	SB-363	WPT38W	R54250	Annealed
2	Ti-4Al-2.5V-1.5Fe	Forgings	SB-381	F-38	R54250	Annealed
3	Ti-4Al-2.5V-1.5Fe	Smls. pipe	SB-861	38	R54250	Annealed
4	Ti-4Al-2.5V-1.5Fe	Wld. pipe	SB-862	38	R54250	Annealed
5	Ti-3Al-2.5V	Plate, sheet, strip	SB-265	9	R56320	Annealed
6	Ti-3Al-2.5V	Smls. & wld. tube	SB-338	9	R56320	Annealed
7	Ti-3Al-2.5V	Bar, billet	SB-348	9	R56320	Annealed
8	Ti-3Al-2.5V	Smls. fittings	SB-363	WPT9	R56320	Annealed
9	Ti-3Al-2.5V	Wld. fittings	SB-363	WPT9W	R56320	Annealed
10	Ti-3Al-2.5V	Forgings	SB-381	F-9	R56320	Annealed
11	Ti-3Al-2.5V	Smls. pipe	SB-861	9	R56320	Annealed
12	Ti-3Al-2.5V	Wld. pipe	SB-862	9	R56320	Annealed
13	Ti-3Al-2.5V-0.1Ru	Plate, sheet, strip	SB-265	28	R56323	Annealed
14	Ti-3Al-2.5V-0.1Ru	Smls. & wld. tube	SB-338	28	R56323	Annealed
15	Ti-3Al-2.5V-0.1Ru	Bar, billet	SB-348	28	R56323	Annealed
16	Ti-3Al-2.5V-0.1Ru	Smls. fittings	SB-363	WPT28	R56323	Annealed
17	Ti-3Al-2.5V-0.1Ru	Wld. fittings	SB-363	WPT28W	R56323	Annealed
18	Ti-3Al-2.5V-0.1Ru	Forgings	SB-381	F-28	R56323	Annealed
19	Ti-3Al-2.5V-0.1Ru	Smls. pipe	SB-861	28	R56323	Annealed
20	Ti-3Al-2.5V-0.1Ru	Wld. pipe	SB-862	28	R56323	Annealed
21	99.2Zr	Forgings	SB-493	...	R60702	Annealed
22	99.2Zr	Smls. & wld. tube	SB-523	...	R60702	Annealed
23	99.2Zr	Bar, wire	SB-550	...	R60702	Annealed
24	99.2Zr	Plate, sheet, strip	SB-551	...	R60702	Annealed
25	99.2Zr	Smls. fittings	SB-653	PZ-2	R60702	Annealed
26	99.2Zr	Wld. fittings	SB-653	PZ-2W	R60702	Annealed
27	99.2Zr	Smls. & wld. pipe	SB-658	...	R60702	Annealed
(25) 28	99.2Zr	Castings	SB-752	702C	R61702	...
29	95.5Zr + 2.5Nb	Forgings	SB-493	...	R60705	Annealed
30	95.5Zr + 2.5Nb	Smls. & wld. tube	SB-523	...	R60705	Annealed
31	95.5Zr + 2.5Nb	Bar, wire	SB-550	...	R60705	Annealed
32	95.5Zr + 2.5Nb	Plate, sheet, strip	SB-551	...	R60705	Annealed
33	95.5Zr + 2.5Nb	Smls. fittings	SB-653	PZ-5	R60705	Annealed
34	95.5Zr + 2.5Nb	Wld. fittings	SB-653	PZ-5W	R60705	Annealed
35	95.5Zr + 2.5Nb	Smls. & wld. pipe	SB-658	...	R60705	Annealed
(25) 36	95.5Zr + 2.5Nb	Castings	SB-752	705C	R61705	...

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	...	895	794	...
2	...	895	794	...
3	...	895	794	...
4	...	895	794	...
5	...	620	485	...
6	...	620	485	...
7	...	620	485	...
8	...	620	485	...
9	...	620	485	...
10	...	620	485	...
11	...	620	485	...
12	...	620	485	...
13	...	620	485	...
14	...	620	485	...
15	...	620	485	...
16	...	620	485	...
17	...	620	485	...
18	...	620	485	...
19	...	620	485	...
20	...	620	485	...
21	...	380	205	...
22	...	380	205	...
23	...	380	205	...
24	...	380	205	...
25	...	380	205	...
26	...	380	205	...
27	...	380	205	...
28	...	380	276	...
29	...	485	380	...
30	...	550	380	...
31	...	550	380	...
32	...	550	380	...
33	...	550	380	...
34	...	550	380	...
35	...	550	380	...
36	...	483	345	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	40	65	100	125	150	175	200	225	250	275
	Nonferrous Materials (Cont'd)									
1	793	735	686	652	621	592	566	542	522	504
2	793	735	686	652	621	592	566	542	522	504
3	793	735	686	652	621	592	566	542	522	504
4	793	735	686	652	621	592	566	542	522	504
5	483	449	416	398	381	363	346	328	313	304
6	483	449	416	398	381	363	346	328	313	304
7	483	449	416	398	381	363	346	328	313	304
8	483	449	416	398	381	363	346	328	313	304
9	483	449	416	398	381	363	346	328	313	304
10	483	449	416	398	381	363	346	328	313	304
11	483	449	416	398	381	363	346	328	313	304
12	483	449	416	398	381	363	346	328	313	304
13	483	449	416	398	381	363	346	328	313	304
14	483	449	416	398	381	363	346	328	313	304
15	483	449	416	398	381	363	346	328	313	304
16	483	449	416	398	381	363	346	328	313	304
17	483	449	416	398	381	363	346	328	313	304
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	207	178	155	138	123	110	98.5	88.2	79.1	71.5
22	207	178	155	138	123	110	98.5	88.2	79.1	71.5
23	207	178	155	138	123	110	98.5	88.2	79.1	71.5
24	207	178	155	138	123	110	98.5	88.2	79.1	71.5
25	207	178	155	138	123	110	98.5	88.2	79.1	71.5
26	207	178	155	138	123	110	98.5	88.2	79.1	71.5
27	207	178	155	138	123	110	98.5	88.2	79.1	71.5
28	276	230	202	184	166	149	133	118	105	94.1
29	379	298	251	225	203	186	171.8	159.9	149.8	141.0
30	379	298	251	225	203	186	171.8	159.9	149.8	141.0
31	379	298	251	225	203	186	171.8	159.9	149.8	141.0
32	379	298	251	225	203	186	171.8	159.9	149.8	141.0
33	379	298	251	225	203	186	171.8	159.9	149.8	141.0
34	379	298	251	225	203	186	171.8	159.9	149.8	141.0
35	379	298	251	225	203	186	171.8	159.9	149.8	141.0
36	345	290	252	228	207	188	171	156	143	131

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding										
Line No.	300	325	350	375	400	425	450	475	500	525
	Nonferrous Materials (Cont'd)									
1	488	474	460	...	...	...	...	...	...	...
2	488	474	460	...	...	...	...	...	...	...
3	488	474	460	...	...	...	...	...	...	...
4	488	474	460	...	...	...	...	...	...	...
5	293	280	...	...	...	...	...	...	...	...
6	293	280	...	...	...	...	...	...	...	...
7	293	280	...	...	...	...	...	...	...	...
8	293	280	...	...	...	...	...	...	...	...
9	293	280	...	...	...	...	...	...	...	...
10	293	280	...	...	...	...	...	...	...	...
11	293	280	...	...	...	...	...	...	...	...
12	293	280	...	...	...	...	...	...	...	...
13	293	280	...	...	...	...	...	...	...	...
14	293	280	...	...	...	...	...	...	...	...
15	293	280	...	...	...	...	...	...	...	...
16	293	280	...	...	...	...	...	...	...	...
17	293	280	...	...	...	...	...	...	...	...
18	293	280	...	...	...	...	...	...	...	...
19	293	280	...	...	...	...	...	...	...	...
20	293	280	...	...	...	...	...	...	...	...
21	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
22	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
23	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
24	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
25	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
26	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
27	65.3	60.5	57.0	54.1	52.4	51.7	51.1	...	...	...
28	85.9	80.3	...	...	...	...	...	...	...	...
29	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
30	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
31	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
32	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
33	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
34	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
35	133.3	126.7	121.2	117.3	115.3	115.3	115.3	...	...	...
36	121	113	...	...	...	...	...	...	...	...

Table Y-1 (Cont'd)
Yield Strength Values, S_y , for Ferrous and Nonferrous Materials

Yield Strength, MPa (Multiply by 1000 to Obtain kPa), for Metal Temperature, °C, Not Exceeding															
Line No.	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	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(25)

(25)

NOTES TO TABLE Y-1**GENERAL NOTES**

- (25) (a) The following abbreviations are used: ann., annealed; cond., condenser; CW, cold worked; extr., extruded; fin., finished; fr., from; HW, hot worked; N, Normalized; NT, Normalized and tempered; QT, Quenched 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 Sections I, III, VIII, or XII 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.
- (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) Strength values for intermediate thickness may be interpolated.

Table Y-2
Factors for Limiting Permanent Strain in
Austenitic Stainless Steels, High-Nickel
Alloy Steels, Nickel, Nickel Alloys, Copper,
and Copper 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 Table 1A, Table 1B, Table 2A, Table 2B, Table 5A, or Table 5B, or the design stress intensity value listed in Table 2A or Table 2B, the lower value shall be used.

SUBPART 2

PHYSICAL PROPERTIES TABLES

INTRODUCTION

Section II, Part D, [Subpart 2](#) 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 1 000°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 $\pm 10\%$.

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.

Values for temperatures between those tabulated may be obtained by linear interpolation.

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

(25)

Table TE-1
Thermal Expansion for Ferrous Materials

Temperature, °C	Coefficients for Carbon and Low Alloy Steels (Group 1) [Note (1)]			Coefficients for Other 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	0.35	13.0	12.8	0.38	12.0	11.8	0.35
75	12.3	11.9	0.65	13.3	13.0	0.72	12.3	12.0	0.66
100	12.7	12.1	0.97	13.5	13.1	1.0	12.6	12.1	0.97
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)

Temperature, °C	Coefficients for 9Cr-1Mo Steels (Including Grades 9, 91, 911, and 92)			Coefficients for 5Ni- $\frac{1}{4}$ Mo Steels			Coefficients for 7% Nickel Steel		
	A	B	C	A	B	C	A	B	C
20	10.5	10.5	0	11.2	11.2	0	10.6	10.6	0
50	10.8	10.6	0.32	11.6	11.4	0.34	11.1	10.8	0.32
75	11.0	10.7	0.59	12.0	11.6	0.64	11.6	11.1	0.61
100	11.2	10.9	0.87	12.3	11.8	0.94	11.9	11.3	0.90
125	11.4	11.0	1.2	12.5	11.9	1.3	12.2	11.5	1.3
150	11.6	11.1	1.4	12.7	12.0	1.6	12.5	11.6	1.6
175	11.8	11.2	1.7	13.0	12.2	1.9	12.7	11.8	1.9
200	12.0	11.3	2.0	13.2	12.3	2.2	12.9	11.9	2.2
225	12.2	11.4	2.3	13.4	12.4	2.5	13.1	12.1	2.5
250	12.4	11.5	2.6	13.6	12.5	2.9	13.2	12.2	2.8
275	12.5	11.6	3.0	13.8	12.7	3.2	13.4	12.3	3.1
300	12.7	11.7	3.3	14.0	12.8	3.6	13.5	12.4	3.5
325	12.8	11.8	3.6	14.3	12.9	3.9	13.7	12.5	3.8
350	13.0	11.9	3.9	14.5	13.0	4.3	13.9	12.6	4.2
375	13.1	11.9	4.2	14.6	13.1	4.7	14.0	12.7	4.5
400	13.3	12.0	4.6	14.8	13.2	5.0	14.2	12.8	4.9
425	13.4	12.1	4.9	15.0	13.3	5.4	14.4	12.9	5.2
450	13.6	12.2	5.2	15.1	13.4	5.8	14.5	13.0	5.6
475	13.7	12.3	5.6	15.3	13.5	6.1	14.5	13.0	5.9
500	13.8	12.3	5.9	15.4	13.6	6.5	14.4	13.1	6.3
525	14.0	12.4	6.3	15.6	13.7	6.9	...	...	...
550	14.2	12.5	6.6	15.8	13.8	7.3	...	...	...
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)

Temperature, °C	Coefficients for 8Ni and 9Ni Steels			Coefficients for 12Cr, 12Cr-1Al, 13Cr, and 13Cr-4Ni Steels			Coefficients for 15Cr and 17Cr Steels		
	A	B	C	A	B	C	A	B	C
20	9.9	9.9	0	10.6	10.6	0	9.6	9.6	0
50	10.5	10.2	0.31	11.1	10.9	0.33	9.9	9.7	0.29
75	11.1	10.5	0.58	11.3	11.0	0.61	10.1	9.9	0.54
100	11.5	10.7	0.86	11.5	11.1	0.89	10.3	10.0	0.80
125	11.9	11.0	1.2	11.7	11.3	1.2	10.5	10.1	1.1
150	12.2	11.2	1.5	11.8	11.4	1.5	10.7	10.2	1.3
175	12.4	11.4	1.8	11.9	11.4	1.8	10.9	10.3	1.6
200	12.6	11.5	2.1	12.0	11.5	2.1	11.1	10.4	1.9
225	12.7	11.7	2.4	12.1	11.6	2.4	11.2	10.5	2.2
250	12.8	11.8	2.7	12.1	11.6	2.7	11.4	10.6	2.4
275	12.9	11.9	3.0	12.2	11.7	3.0	11.5	10.7	2.7
300	12.9	12.0	3.4	12.3	11.7	3.3	11.7	10.8	3.0
325	13.1	12.0	3.7	12.4	11.8	3.6	11.8	10.8	3.3
350	13.2	12.1	4.0	12.5	11.8	3.9	11.9	10.9	3.6
375	13.4	12.2	4.3	12.6	11.9	4.2	12.0	11.0	3.9
400	13.6	12.3	4.7	12.7	11.9	4.5	12.0	11.0	4.2
425	13.7	12.4	5.0	12.8	12.0	4.9	12.1	11.1	4.5
450	13.8	12.5	5.4	12.9	12.0	5.2	12.2	11.2	4.8
475	13.7	12.5	5.7	13.0	12.1	5.5	12.2	11.2	5.1
500	13.4	12.6	6.0	13.1	12.1	5.8	12.2	11.3	5.4
525	12.7	12.6	6.4	13.2	12.2	6.2	12.3	11.3	5.7
550	11.6	12.6	6.7	13.3	12.2	6.5	12.3	11.4	6.0
575	...	...	...	13.3	12.3	6.8	12.4	11.4	6.3
600	...	...	...	13.3	12.3	7.2	12.5	11.5	6.6
625	...	...	...	13.4	12.4	7.5	12.5	11.5	7.0
650	...	...	...	13.4	12.4	7.8	12.7	11.5	7.3
675	...	...	...	13.4	12.5	8.2	12.8	11.6	7.6
700	...	...	...	13.4	12.5	8.5	13.0	11.6	7.9
725	...	...	...	13.4	12.5	8.8	13.3	11.7	8.2
750	...	...	...	13.4	12.5	9.2	13.6	11.7	8.6
775	...	...	...	13.5	12.6	9.5	14.0	11.8	8.9
800	...	...	...	13.6	12.6	9.8	14.5	11.9	9.3
825	...	...	...	13.8	12.6	10.2	15.2	12.0	9.6

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

Temperature, °C	Coefficients for 27Cr Steels			Coefficients for Austenitic Stainless Steels (Group 3) [Note (3)]			Coefficients for Other Austenitic Stainless Steels (Group 4) [Note (4)]		
	A	B	C	A	B	C	A	B	C
20	9.0	9.0	0	15.3	15.3	0	14.7	14.7	0
50	9.3	9.2	0.28	16.0	15.6	0.47	15.2	15.0	0.45
75	9.4	9.2	0.51	16.5	15.9	0.87	15.6	15.2	0.84
100	9.5	9.3	0.74	17.0	16.2	1.3	16.0	15.4	1.2
125	9.6	9.4	0.99	17.4	16.4	1.7	16.3	15.6	1.6
150	9.7	9.4	1.2	17.8	16.6	2.2	16.5	15.7	2.0
175	9.8	9.5	1.5	18.1	16.8	2.6	16.8	15.9	2.5
200	9.9	9.5	1.7	18.4	17.0	3.1	16.9	16.0	2.9
225	10.0	9.6	2.0	18.6	17.2	3.5	17.1	16.1	3.3
250	10.1	9.6	2.2	18.8	17.4	4.0	17.3	16.3	3.7
275	10.2	9.7	2.5	18.9	17.5	4.5	17.4	16.4	4.2
300	10.3	9.7	2.7	19.1	17.7	4.9	17.6	16.5	4.6
325	10.5	9.8	3.0	19.2	17.8	5.4	17.7	16.6	5.0
350	10.6	9.9	3.3	19.3	17.9	5.9	17.8	16.6	5.5
375	10.8	9.9	3.5	19.4	18.0	6.4	18.0	16.7	5.9
400	10.9	10.0	3.8	19.5	18.1	6.9	18.1	16.8	6.4
425	11.1	10.0	4.1	19.6	18.2	7.4	18.3	16.9	6.8
450	11.2	10.1	4.3	19.8	18.3	7.9	18.4	17.0	7.3
475	11.3	10.2	4.6	20.0	18.4	8.3	18.6	17.1	7.8
500	11.4	10.2	4.9	20.2	18.4	8.9	18.8	17.2	8.2
525	11.5	10.3	5.2	20.4	18.5	9.4	19.0	17.2	8.7
550	11.6	10.4	5.5	20.6	18.6	9.9	19.2	17.3	9.2
575	11.6	10.4	5.8	20.9	18.7	10.4	19.4	17.4	9.7
600	11.7	10.5	6.1	21.1	18.8	10.9	19.6	17.5	10.2
625	11.7	10.5	6.4	21.4	18.9	11.4	19.8	17.6	10.6
650	11.8	10.6	6.7	21.6	19.0	12.0	20.0	17.7	11.1
675	11.9	10.6	7.0	21.7	19.1	12.5	20.3	17.8	11.7
700	12.0	10.7	7.2	21.7	19.2	13.1	20.5	17.9	12.2
725	12.2	10.7	7.6	21.5	19.3	13.6	20.7	18.0	12.7
750	12.4	10.8	7.9	21.2	19.4	14.1	20.9	18.1	13.2
775	12.9	10.8	8.2	20.6	19.4	14.7	21.2	18.2	13.7
800	13.4	10.9	8.5	19.7	19.4	15.2	21.4	18.3	14.3
825	14.2	11.0	8.8	18.4	19.4	15.6	21.6	18.4	14.8

Table TE-1
Thermal Expansion for Ferrous Materials (Cont'd)

Temperature, °C	Coefficients for Ductile Cast Iron			Coefficients for Precipitation Hardened 17Cr-4Ni-4Cu Stainless Steels, Condition 1075			Coefficients for Precipitation Hardened 17Cr-4Ni-4Cu Stainless Steels, Condition 1150		
	A	B	C	A	B	C	A	B	C
20	10.3	10.3	0	11.1	11.1	0	11.5	11.5	0
50	10.7	10.5	0.32	11.3	11.2	0.34	11.8	11.6	0.35
75	11.1	10.7	0.59	11.4	11.3	0.62	12.0	11.8	0.65
100	11.6	10.9	0.87	11.6	11.4	0.91	12.3	11.9	0.95
125	12.1	11.1	1.2	11.7	11.4	1.2	12.5	12.0	1.3
150	12.5	11.3	1.5	11.8	11.5	1.5	12.7	12.1	1.6
175	13.0	11.6	1.8	12.0	11.6	1.8	12.9	12.2	1.9
200	13.3	11.8	2.1	12.1	11.6	2.1	13.1	12.3	2.2
225	13.6	12.0	2.5	12.2	11.7	2.4	13.2	12.4	2.6
250	13.9	12.2	2.8	12.3	11.8	2.7	13.4	12.5	2.9
275	14.1	12.4	3.1	12.5	11.8	3.0	13.5	12.6	3.2
300	14.2	12.5	3.5	12.6	11.9	3.3	13.5	12.7	3.6
325	14.2	12.6	3.9	12.7	11.9	3.6	13.6	12.8	3.9
350	14.3	12.8	4.2	12.8	12.0	4.0	13.6	12.8	4.2
375	14.3	12.9	4.6	12.9	12.1	4.3	13.6	12.9	4.6
400	14.4	13.0	4.9	13.0	12.1	4.6	13.6	12.9	4.9
425	14.5	13.1	5.3	13.0	12.2	4.9	13.7	13.0	5.3
450	14.6	13.2	5.7	13.1	12.2	5.3	13.8	13.0	5.6
475	14.9	13.2	6.0	13.1	12.3	5.6	13.9	13.1	5.9
500	15.1	13.3	6.4	...	...	...	14.3	13.1	6.3
525	15.5	13.4	6.8	...	...	...	14.8	13.2	6.7
550	16.0	13.5	7.2	...	...	...	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 $\times 10^{-6}$ (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion $\times 10^{-6}$ (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	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
C-Mn-Cb	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Cu}-\text{Mo}$
C-Mn-Si-Cb	$1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Cu}$	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\frac{1}{3}\text{Cr}-\text{V}$
C-Mn-Si-V	$1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Ti}$	$\frac{3}{4}\text{Ni}-\frac{1}{2}\text{Mo}-\text{Cr}-\text{V}$
C-Mn-Ti	$2\text{Cr}-\frac{1}{2}\text{Mo}$	$\frac{3}{4}\text{Ni}-1\text{Mo}-\frac{3}{4}\text{Cr}$
C-Si-Ti	$2\frac{1}{4}\text{Cr}-1\text{Mo}$	$1\text{Ni}-\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$
C- $\frac{1}{4}\text{Mo}$	$3\text{Cr}-1\text{Mo}$	$1\frac{1}{4}\text{Ni}-1\text{Cr}-\frac{1}{2}\text{Mo}$
C- $\frac{1}{2}\text{Mo}$	$3\text{Cr}-1\text{Mo}-\frac{1}{4}\text{V}-\text{Cb}-\text{Ca}$	$1\frac{3}{4}\text{Ni}-\frac{3}{4}\text{Cr}-\frac{1}{4}\text{Mo}$
$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}$	$3\text{Cr}-1\text{Mo}-\frac{1}{4}\text{V}-\text{Ti}-\text{B}$	$2\text{Ni}-\frac{3}{4}\text{Cr}-\frac{1}{4}\text{Mo}$
$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}-\text{V}$	$\text{Mn}-\frac{1}{4}\text{Mo}$	$2\text{Ni}-\frac{3}{4}\text{Cr}-\frac{1}{3}\text{Mo}$
$\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{Si}$	$\text{Mn}-\frac{1}{2}\text{Mo}$	$2\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$
$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	$\text{Mn}-\frac{1}{2}\text{Mo}-\frac{1}{4}\text{Ni}$	$2\frac{1}{2}\text{Ni}$
$\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Ni}-\text{Cu}$	$\text{Mn}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Ni}$	$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$\frac{3}{4}\text{Cr}-\frac{3}{4}\text{Ni}-\text{Cu}-\text{Al}$	$\text{Mn}-\frac{1}{2}\text{Mo}-\frac{3}{4}\text{Ni}$	$3\frac{1}{2}\text{Ni}$
$1\text{Cr}-\frac{1}{5}\text{Mo}$	$\text{Mn}-\text{V}$	$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$
$1\text{Cr}-\frac{1}{5}\text{Mo}-\text{Si}$	$\frac{1}{2}\text{Ni}-\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}$	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$1\text{Cr}-\frac{1}{2}\text{Mo}$	$\frac{1}{2}\text{Ni}-\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{V}$	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$1\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	$\frac{1}{2}\text{Ni}-\frac{1}{2}\text{Mo}-\text{V}$	

NOTES (CONT'D):

(2) Group 2 alloys (by nominal composition):

18Cr-5Ni-3Mo-N	23Cr-4Ni-Mo-Cu	27Cr-7.5Ni-4.5Mo-Co-N
22Cr-2Ni-Mo-N	25Cr-7Ni-4Mo-N	
22Cr-5Ni-3Mo-N	25Cr-6Ni-Mo-N	

(3) Group 3 alloys (by nominal composition):

16Cr-12Ni-2Mo	18Cr-10Ni-Cb	18Cr-18Ni-2Si
16Cr-12Ni-2Mo-N	18Cr-10Ni-Ti	19Cr-9Ni-Mo-W
16Cr-12Ni-2Mo-Ti	18Cr-11Ni	21Cr-11Ni-N
18Cr-8Ni	18Cr-13Ni-3Mo	
18Cr-8Ni-N	18Cr-15Ni-4Si	

(4) Group 4 alloys (by nominal composition):

14Cr-16Ni-6Si-Cu-Mo	22Cr-13Ni-5Mn	25Cr-20Ni-2Mo
25Ni-15Cr-2Ti	23Cr-12Ni	31Ni-31Fe-29Cr-Mo
29Ni-20Cr-3Cu-2Mo	24Cr-22Ni-6Mo-2W-Cu-N	44Fe-25Ni-21Cr-Mo
18Cr-20Ni-5.5Si	25Cr-12Ni	47Fe-25Ni-23Cr-5.5Mo-N
20Cr-18Ni-6Mo	25Cr-20Ni	

Table TE-2
Thermal Expansion for Aluminum Alloys

Temperature, °C	Coefficients for Aluminum Alloys		
	A	B	C
20	21.7	21.7	0
50	23.3	22.6	0.68
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 $\times 10^{-6}$ (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion $\times 10^{-6}$ (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 [Note (1)]			Coefficients for Brass Alloys [Note (2)]			Coefficients for Copper-Nickel (70Cu-30Ni) [Note (3)]			Coefficients for Copper-Nickel (90Cu-10Ni) [Note (4)]		
	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	0.51	18.0	17.6	0.53	17.5	17.1	0.51	15.3	14.9	0.45	...	...	...
75	17.4	17.2	0.95	18.3	17.9	0.98	17.9	17.4	0.96	15.6	15.2	0.84	...	...	...
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 $\times 10^{-6}$ (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion $\times 10^{-6}$ (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) Includes C6XXXX, C8XXXX, C92XXX, C93XXX, and C95XXX alloys.
- (2) Includes C2XXXX, C3XXXX, and C4XXXX alloys.
- (3) Includes C71XXX, C72XXX, and C97600 alloys.
- (4) Includes C70XXX and C96200 alloys.

Table TE-4
Thermal Expansion for Nickel Alloys

(25)

Temperature, °C	Coefficients for N02200 and N02201			Coefficients for N04400 and N04405			Coefficients for N06002		
	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	0.37	14.4	14.1	0.42	13.5	13.3	0.40
75	13.5	12.7	0.70	14.9	14.4	0.79	13.7	13.4	0.74
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
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N06007			Coefficients for N06022			Coefficients for N06030		
	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	0.40	12.4	12.4	0.37	12.7	12.4	0.37
75	13.6	13.5	0.74	12.4	12.4	0.68	13.3	12.7	0.70
100	13.7	13.5	1.1	12.4	12.4	0.99	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	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N06045			Coefficients for N06059 and N06686			Coefficients for N06230		
	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	0.35	11.8	11.7	0.35	12.5	12.5	0.38
75	13.7	12.4	0.68	11.9	11.8	0.65	12.7	12.5	0.69
100	14.5	13.0	1.0	12.1	11.8	0.94	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	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N06455			Coefficients for N06600			Coefficients for N06617		
	A	B	C	A	B	C	A	B	C
20	10.4	10.4	0	12.3	12.3	0	12.6	12.6	0
50	11.0	10.7	0.32	12.7	12.5	0.38	12.8	12.7	0.36
75	11.4	10.9	0.60	13.0	12.7	0.70	12.9	12.7	0.68
100	11.8	11.1	0.89	13.4	12.8	1.0	13.0	12.8	1.0
125	12.3	11.4	1.2	13.7	13.0	1.4	13.2	12.9	1.4
150	12.6	11.6	1.5	14.0	13.2	1.7	13.3	12.9	1.7
175	13.0	11.8	1.8	14.2	13.3	2.1	13.5	13.0	2.0
200	13.3	12.0	2.2	14.5	13.5	2.4	13.6	13.1	2.4
225	13.5	12.1	2.5	14.7	13.6	2.8	13.8	13.2	2.7
250	13.7	12.3	2.8	14.9	13.7	3.2	14.0	13.2	3.0
275	13.9	12.4	3.2	15.0	13.8	3.5	14.2	13.3	3.4
300	14.0	12.6	3.5	15.2	14.0	3.9	14.4	13.4	3.8
325	14.1	12.7	3.9	15.4	14.1	4.3	14.6	13.5	4.1
350	14.2	12.8	4.2	15.5	14.2	4.7	14.8	13.6	4.5
375	14.2	12.9	4.6	15.7	14.3	5.1	15.0	13.7	4.9
400	14.2	13.0	4.9	15.9	14.4	5.5	15.2	13.8	5.2
425	14.2	13.1	5.3	16.1	14.5	5.9	15.4	13.9	5.6
450	14.2	13.1	5.6	16.3	14.6	6.3	15.7	14.0	6.0
475	14.2	13.2	6.0	16.5	14.7	6.7	15.9	14.1	6.4
500	14.3	13.2	6.4	16.7	14.8	7.1	16.2	14.2	6.8
525	14.3	13.3	6.7	17.0	14.9	7.5	16.4	14.3	7.2
550	14.4	13.4	7.1	17.2	15.0	7.9	16.7	14.4	7.6
575	14.4	13.4	7.4	17.5	15.1	8.4	17.0	14.5	8.0
600	14.5	13.4	7.8	17.8	15.2	8.8	17.2	14.6	8.5
625	14.6	13.5	8.2	18.1	15.3	9.3	17.5	14.7	8.9
650	14.6	13.5	8.5	18.5	15.4	9.7	17.8	14.8	9.3
675	14.6	13.6	8.9	18.8	15.6	10.2	18.1	15.0	9.8
700	14.6	13.6	9.3	19.1	15.7	10.7	18.4	15.1	10.3
725	14.5	13.6	9.6	19.4	15.8	11.1	18.8	15.2	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	19.4	15.5	11.7
800	13.4	13.7	10.7	19.9	16.2	12.6	19.8	15.6	12.2
825	12.7	13.7	11.0	20.0	16.3	13.1	20.1	15.7	12.7
850	...	...	...	...	...	...	20.5	15.9	13.2
875	...	...	...	...	...	...	20.8	16.0	13.7
900	...	...	...	...	...	...	21.2	16.1	14.2
925	...	...	...	...	...	...	21.6	16.3	14.7
950	...	...	...	...	...	...	21.9	16.4	15.3
975	...	...	...	...	...	...	22.3	16.6	15.8

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N06625			Coefficients for N06690			Coefficients for N07718		
	A	B	C	A	B	C	A	B	C
20	12.0	12.0	0	13.9	13.9	0	12.8	12.8	0
50	12.7	12.4	0.37	14.2	14.0	0.42	12.9	12.9	0.39
75	13.1	12.6	0.69	14.3	14.1	0.78	13.1	12.9	0.71
100	13.3	12.8	1.0	14.3	14.2	1.1	13.3	13.0	1.0
125	13.4	12.9	1.4	14.4	14.2	1.5	13.5	13.1	1.4
150	13.4	13.0	1.7	14.6	14.3	1.9	13.7	13.2	1.7
175	13.5	13.1	2.0	14.8	14.3	2.2	13.9	13.3	2.1
200	13.5	13.2	2.4	15.0	14.4	2.6	14.1	13.4	2.4
225	13.5	13.2	2.7	15.2	14.5	3.0	14.3	13.5	2.8
250	13.5	13.2	3.0	15.5	14.6	3.4	14.4	13.6	3.1
275	13.6	13.3	3.4	15.6	14.7	3.7	14.6	13.7	3.5
300	13.8	13.3	3.7	15.7	14.8	4.1	14.7	13.8	3.9
325	14.0	13.3	4.1	15.7	14.8	4.5	14.8	13.9	4.2
350	14.2	13.4	4.4	15.5	14.9	4.9	15.0	13.9	4.6
375	14.5	13.5	4.8	15.3	14.9	5.3	15.1	14.0	5.0
400	14.8	13.5	5.1	14.9	15.0	5.7	15.3	14.1	5.4
425	15.1	13.6	5.5	...	...	...	15.4	14.2	5.7
450	15.5	13.7	5.9	...	...	...	15.6	14.2	6.1
475	15.9	13.8	6.3	...	...	...	15.8	14.3	6.5
500	16.3	14.0	6.7	...	...	...	16.0	14.4	6.9
525	16.7	14.1	7.1	...	...	...	16.2	14.5	7.3
550	17.0	14.2	7.5	...	...	...	16.5	14.6	7.7
575	17.3	14.3	8.0	...	...	...	...	...	...
600	17.7	14.5	8.4	...	...	...	...	...	...
625	17.9	14.6	8.8	...	...	...	...	...	...
650	18.2	14.8	9.3	...	...	...	...	...	...
675	18.4	14.9	9.8	...	...	...	...	...	...
700	18.6	15.0	10.2	...	...	...	...	...	...
725	18.8	15.1	10.7	...	...	...	...	...	...
750	19.1	15.3	11.2	...	...	...	...	...	...
775	19.5	15.4	11.6	...	...	...	...	...	...
800	20.0	15.6	12.1	...	...	...	...	...	...
825	20.6	15.7	12.6	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N07750			Coefficients for N08031 and N08367			Coefficients for N08330		
	A	B	C	A	B	C	A	B	C
20	12.1	12.1	0	13.8	13.8	0	14.6	14.6	0
50	12.5	12.3	0.37	14.1	14.0	0.42	14.8	14.7	0.44
75	12.9	12.5	0.69	14.4	14.1	0.78	15.2	14.8	0.81
100	13.3	12.7	1.0	14.6	14.2	1.1	15.5	15.0	1.2
125	13.6	12.8	1.3	14.9	14.4	1.5	15.7	15.1	1.6
150	13.9	13.0	1.7	15.1	14.5	1.9	15.9	15.3	2.0
175	14.0	13.2	2.0	15.4	14.6	2.3	16.1	15.4	2.4
200	14.1	13.3	2.4	15.5	14.7	2.7	16.2	15.5	2.8
225	14.0	13.4	2.7	15.7	14.8	3.0	16.3	15.6	3.2
250	14.0	13.4	3.1	15.8	14.9	3.4	16.4	15.7	3.6
275	13.9	13.5	3.4	16.0	15.0	3.8	16.6	15.7	4.0
300	13.9	13.5	3.8	16.1	15.1	4.2	16.9	15.8	4.4
325	14.0	13.6	4.1	16.2	15.2	4.6	17.2	15.9	4.9
350	14.2	13.6	4.5	16.3	15.3	5.0	17.5	16.0	5.3
375	14.7	13.7	4.8	16.4	15.4	5.5	17.8	16.2	5.7
400	15.6	13.8	5.2	16.6	15.4	5.9	17.8	16.3	6.2
425	...	...	...	16.7	15.5	6.3	...	...	...
450	...	...	...	16.8	15.6	6.7	...	...	...
475	...	...	...	16.9	15.6	7.1	...	...	...
500	...	...	...	16.9	15.7	7.5	...	...	...
525	...	...	...	16.8	15.8	8.0	...	...	...
550	...	...	...	16.6	15.8	8.4	...	...	...
575	...	...	...	16.2	15.8	8.8	...	...	...
600	...	...	...	15.6	15.8	9.2	...	...	...
625	...	...	...	...	...	...	...	...	...
650	...	...	...	...	...	...	...	...	...
675	...	...	...	...	...	...	...	...	...
700	...	...	...	...	...	...	...	...	...
725	...	...	...	...	...	...	...	...	...
750	...	...	...	...	...	...	...	...	...
775	...	...	...	...	...	...	...	...	...
800	...	...	...	...	...	...	...	...	...
825	...	...	...	...	...	...	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N08354			Coefficients for N08800, N08801, N08810, and N08811			Coefficients for N08825		
	A	B	C	A	B	C	A	B	C
20	13.9	13.9	0	14.2	14.2	0	13.5	13.5	0
50	14.2	14.0	0.42	14.9	14.6	0.44	13.8	13.6	0.41
75	14.4	14.1	0.78	15.4	14.9	0.82	14.1	13.7	0.75
100	14.5	14.2	1.1	15.8	15.1	1.2	14.4	13.9	1.1
125	14.6	14.3	1.5	16.1	15.3	1.6	14.6	14.0	1.5
150	14.8	14.4	1.9	16.4	15.5	2.0	14.8	14.2	1.8
175	14.9	14.5	2.2	16.6	15.6	2.4	14.8	14.3	2.2
200	15.1	14.5	2.6	16.7	15.8	2.8	14.9	14.4	2.6
225	15.2	14.6	3.0	16.9	15.9	3.3	15.0	14.4	3.0
250	15.4	14.7	3.4	17.0	16.0	3.7	15.2	14.5	3.3
275	15.5	14.8	3.8	17.1	16.1	4.1	15.4	14.6	3.7
300	15.7	14.8	4.2	17.2	16.2	4.5	15.8	14.7	4.1
325	15.8	14.9	4.5	17.3	16.3	5.0	16.2	14.8	4.5
350	15.9	15.0	4.9	17.4	16.4	5.4	16.6	14.9	4.9
375	16.1	15.0	5.3	17.6	16.5	5.8	16.6	15.0	5.3
400	16.2	15.1	5.7	17.7	16.5	6.3	15.9	15.1	5.7
425	16.3	15.2	6.2	17.9	16.6	6.7	...	...	...
450	16.5	15.3	6.6	18.0	16.7	7.2	...	...	...
475	...	...	...	18.2	16.8	7.6	...	...	...
500	...	...	...	18.3	16.8	8.1	...	...	...
525	...	...	...	18.5	16.9	8.5	...	...	...
550	...	...	...	18.6	17.0	9.0	...	...	...
575	...	...	...	18.8	17.1	9.5	...	...	...
600	...	...	...	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	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N10001			Coefficients for N10003			Coefficients for N10242		
	A	B	C	A	B	C	A	B	C
20	10.8	10.8	0	11.1	11.1	0	10.4	10.4	0
50	11.2	11.0	0.33	11.4	11.3	0.34	10.7	10.5	0.33
75	11.5	11.2	0.62	11.7	11.4	0.63	10.9	10.7	0.59
100	11.6	11.3	0.90	12.0	11.6	0.93	11.2	10.8	0.86
125	11.6	11.4	1.2	12.3	11.7	1.2	11.5	10.9	1.1
150	11.7	11.4	1.5	12.4	11.8	1.5	11.8	11.1	1.4
175	11.7	11.5	1.8	12.5	11.9	1.8	12.1	11.2	1.7
200	11.7	11.5	2.1	12.6	12.0	2.2	12.3	11.3	2.0
225	11.8	11.5	2.4	12.7	12.1	2.5	12.4	11.5	2.4
250	11.9	11.6	2.7	12.8	12.2	2.8	12.5	11.6	2.7
275	12.0	11.6	3.0	12.9	12.2	3.1	12.6	11.7	3.0
300	12.2	11.6	3.3	13.1	12.3	3.4	12.6	11.8	3.3
325	12.4	11.7	3.6	13.4	12.4	3.8	12.6	11.8	3.6
350	12.7	11.8	3.9	13.7	12.5	4.1	12.6	11.9	3.9
375	13.0	11.8	4.2	14.0	12.6	4.5	12.6	11.9	4.2
400	13.3	11.9	4.5	14.1	12.7	4.8	12.5	12.0	4.6
425	13.6	12.0	4.9	...	...	...	12.5	12.0	4.9
450	13.9	12.1	5.2	...	...	...	12.5	12.0	5.2
475	14.2	12.2	5.6	...	...	...	12.6	12.1	5.5
500	14.5	12.3	5.9	...	...	...	12.8	12.1	5.8
525	14.7	12.4	6.3	...	...	...	13.0	12.1	6.1
550	14.9	12.6	6.7	...	...	...	13.4	12.2	6.5
575	15.1	12.7	7.0	...	...	...	13.9	12.3	6.8
600	15.3	12.8	7.4	...	...	...	14.5	12.3	7.2
625	15.5	12.9	7.8	...	...	...	15.3	12.5	7.5
650	15.7	13.0	8.2	...	...	...	16.3	12.6	7.9
675	15.9	13.1	8.6	...	...	...	17.5	12.7	8.4
700	16.2	13.2	9.0	...	...	...	18.9	12.9	8.8
725	16.7	13.3	9.4	...	...	...	20.5	13.2	9.3
750	17.3	13.4	9.8	...	...	...	22.3	13.5	9.8
775	18.2	13.6	10.3	...	...	...	24.5	13.8	10.4
800	19.4	13.8	10.7	...	...	...	26.8	14.2	11.1
825	...	...	...	...	...	...	29.5	14.6	11.8
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N10276			Coefficients for N10629			Coefficients for N10665		
	A	B	C	A	B	C	A	B	C
20	10.8	10.8	0	9.8	9.8	0	9.5	9.5	0
50	11.2	11.0	0.33	10.2	10.0	0.30	10.2	9.9	0.30
75	11.6	11.2	0.62	10.5	10.2	0.56	10.6	10.1	0.56
100	11.9	11.4	0.91	10.7	10.3	0.82	10.9	10.3	0.82
125	12.3	11.6	1.2	10.9	10.4	1.1	11.1	10.5	1.1
150	12.6	11.7	1.5	11.1	10.5	1.4	11.2	10.6	1.4
175	12.9	11.9	1.8	11.2	10.6	1.6	11.4	10.7	1.7
200	13.2	12.0	2.2	11.4	10.7	1.9	11.5	10.8	1.9
225	13.5	12.2	2.5	11.6	10.8	2.2	11.6	10.9	2.2
250	13.7	12.4	2.8	11.7	10.9	2.5	11.7	11.0	2.5
275	13.9	12.5	3.2	11.9	11.0	2.8	11.9	11.1	2.8
300	14.1	12.6	3.5	12.0	11.1	3.1	12.0	11.2	3.1
325	14.3	12.8	3.9	12.1	11.2	3.4	12.2	11.2	3.4
350	14.5	12.9	4.3	12.2	11.2	3.7	12.4	11.3	3.7
375	14.7	13.0	4.6	12.3	11.3	4.0	12.6	11.4	4.0
400	14.8	13.1	5.0	12.4	11.4	4.3	12.8	11.5	4.4
425	15.0	13.2	5.4	12.5	11.4	4.6	12.9	11.6	4.7
450	15.1	13.3	5.7	12.5	11.5	4.9	13.0	11.6	5.0
475	15.3	13.4	6.1	12.5	11.6	5.3	13.1	11.7	5.3
500	15.4	13.5	6.5	12.5	11.6	5.6	13.1	11.8	5.7
525	15.6	13.6	6.9	12.6	11.7	5.9	13.1	11.8	6.0
550	15.7	13.7	7.3	12.6	11.7	6.2	13.0	11.9	6.3
575	15.8	13.8	7.7	12.7	11.7	6.5	12.9	12.0	6.6
600	16.0	13.9	8.1	12.8	11.8	6.8	12.7	12.0	7.0
625	16.1	14.0	8.5	13.1	11.8	7.2	12.6	12.0	7.3
650	16.3	14.1	8.9	...	...	...	12.4	12.0	7.6
675	16.4	14.2	9.3	...	...	...	12.3	12.1	7.9
700	16.5	14.3	9.7	...	...	...	12.3	12.1	8.2
725	16.6	14.3	10.1	...	...	...	12.5	12.1	8.5
750	16.6	14.4	10.5	...	...	...	12.9	12.1	8.8
775	16.7	14.5	10.9	...	...	...	13.6	12.1	9.2
800	16.6	14.6	11.4	...	...	...	14.8	12.2	9.5
825	16.5	14.6	11.8	...	...	...	16.5	12.3	9.9
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

Table TE-4
Thermal Expansion for Nickel Alloys (Cont'd)

Temperature, °C	Coefficients for N10675			Coefficients for N12160			Coefficients for R20033		
	A	B	C	A	B	C	A	B	C
20	10.3	10.3	0	12.4	12.4	0	14.1	14.1	0
50	10.4	10.3	0.31	12.9	12.6	0.38	14.5	14.3	0.43
75	10.6	10.4	0.57	13.2	12.8	0.70	14.9	14.4	0.79
100	10.8	10.5	0.84	13.6	13.0	1.0	15.3	14.6	1.2
125	11.0	10.6	1.1	13.9	13.2	1.4	15.6	14.8	1.6
150	11.3	10.7	1.4	14.2	13.4	1.7	15.7	15.0	1.9
175	11.5	10.8	1.7	14.5	13.5	2.1	15.8	15.1	2.3
200	11.7	10.9	2.0	14.8	13.7	2.5	15.7	15.2	2.7
225	12.0	11.0	2.3	15.0	13.8	2.8	15.6	15.3	3.1
250	12.1	11.1	2.6	15.2	14.0	3.2	15.6	15.3	3.5
275	12.3	11.3	2.9	15.3	14.1	3.6	15.6	15.3	3.9
300	12.4	11.3	3.2	15.4	14.2	4.0	15.7	15.3	4.3
325	12.5	11.4	3.5	15.5	14.3	4.4	16.0	15.4	4.7
350	12.5	11.5	3.8	15.6	14.4	4.7	16.4	15.4	5.1
375	12.5	11.6	4.1	15.6	14.5	5.1	16.9	15.5	5.5
400	12.4	11.6	4.4	15.7	14.6	5.5	17.5	15.6	5.9
425	12.3	11.7	4.7	15.8	14.6	5.9	17.9	15.8	6.4
450	12.2	11.7	5.0	16.0	14.7	6.3	17.9	15.9	6.8
475	12.1	11.7	5.3	16.1	14.8	6.7	...	...	...
500	12.1	11.8	5.6	16.4	14.9	7.1	...	...	...
525	12.0	11.8	5.9	16.6	14.9	7.5	...	...	...
550	12.1	11.8	6.2	17.0	15.0	8.0	...	...	...
575	12.2	11.8	6.6	17.3	15.1	8.4	...	...	...
600	12.4	11.8	6.9	17.8	15.2	8.8	...	...	...
625	12.9	11.9	7.2	18.2	15.3	9.3	...	...	...
650	13.5	11.9	7.5	18.7	15.5	9.7	...	...	...
675	14.4	12.0	7.9	19.1	15.6	10.2	...	...	...
700	15.6	12.1	8.2	19.5	15.7	10.7	...	...	...
725	17.2	12.2	8.6	19.9	15.9	11.2	...	...	...
750	19.3	12.5	9.1	20.1	16.0	11.7	...	...	...
775	...	...	...	20.2	16.2	12.2	...	...	...
800	...	...	...	20.0	16.3	12.7	...	...	...
825	...	...	...	19.4	16.4	13.2	...	...	...
850	...	...	...	...	...	...	...	...	...
875	...	...	...	...	...	...	...	...	...
900	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...

GENERAL NOTE: Coefficient A is the instantaneous coefficient of thermal expansion $\times 10^{-6}$ (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion $\times 10^{-6}$ (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-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	0.25	8.6	8.6	0.26	8.8	8.7	0.26
75	8.6	8.5	0.47	8.8	8.6	0.47	8.9	8.7	0.48
100	8.7	8.5	0.68	8.9	8.7	0.70	9.0	8.7	0.70
125	8.7	8.6	0.90	9.2	8.8	0.92	9.1	8.8	0.92
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
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 $\times 10^{-6}$ (mm/mm/°C). Coefficient B is the mean coefficient of thermal expansion $\times 10^{-6}$ (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.

(25)

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and
Thermal Diffusivity (TD)

	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)]		Material Group B [Note (2)]		Material Group C [Note (3)]		Material Group D [Note (4)]		Material Group E [Note (5)]	
	Plain Carbon		B [Note (2)]		C [Note (3)]		D [Note (4)]		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	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal
Diffusivity (TD) (Cont'd)

Temp., °C	Carbon and Low Alloy Steels (Cont'd)		Ductile Cast Iron		High Chrome Steels		High Chrome Steels		High Alloy Steels		High Alloy Steels	
	Material Group F [Note (6)]		Material Group G [Note (7)]		Material Group H [Note (8)]		Material Group I [Note (9)]		Material Group J [Note (10)]			
	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	...	...	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...	...	...

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	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and
Thermal Diffusivity (TD) (Cont'd)

Temp., °C	High Nickel Alloys (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	
	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	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and
Thermal Diffusivity (TD) (Cont'd)

Temp., °C	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	
	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	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal
Diffusivity (TD) (Cont'd)

Temp., °C	High Nickel Alloys		High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	52Ni-22Cr-13Co-9Mo N06617		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	
	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	10.5	2.88	9.8	2.85	11.8	3.23	11.1	3.05	11.9	3.41	...	3.06
50	11.1	2.99	10.2	2.95	12.3	3.33	11.6	3.21	12.3	3.41	12.2	3.16
75	11.6	3.08	10.6	3.02	12.8	3.40	12.0	3.30	12.6	3.42	12.7	3.23
100	12.1	3.17	10.9	3.08	13.3	3.48	12.4	3.37	12.9	3.43	13.1	3.31
125	12.6	3.25	11.3	3.14	13.8	3.55	12.9	3.43	13.2	3.45	13.5	3.39
150	13.0	3.33	11.7	3.19	14.2	3.63	13.3	3.49	13.5	3.48	13.9	3.47
175	13.5	3.41	12.0	3.24	14.7	3.70	13.7	3.55	13.8	3.52	14.3	3.54
200	14.0	3.49	12.4	3.29	15.1	3.78	14.1	3.61	14.1	3.56	14.7	3.62
225	14.4	3.57	12.8	3.33	15.6	3.86	14.6	3.68	14.4	3.61	15.2	3.70
250	14.9	3.64	13.2	3.38	16.1	3.93	15.0	3.76	14.8	3.67	15.6	3.78
275	15.3	3.71	13.5	3.43	16.5	4.01	15.4	3.84	15.1	3.73	16.0	3.85
300	15.8	3.79	13.9	3.47	17.0	4.09	15.8	3.94	15.5	3.79	16.5	3.93
325	16.2	3.86	14.3	3.52	17.5	4.17	16.3	4.05	15.8	3.85	16.9	4.01
350	16.6	3.93	14.7	3.57	17.9	4.25	16.7	4.15	16.2	3.91	17.4	4.09
375	17.0	4.01	15.0	3.62	18.4	4.33	17.1	4.27	16.5	3.96	17.8	4.16
400	17.4	4.08	15.4	3.66	18.9	4.41	17.5	4.38	16.9	4.02	18.2	4.24
425	17.8	4.15	15.8	3.71	19.4	4.49	18.0	4.48	17.3	4.07	18.6	4.32
450	18.2	4.22	16.1	3.76	19.9	4.57	18.4	4.57	17.7	4.12	19.0	4.40
475	18.6	4.30	16.5	3.81	20.4	4.64	18.8	4.65	18.0	4.17	19.4	...
500	18.9	4.37	16.9	3.86	20.8	4.71	19.3	4.70	18.4	4.23	19.9	...
525	19.3	4.45	17.2	3.91	21.3	4.78	19.7	4.74	...	...	...	...
550	19.6	4.53	17.6	3.95	21.8	4.85	20.1	4.74	...	...	...	...
575	21.7	4.60	18.0	3.99	22.3	4.91	20.5	4.72	...	...	...	...
600	23.3	4.69	18.4	4.04	22.8	4.97	20.9	4.67	...	...	...	...
625	24.5	4.77	18.7	4.08	23.3	5.03	21.4	4.60	...	...	...	...
650	25.3	4.85	19.1	4.12	23.7	5.08	21.8	4.52	...	...	...	...
675	25.7	4.94	19.5	4.15	24.2	5.13	22.2	4.42	...	...	...	...
700	25.7	5.03	19.9	4.19	24.7	5.17	22.6	4.32	...	...	...	...
725	25.4	4.94	20.3	4.23	25.1	5.22	23.0	4.23	...	...	...	...
750	25.3	4.89	20.7	4.28	25.6	5.26	23.4	4.15	...	...	...	...
775	25.2	4.86	...	...	...	...	...	...	...	...	...	...
800	25.2	4.87	...	...	...	...	...	...	...	...	...	...
825	25.3	4.90	...	...	...	...	...	...	...	...	...	...
850	25.5	4.94	...	...	...	...	...	...	...	...	...	...
875	25.8	5.00	...	...	...	...	...	...	...	...	...	...
900	26.2	5.07	...	...	...	...	...	...	...	...	...	...
925	26.7	5.14	...	...	...	...	...	...	...	...	...	...
950	27.4	5.22	...	...	...	...	...	...	...	...	...	...
975	28.1	5.29	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal
Diffusivity (TD) (Cont'd)

Temp., °C	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	N08031 and N08367		Ni-Fe-Cr-Si N08330		N08354		Ni-Fe-Cr N08800, N08801, N08810, N08811		Ni-Fe-Cr-Mo-Cu N08825		Ni-Mo N10001	
	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	11.6	3.15	12.4	3.39	11.2	2.97	11.5	3.14	...	...	...	...
50	12.2	...	12.7	3.43	11.9	3.19	12.1	3.27	...	...	10.6	2.96
75	12.6	...	13.0	3.53	12.5	3.20	12.5	3.37	11.9	3.26	10.9	2.97
100	13.1	...	13.4	3.63	13.1	3.30	13.0	3.46	12.4	3.25	11.1	2.98
125	13.6	...	13.8	...	13.7	3.41	13.4	3.54	12.8	3.27	11.3	3.00
150	14.1	...	14.2	...	14.3	3.51	13.9	3.63	13.2	3.30	11.6	3.02
175	14.5	...	14.7	...	14.8	3.61	14.3	3.71	13.6	3.33	11.8	3.05
200	15.0	...	15.1	...	15.4	3.70	14.7	3.78	14.0	3.36	12.1	3.07
225	15.4	...	15.6	...	15.9	3.80	15.1	3.85	14.4	3.39	12.3	3.09
250	15.9	...	16.1	...	16.4	3.89	15.5	3.92	14.8	3.41	12.6	3.12
275	16.3	...	16.6	...	16.9	3.97	16.0	3.99	15.2	3.42	12.9	3.15
300	16.8	...	17.0	...	17.4	4.05	16.4	4.05	15.5	3.44	13.2	3.18
325	17.2	...	17.5	...	17.9	4.13	16.7	4.12	15.9	3.44	13.5	3.21
350	17.6	...	18.0	...	18.3	4.19	17.1	4.18	16.3	3.44	13.9	3.25
375	18.0	...	18.4	...	18.8	4.25	17.5	4.24	16.6	3.44	14.2	3.29
400	18.4	...	18.9	...	19.2	4.30	17.9	4.30	17.0	3.44	14.6	3.34
425	18.9	...	19.4	...	19.6	4.35	18.3	4.36	17.3	3.43	15.0	3.40
450	19.3	...	19.8	...	19.9	4.38	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	...	...	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and
Thermal Diffusivity (TD) (Cont'd)

Temp., °C	High Nickel Alloys (Cont'd)									
	High Nickel Alloys (Cont'd)		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys		High Nickel Alloys	
	Ni-Mo-Cr-Fe		65Ni-25Mo-8Cr-2Fe		Ni-Mo-Cr		N10629		Ni-Mo	
	N10003	N10003	N10242	N10242	N10276	N10276	N10629	N10629	N10665	N10665
	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	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and
Thermal Diffusivity (TD) (Cont'd)

Temp., °C	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	
	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	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

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	...	...	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...	...	...

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	
Temp., °C	A92024		A93003		A93004		A95052 and A95652		A95083	
	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	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...

Table TCD
Nominal Coefficients of Thermal Conductivity (TC) and Thermal
Diffusivity (TD) (Cont'd)

	Aluminum											
	Aluminum Alloys (Cont'd)		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys		Aluminum Alloys	
	A95154 and											
	A95086		A95254		A95454		A95456		A96061		A96063	
Temp., °C	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD	TC	TD
20	126.9	52.83	126.9	52.83	134.0	55.45	116.1	48.75	166.2	68.66	209.1	68.53
50	131.0	53.96	131.0	53.96	137.6	56.25	120.6	49.63	168.6	68.54	207.8	68.42
75	134.1	54.37	134.1	54.37	140.8	56.71	123.7	50.34	170.2	68.41	206.7	68.40
100	136.9	54.81	136.9	54.81	143.6	57.15	126.7	51.03	171.7	68.29	205.7	68.34
125	139.4	55.32	139.4	55.32	145.9	57.56	129.6	51.66	173.0	68.12	204.9	68.11
150	141.8	55.76	141.8	55.76	148.0	57.87	132.2	52.20	174.1	67.87	204.5	67.84
175	143.9	55.99	143.9	55.99	150.0	58.03	134.5	52.60	175.3	67.61	204.2	67.63
200	145.9	56.18	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	...	...	...	...	...	...	...	...	...	...	...	...
925	...	...	...	...	...	...	...	...	...	...	...	...
950	...	...	...	...	...	...	...	...	...	...	...	...
975	...	...	...	...	...	...	...	...	...	...	...	...

GENERAL NOTES:

(a) TC is the thermal conductivity, $W/(m \cdot ^\circ C)$, and TD is the thermal diffusivity, $10^{-6} m^2/sec$:

$$TD = \frac{TC [W / (m \cdot ^\circ C)]}{\text{density} (kg / m^3) \times \text{specific heat} [J / (kg \cdot ^\circ C)]}$$

(b) Values of thermal conductivity and thermal diffusivity should be used with the understanding that there is an associated $\pm 10\%$ 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:

$\frac{3}{4}Cr-\frac{1}{2}Ni-Cu$	$\frac{3}{4}Ni-\frac{1}{2}Cu-Mo$
$1Cr-\frac{1}{2}Mo-Si$	$2\frac{1}{2}Ni$

(3) Material Group C includes the following carbon-moly steels:

$C-\frac{1}{4}Mo$	$C-\frac{1}{2}Mo$

The following low chrome steels:

$\frac{1}{2}Cr-\frac{1}{5}Mo-V$	$1Cr-\frac{1}{2}Mo$
$\frac{1}{2}Cr-\frac{1}{4}Mo-Si$	$1\frac{1}{4}Cr-\frac{1}{2}Mo$
$\frac{1}{2}Cr-\frac{1}{2}Mo$	$1\frac{1}{4}Cr-\frac{1}{2}Mo-Si$
$\frac{1}{2}Cr-\frac{1}{2}Ni-\frac{1}{5}Mo$	$1\frac{3}{4}Cr-\frac{1}{2}Mo-Cu$
$\frac{3}{4}Cr-\frac{3}{4}Ni-Cu-Al$	$1\frac{3}{4}Cr-\frac{1}{2}Mo-Ti$
$1Cr-1Mn-\frac{1}{4}Mo$	$2Cr-\frac{1}{2}Mo$
$1Cr-\frac{1}{5}Mo$	

The following manganese steels:

$Mn-\frac{1}{2}Mo$	$Mn-\frac{1}{2}Mo-\frac{3}{4}Ni$
$Mn-\frac{1}{2}Mo-\frac{1}{4}Ni$	$Mn-\frac{1}{2}Ni-V$
$Mn-\frac{1}{2}Mo-\frac{1}{2}Ni$	$Mn-V$

The following nickel steels:

$\frac{1}{2}Ni-\frac{1}{2}Cr-\frac{1}{4}Mo-V$	$\frac{3}{4}Ni-1Mo-\frac{3}{4}Cr$
$\frac{1}{2}Ni-\frac{1}{2}Mo-V$	$1Ni-\frac{1}{2}Cr-\frac{1}{2}Mo$
$\frac{3}{4}Ni-\frac{1}{2}Cr-\frac{1}{2}Mo-V$	$1\frac{1}{4}Ni-1Cr-\frac{1}{2}Mo$
$\frac{3}{4}Ni-\frac{1}{2}Mo-\frac{1}{3}Cr-V$	$3\frac{1}{2}Ni-1\frac{3}{4}Cr-\frac{1}{2}Mo-V$
$\frac{3}{4}Ni-\frac{1}{2}Mo-Cr-V$	$4Ni-1\frac{1}{2}Cr-\frac{1}{2}Mo-V$

(4) Material Group D includes the following low chrome steels:

$2\frac{1}{4}Cr-1Mo$	$3Cr-1Mo-\frac{1}{4}V-Cb-Ca$
$3Cr-1Mo$	$3Cr-1Mo-\frac{1}{4}V-Ti-B$

The following manganese steel:

$Mn-\frac{1}{4}Mo$

The following nickel steels:

$1\frac{3}{4}Ni-\frac{3}{4}Cr-\frac{1}{4}Mo$	$2\frac{3}{4}Ni-1\frac{1}{2}Cr-\frac{1}{2}Mo-V$
$2Ni-\frac{3}{4}Cr-\frac{1}{4}Mo$	$5Ni-\frac{1}{4}Mo$
$2Ni-\frac{3}{4}Cr-\frac{1}{3}Mo$	$7Ni$
$2Ni-1\frac{1}{2}Cr-\frac{1}{4}Mo-V$	$8Ni$
$2Ni-1Cu$	$9Ni$

(5) Material Group E includes:

$3\frac{1}{2}Ni-1\frac{1}{2}Cr-\frac{1}{2}Mo-\frac{1}{2}Mn$	$5Cr-\frac{1}{2}Mo-Si$
$5Cr-\frac{1}{2}Mo$	$5Cr-\frac{1}{2}Mo-Ti$

(6) Material Group F includes:

$9Cr-1Mo$

(7) Material Group G includes:

$12Cr$	$13Cr-4Ni$
$12Cr-1Al$	$15Cr$
$13Cr$	$17Cr$

NOTES (CONT'D):

- (8) Material Group H includes:
27Cr

- (9) Material Group I includes:
17Cr-4Ni-4Cu

15Cr-5Ni-3Mo (only to 425°C)

- (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
18Cr-15Ni-4Si

19Cr-9Ni-Mo-W
21Cr-11Ni-N
22Cr-5Ni-3Mo-N
23Cr-12Ni
25Cr-6Ni-Mo-N
25Cr-7Ni-4Mo-N
25Cr-20Ni
25Cr-20Ni-2Mo
27Cr-7.5Ni-4.5Mo-Co-N
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:

14Cr-16Ni-6Si-Cu-Mo
18Cr-18Ni-2Si
18Cr-20Ni-5.5Si
22Cr-13Ni-5Mn
23Cr-25Ni-5.5Mo-N

24Cr-22Ni-7.5Mo
24Cr-22Ni-6Mo-2W-Cu-N
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 $\times 10^3$ 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 (9)]	...	...	209	200	194	190	186	183	180	177	174	172	...	...	...	...	...
Material Group I [Note (10)]	192	187	184	178	173	170	167	163	160	157	154	151	148	145	142	139	135
Material Group J [Note (11)]	214	209	205	197	191	187	184	180	176	172	168	164	161	157	...	...	...
S13800 [Note (12)]	217	213	209	202	197	194	190	186	183	179	175	171	...	...	...	...	...
S15500 [Note (13)]	210	206	203	196	191	188	184	181	177	173	169	166	...	...	...	...	...
S45000 [Note (14)]	218	213	210	203	198	194	191	187	183	179	175	171	...	...	...	...	...
S17400 [Note (15)]	210	206	203	196	191	188	184	181	177	173	169	166	...	...	...	...	...
S17700 [Note (16)]	218	213	210	203	198	194	191	187	183	179	175	171	...	...	...	...	...
S66286 [Note (17)]	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- $\frac{1}{4}$ Mo
 C- $\frac{1}{2}$ Mo
 Mn- $\frac{1}{4}$ Mo
 Mn- $\frac{1}{2}$ Mo

Mn- $\frac{1}{2}$ Mo- $\frac{1}{4}$ Ni
 Mn- $\frac{1}{2}$ Mo- $\frac{1}{2}$ Ni
 Mn- $\frac{1}{2}$ Ni-V
 Mn-V

- (2) Material Group B consists of the following Ni steels:

$\frac{3}{4}$ Cr- $\frac{1}{2}$ Ni-Cu
 $\frac{3}{4}$ Cr- $\frac{3}{4}$ Ni-Cu-Al
 $\frac{1}{2}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V
 $\frac{1}{2}$ Ni- $\frac{1}{2}$ Mo-V
 $\frac{3}{4}$ Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo-V
 $\frac{3}{4}$ Ni- $\frac{1}{2}$ Cu-Mo
 $\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo- $\frac{1}{3}$ Cr-V

$\frac{3}{4}$ Ni- $\frac{1}{2}$ Mo-Cr-V
 $\frac{3}{4}$ Ni-1Mo- $\frac{3}{4}$ Cr
 1Ni- $\frac{1}{2}$ Cr- $\frac{1}{2}$ Mo
 1 $\frac{1}{4}$ Ni-1Cr- $\frac{1}{2}$ Mo
 1 $\frac{3}{4}$ Ni- $\frac{3}{4}$ Cr- $\frac{1}{4}$ Mo
 2Ni-1 $\frac{1}{2}$ Cr- $\frac{1}{4}$ Mo-V
 2Ni-1Cu

Table TM-1
Moduli of Elasticity E of Ferrous Materials for Given Temperatures (Cont'd)

NOTES (CONT'D):

$2\frac{1}{2}\text{Ni}$	$3\frac{1}{2}\text{Ni}-1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$2\frac{3}{4}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$	$4\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$3\frac{1}{2}\text{Ni}$	7Ni
$3\frac{1}{2}\text{Ni}-1\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}-\frac{1}{2}\text{Mn}$	
(3) Material Group C consists of the following $\frac{1}{2}$ -2Cr steels:	
$\frac{1}{2}\text{Cr}-\frac{1}{5}\text{Mo}-\text{V}$	$1\text{Cr}-\frac{1}{2}\text{Mo}-\text{V}$
$\frac{1}{2}\text{Cr}-\frac{1}{4}\text{Mo}-\text{Si}$	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$
$\frac{1}{2}\text{Cr}-\frac{1}{2}\text{Mo}$	$1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$
$1\text{Cr}-\frac{1}{5}\text{Mo}$	$1\frac{3}{4}\text{Cr}-\frac{1}{2}\text{Mo}-\text{Ti}$
$1\text{Cr}-\frac{1}{2}\text{Mo}$	$2\text{Cr}-\frac{1}{2}\text{Mo}$
(4) Material Group D consists of the following $2\frac{1}{4}$ -3Cr steels:	
$2\frac{1}{4}\text{Cr}-1\text{Mo}$	$3\text{Cr}-1\text{Mo}-\frac{1}{4}\text{V}-\text{Cb}-\text{Ca}$
$3\text{Cr}-1\text{Mo}$	$3\text{Cr}-1\text{Mo}-\frac{1}{4}\text{V}-\text{Ti}-\text{B}$
(5) Material Group E consists of the following 5-9Cr steels:	
$5\text{Cr}-\frac{1}{2}\text{Mo}$	$7\text{Cr}-\frac{1}{2}\text{Mo}$
$5\text{Cr}-\frac{1}{2}\text{Mo}-\text{Si}$	$9\text{Cr}-\text{Mo}$, including variations thereof
$5\text{Cr}-\frac{1}{2}\text{Mo}-\text{Ti}$	
(6) Material Group F consists of the following chromium steels:	
$11\text{Cr}-\text{Ti}$	$13\text{Cr}-4\text{Ni}$
$12\text{Cr}-\text{Al}$	15Cr
13Cr	17Cr
(7) Material Group G consists of the following austenitic steels:	
$16\text{Cr}-12\text{Ni}-2\text{Mo}$	$18\text{Cr}-10\text{Ni}-\text{Ti}$
$16\text{Cr}-12\text{Ni}-2\text{Mo}-\text{N}$	$18\text{Cr}-13\text{Ni}-3\text{Mo}$
$18\text{Cr}-3\text{Ni}-13\text{Mn}$	$18\text{Cr}-18\text{Ni}-2\text{Si}$
$18\text{Cr}-8\text{Ni}$	$21\text{Cr}-6\text{Ni}-9\text{Mn}$
$18\text{Cr}-8\text{Ni}-\text{N}$	$22\text{Cr}-13\text{Ni}-5\text{Mn}$
$18\text{Cr}-8\text{Ni}-\text{S}$	$23\text{Cr}-12\text{Ni}$
$18\text{Cr}-8\text{Ni}-\text{Se}$	$25\text{Cr}-20\text{Ni}$
$18\text{Cr}-10\text{Ni}-\text{Cb}$	

Table TM-1
Moduli of Elasticity E of Ferrous Materials for Given Temperatures (Cont'd)

NOTES (CONT'D):

(8) Material Group H consists of the following duplex (austenitic-ferritic) stainless steels:

18Cr-5Ni-3Mo	25Cr-6.5Ni-3Mo-N
22Cr-2Ni-Mo-N	25Cr-7Ni-3Mo-W-Cu-N
22Cr-5Ni-3Mo-N	25Cr-7Ni-4Mo-N
23Cr-4Ni-Mo-Cu-N	25Cr-7.5Ni-3.5Mo-N-Cu-W
24Cr-10Ni-4Mo-N	27Cr-7.5Ni-4.5Mo-Co-N
25Cr-5Ni-3Mo-2Cu	29Cr-6.5Ni-2Mo-N
25Cr-6Ni-Mo-N	

(9) Material Group H consists of the following duplex (austenitic-ferritic) stainless steels:

18Cr-5Ni-3Mo	25Cr-6.5Ni-3Mo-N
22Cr-2Ni-Mo-N	25Cr-7Ni-3Mo-W-Cu-N
22Cr-5Ni-3Mo-N	25Cr-7Ni-4Mo-N
23Cr-4Ni-Mo-Cu-N	25Cr-7.5Ni-3.5Mo-N-Cu-W
24Cr-10Ni-4Mo-N	27Cr-7.5Ni-4.5Mo-Co-N
25Cr-5Ni-3Mo-2Cu	29Cr-6.5Ni-2Mo-N
25Cr-6Ni-Mo-N	

(10) Material Group I consists of the following high-silicon austenitic steels:

14Cr-16Ni-6Si-Cu-Mo	18Cr-8Ni-4Si-N
17.5Cr-17.5Ni-5.3Si	18Cr-20Ni-5.5Si

(11) Material Group J consists of the following high-molybdenum austenitic stainless steels:

27Ni-22Cr-7Mo-Cu-N	25Ni-47Fe-21Cr-5Mo
20Cr-18Ni-6Mo	25Ni-47Fe-23Cr-5.5Mo-N
24Cr-22Ni-6Mo-2W-Cu-N	44Fe-25Ni-21Cr-Mo
31Ni-31Fe-29Cr-Mo	25Ni-20Cr-6Mo-Cu-N
46Fe-24Ni-21Cr-6Mo-N	

(12) Also known as 13Cr-8Ni-2Mo, XM-13, or PH13-8Mo.

(13) Also known as 15Cr-5Ni-3Mo, XM-12, or 15-5PH.

(14) Also known as 15Cr-6Ni-Cu-Mo, Custom 450, or XM-25. Modulus values are for material aged at 480°C.

(15) Also known as 17Cr-4Ni-4Cu, Grade 630, or 17-4PH.

(16) Also known as 17Cr-7Ni-1Al, Grade 631, or 17-7PH.

(17) 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

Material	Modulus of Elasticity E = Value Given $\times 10^3$ MPa, for Temperature, °C, of						
	-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

Material	Modulus of Elasticity E = Value Given $\times 10^3$ MPa, for Temperature, °C, of						
	-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
C37700	110	108	106	103	101	99	97
C46400	110	108	106	103	101	99	97
C46500	110	108	106	103	101	99	97
C62300	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
C95800	110	108	106	103	101	99	97
C95820	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
C19200	128	126	124	121	118	116	114
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
C70620	131	129	127	124	121	119	117
C96200	131	129	127	124	121	119	117
C97600	139	137	135	131	128	126	123
C72200	139	137	135	131	128	126	124
C71000	146	144	142	138	134	132	130
C71500	161	158	156	152	148	145	143
C71520	161	158	156	152	148	145	143

Table TM-4
Moduli of Elasticity E of High Nickel Alloys for Given Temperatures

Material	Modulus of Elasticity E = Value Given $\times 10^3$ MPa, for Temperature, °C, of																				
	-200	-125	-75	25	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900
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	141
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	...	...	...
N08354	207	204	202	198	194	191	189	186	183	180	177	174	...	...	...	...	...	...	...	...	...
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

Material Grade/UNS No.	Modulus of Elasticity E = Value Given $\times 10^3$ 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

Material	Poisson's Ratio	Density, kg/m ³	Material	Poisson's Ratio	Density, kg/m ³
Ferrous Materials			Nonferrous Materials		
Carbon steels	0.30	7 750	Aluminum Base		
Cast irons	0.29	7 200	Alclad 3003	0.33	2 730
Low alloy steels			Alclad 3004	0.33	2 720
C-Mn steels	0.30	7 750	Alclad 6061	0.33	2 700
1/2Cr to 1 1/4Cr steels	0.30	7 750	A02040	0.33	2 800
1 3/4Cr to 3Cr steels	0.30	7 750	A03560	0.33	2 680
5Cr to 9Cr steels	0.30	7 750	A24430	0.33	2 700
Mn, Mn-Mo, and Si steels	0.30	7 750	A91060	0.33	2 705
Ni steels	0.30	7 750	A91100	0.33	2 710
PH stainless: S15500, S17400, S17700	0.31	7 750	A92014	0.33	2 800
High alloy steels (200 series)	0.31	7 810	A92024	0.33	2 780
High alloy steels (300 series)	0.31	8 030	A93003	0.33	2 730
High-Si stainless: S30600, S30601, S32615, and S38815	0.31	7 600	A93004	0.33	2 720
5-7% Mo stainless: S32050, S31254, S31266, S31277, and S32654	0.31	8 100	A95052	0.33	2 680
S32202	0.31	7 770	A95083	0.33	2 660
High alloy steels (400 series)	0.31	7 750	A95086	0.33	2 660
High alloy steels (duplex/austenitic-ferritic)	0.31	7 800	A95154	0.33	2 660
PH stainless: S66286	0.31	7 920	A95254	0.33	2 660
Cast high alloy steels	0.30	7 830	A95454	0.33	2 690
			A95456	0.33	2 660
			A95652	0.33	2 670
			A96061	0.33	2 700
			A96063	0.33	2 700

Table PRD
Poisson's Ratio and Density of Materials (Cont'd)

Material	Poisson's Ratio	Density, kg/m ³	Material	Poisson's Ratio	Density, kg/m ³
Nonferrous Materials (Cont'd)			Nonferrous Materials (Cont'd)		
Chromium Base			Nickel Base (Cont'd)		
R20033	0.31	7 950	N06045	0.31	8 000
Cobalt Base			N06059	0.31	8 600
R30556	0.31	8 200	N06200	0.31	8 500
R31233	0.31	8 400	N06230	0.31	8 970
Copper Base			N06455	0.31	8 640
C10200, C10400, C10500, and C10700	0.33	8 940	N06600	0.31	8 410
C11000	0.33	8 890	N06601	0.31	8 050
C12000, C12200, C12300, and C14200	0.33	8 940	N06617	0.31	8 360
C19200	0.33	8 860	N06625	0.31	8 440
C19400	0.33	8 910	N06686	0.31	8 730
C23000	0.33	8 750	N06690	0.31	8 110
C28000	0.33	8 390	N06975	0.31	8 170
C36500	0.33	8 420	N06985	0.31	8 310
C37700	0.33	8 440	N07718	0.31	8 220
C44300, C44400, and C44500	0.33	8 520	N07750	0.31	8 250
C46400 and C46500	0.33	8 420	N08020	0.31	8 050
C60800	0.33	8 170	N08024	0.31	8 110
C61400	0.33	7 890	N08026	0.31	8 140
C63000	0.33	7 580	N08028	0.31	8 000
C64200	0.33	7 700	N08031	0.31	8 110
C65100	0.33	8 750	N08330	0.31	8 030
C65500 and C66100	0.33	8 520	N08354	0.31	8 130
C68700	0.33	8 330	N08367 and J94651	0.31	8 060
C70400, C70600, C70620, C71000, C71500, C71520, and C72200	0.33	8 940	N08800, N08810, and N08811	0.31	8 030
C83600	0.33	8 800	N08825	0.31	8 140
C99200	0.33	8 640	N08904	0.31	8 060
C93700	0.33	8 940	N08925	0.31	8 150
C95200	0.31	7 640	N08926	0.31	8 060
C95400	0.32	7 450	N10001	0.31	9 150
C95800	0.32	7 640	N10003	0.31	8 860
C95820	0.32	7 450	N10242	0.31	9 050
C97600	0.33	8 880	N10276	0.31	8 870
Nickel Base			N10629	0.31	9 190
N02200 and N02201	0.31	8 890	N10665 and N10675	0.31	9 220
N04400 and N04405	0.31	8 860	N12160	0.31	8 080
N05500	0.31	8 300	Titanium Base		
N06002	0.31	8 310	R50250, R50400, R50550,	0.32	4 510
N06022	0.31	8 690	R52250, R52252, R52254,		
N06030	0.31	8 220	R52400, R52402, R52404, and R53400		
			R56320 and R56323	0.32	4 480
			R54250	0.32	4 450
			Zirconium Base		
			R60702, R60704, and R60705	0.35	6 480

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)

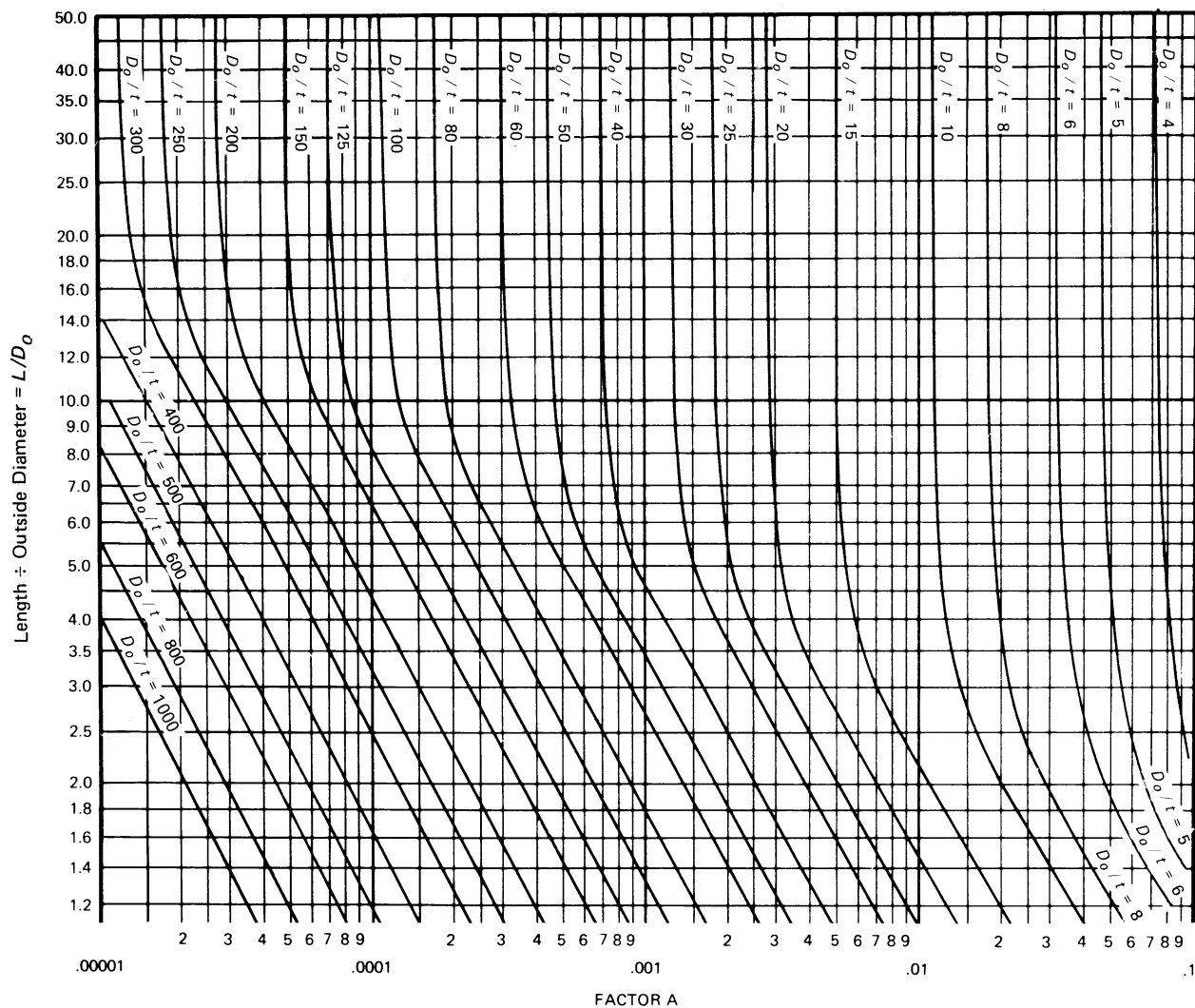
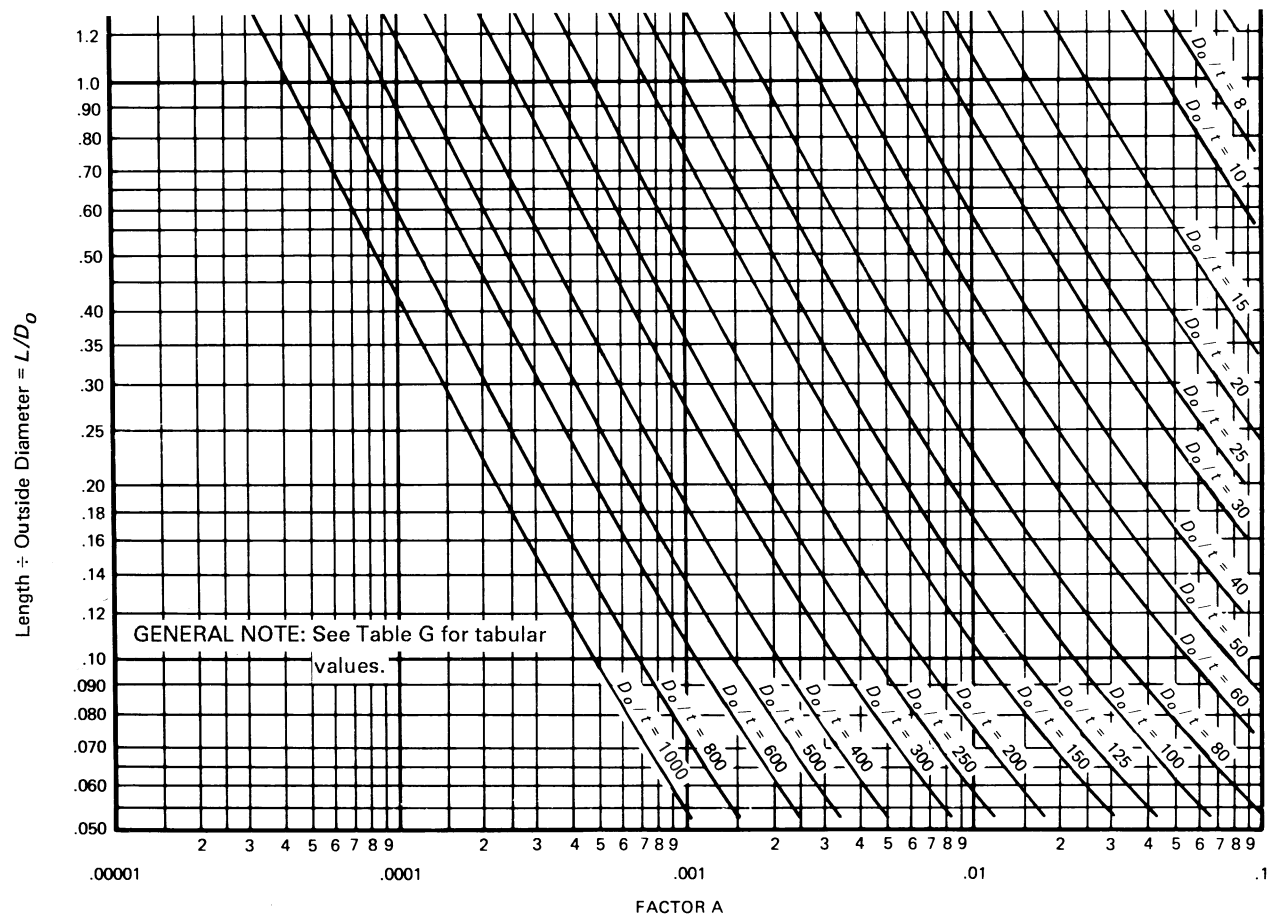
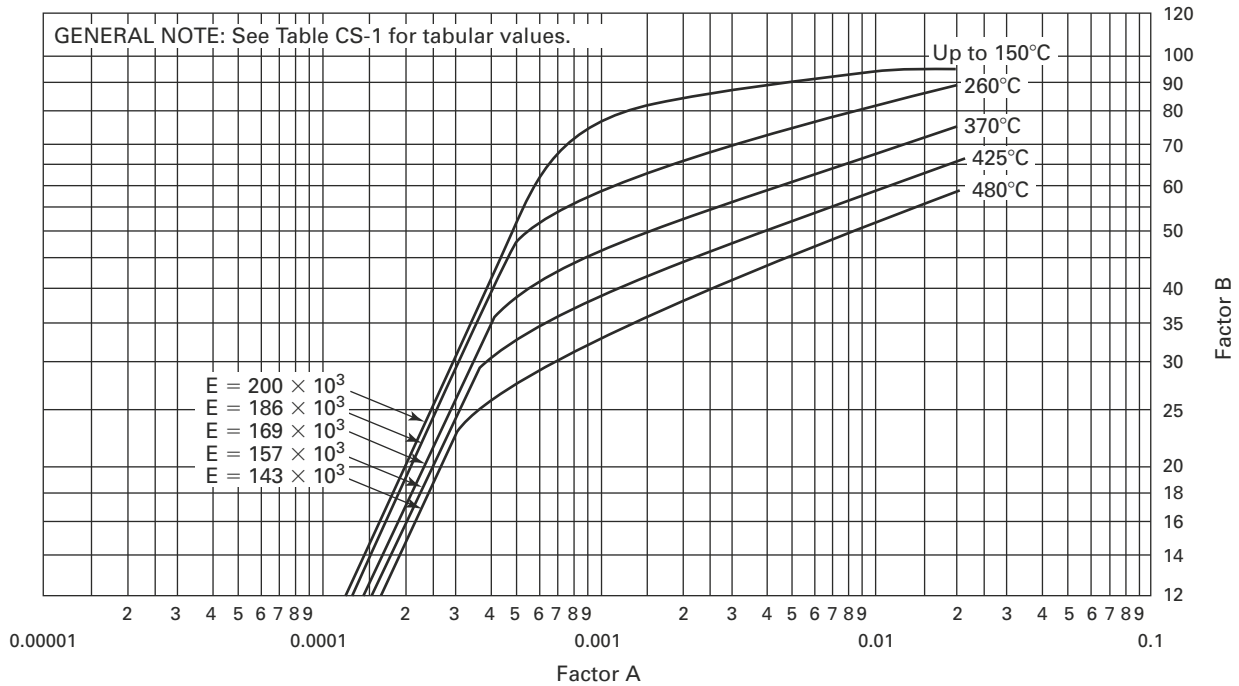


Figure G
Geometric Chart for Components Under External or Compressive Loadings (for All Materials) (Cont'd)



GENERAL NOTE: Extrapolation is not permitted except as explicitly allowed by the Construction Code.

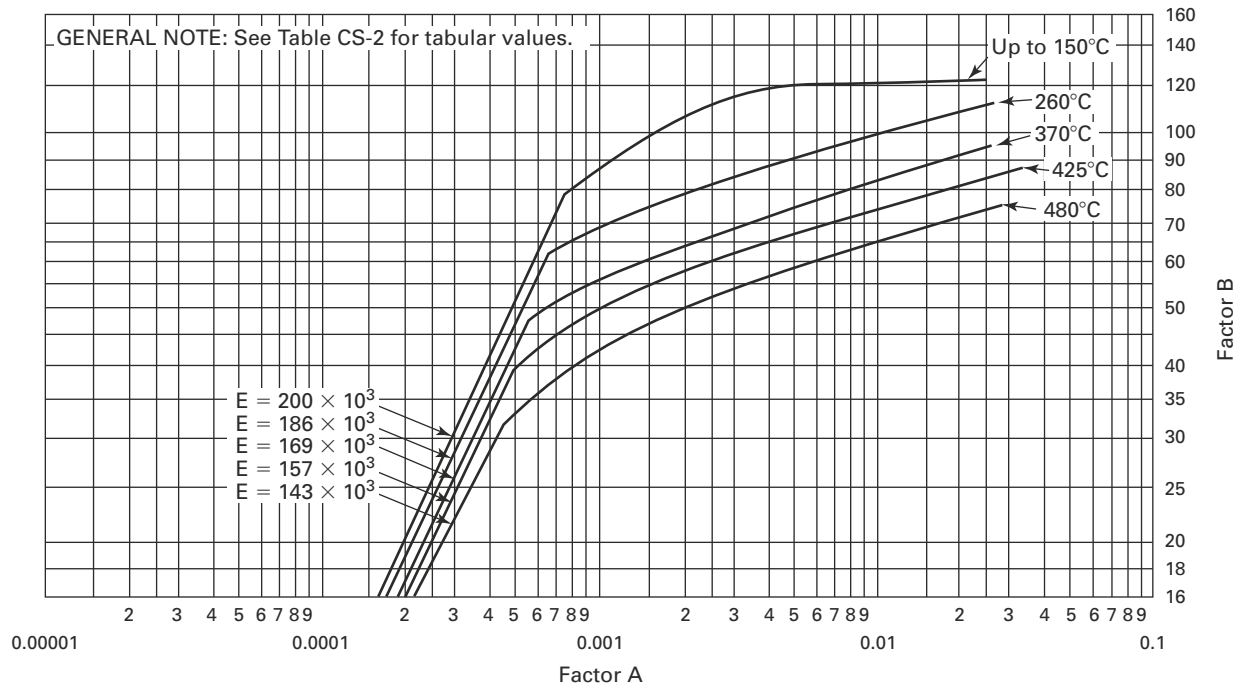
Figure CS-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon or Low Alloy Steels With Specified Minimum Yield Strength Less Than 207 MPa



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

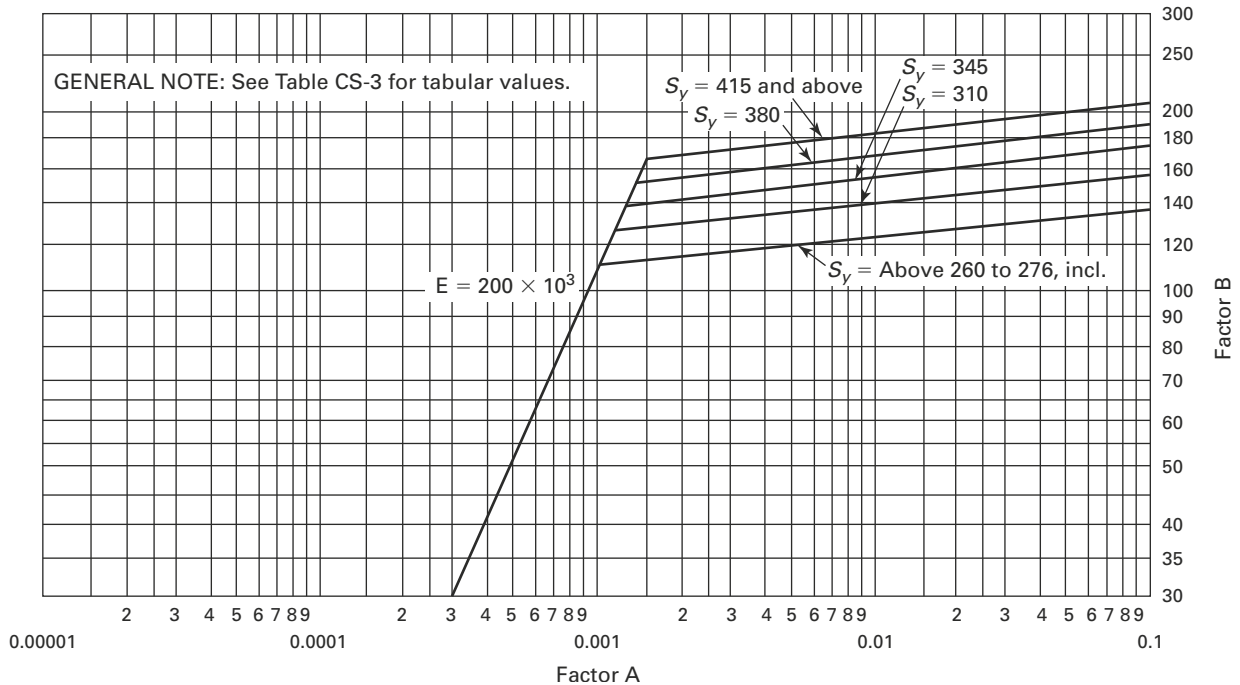
Figure CS-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon or Low Alloy Steels With Specified Minimum Yield Strength 207 MPa and Higher



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

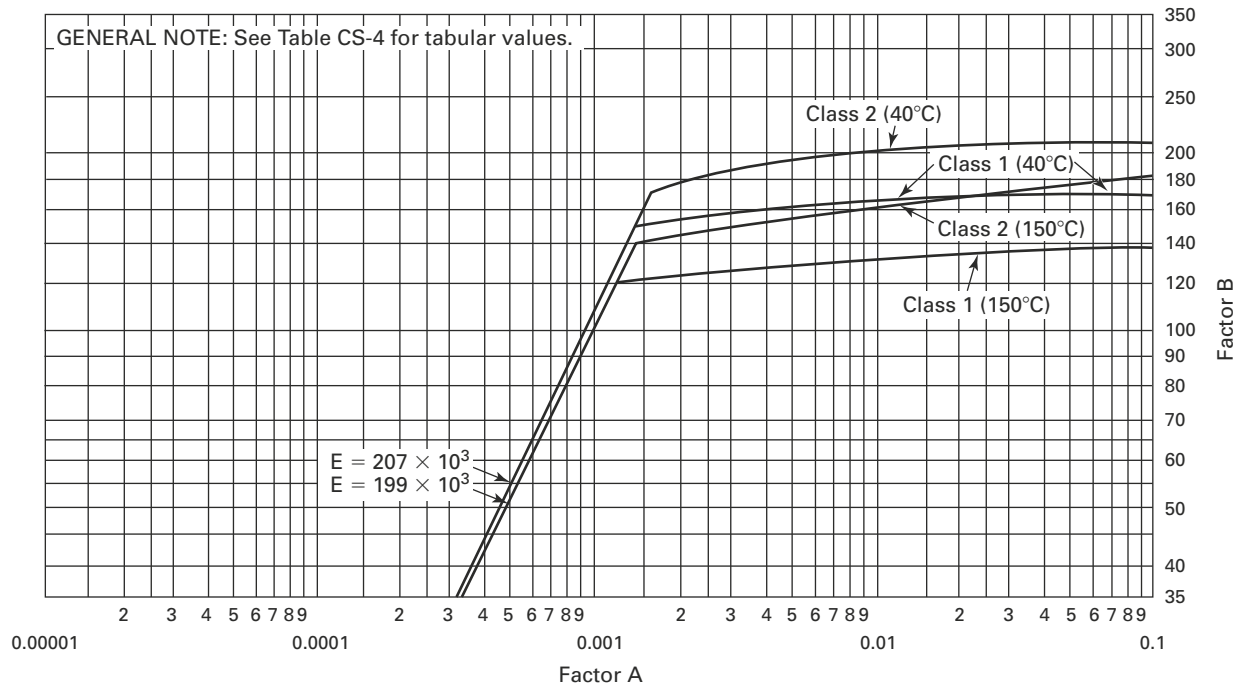
Figure CS-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon Steel and Low Alloy Steels With Specified Minimum Yield Strength 260 MPa and Higher for Temperatures 150°C and Less



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- See Table Y-1 for values of yield strength at design temperature.
- 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.
- 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](#).

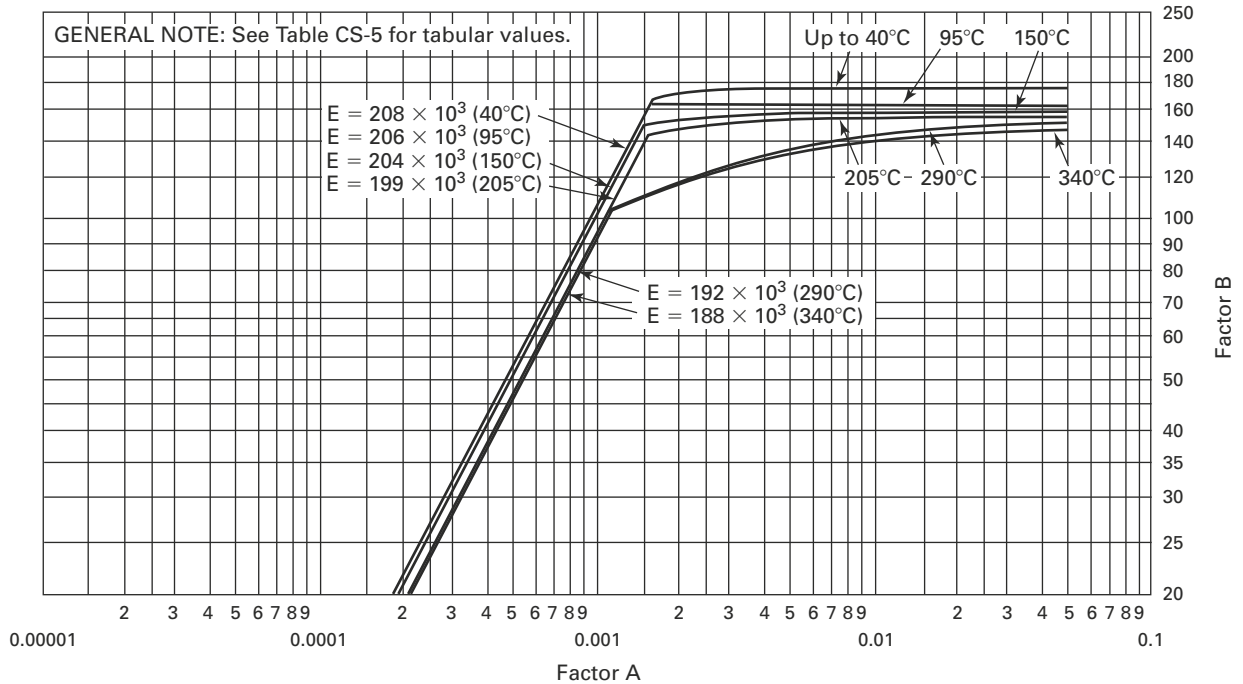
Figure CS-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-537
Thickness 64 mm and Less



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

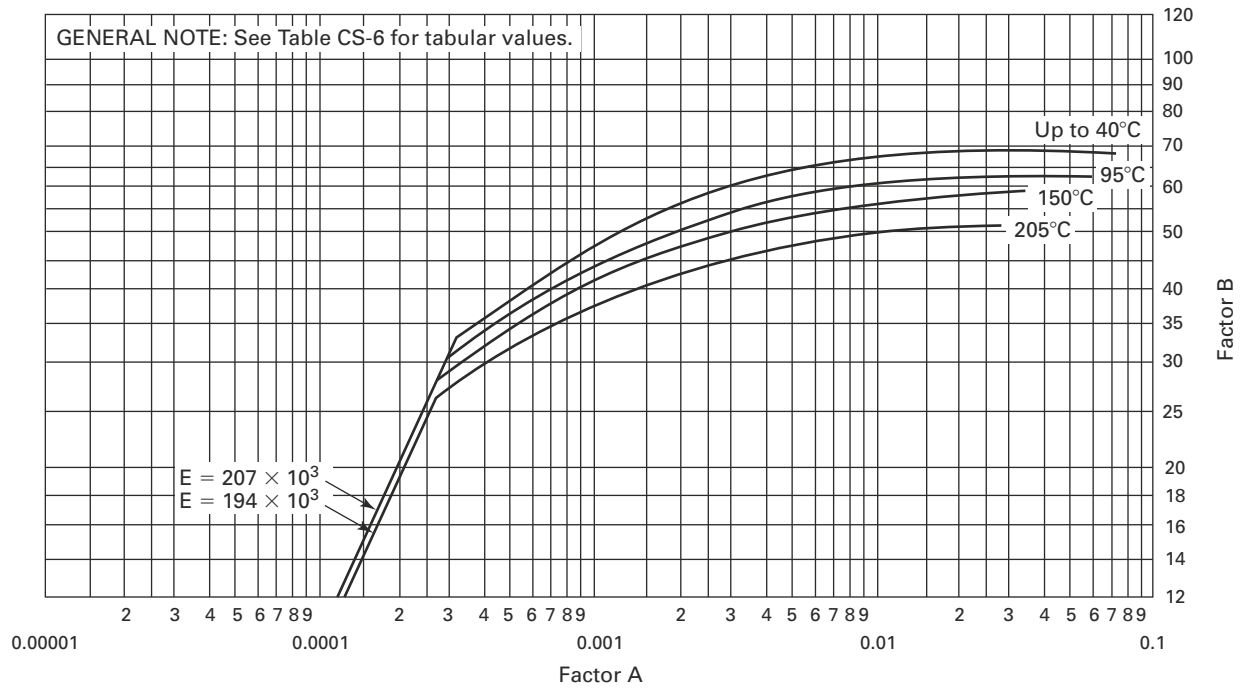
Figure CS-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-508 Class 1, Grades 2 and 3; SA-508 Class 2, Grade 2; SA-533 Class 1, Grades A, B, C, and D; SA-533 Class 2, Grades A, B, C, and D; or SA-541 Grades 2 and 3



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

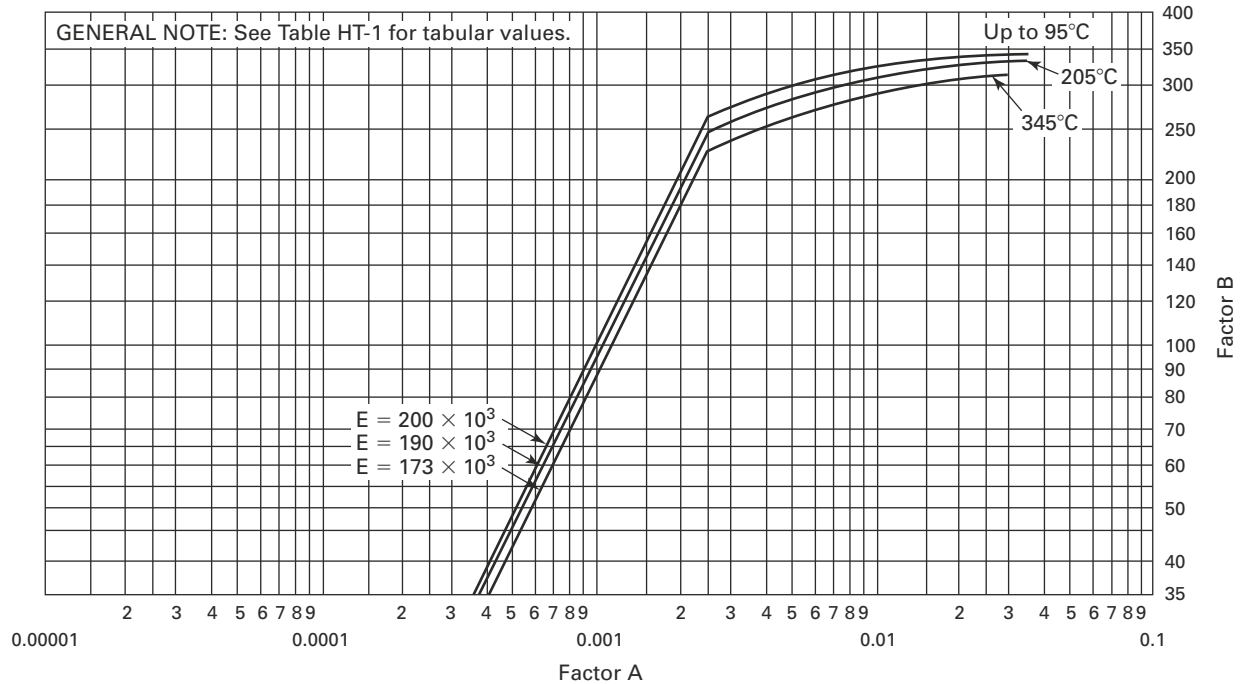
Figure CS-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Carbon Steel With Specified Minimum Yield Strength of 138 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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

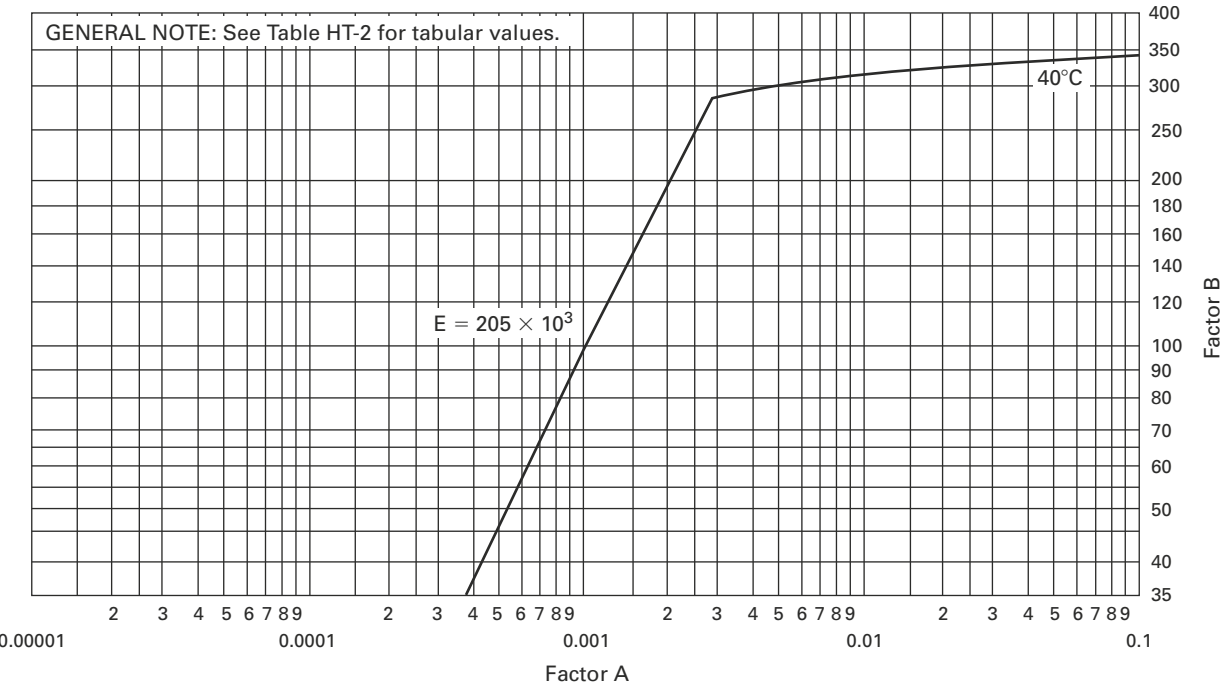


GENERAL NOTES:

- (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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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

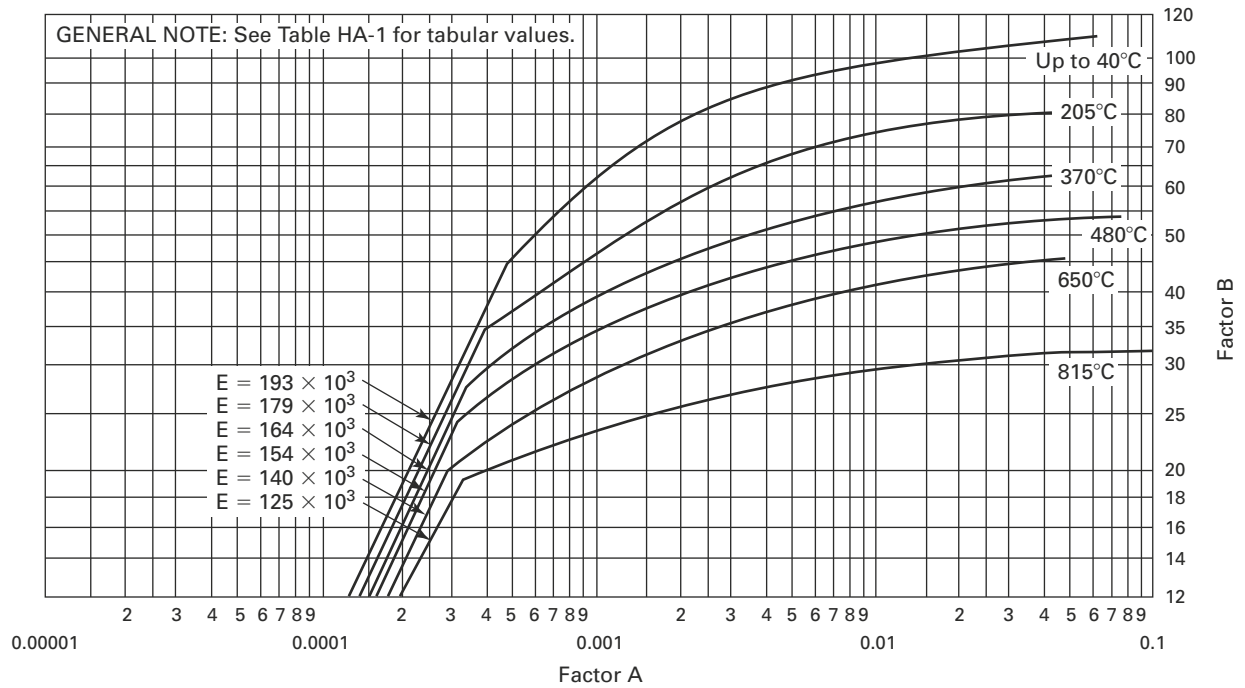
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-508 Grade 4N, Class 2 or SA-543 Types B and C, Class 2 With Specified Minimum Yield Strength of 689 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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](#).

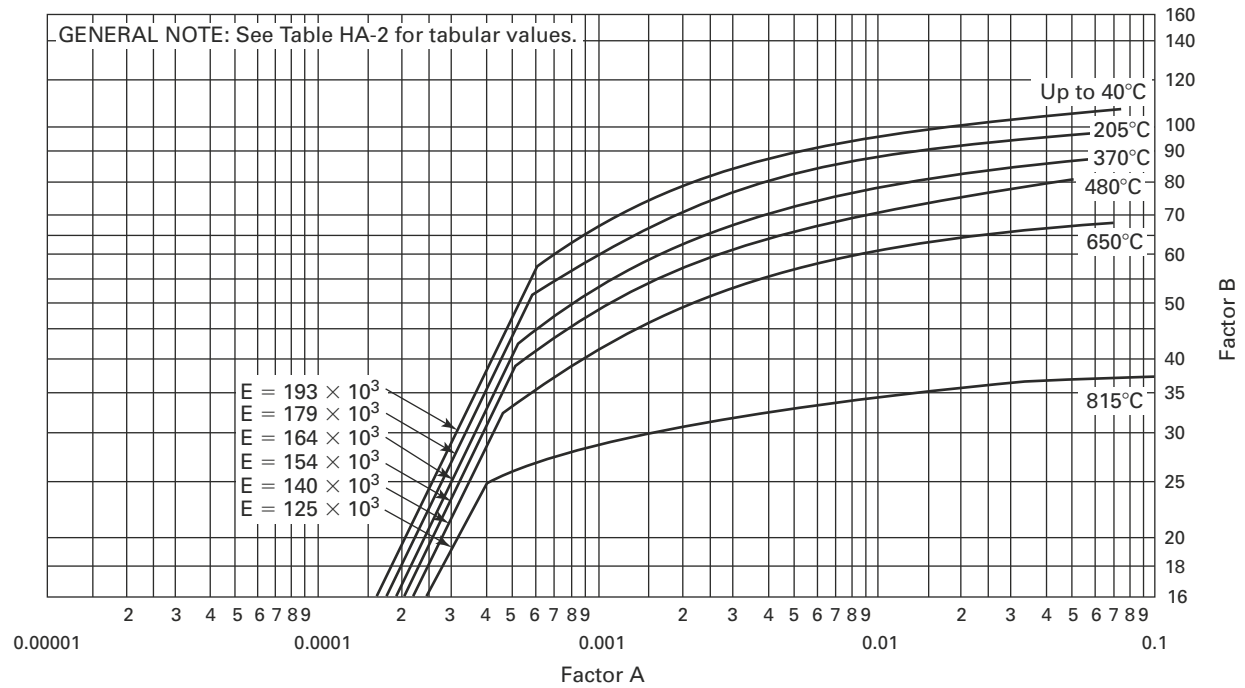
Figure HA-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Steel 18Cr-8Ni, Type 304



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

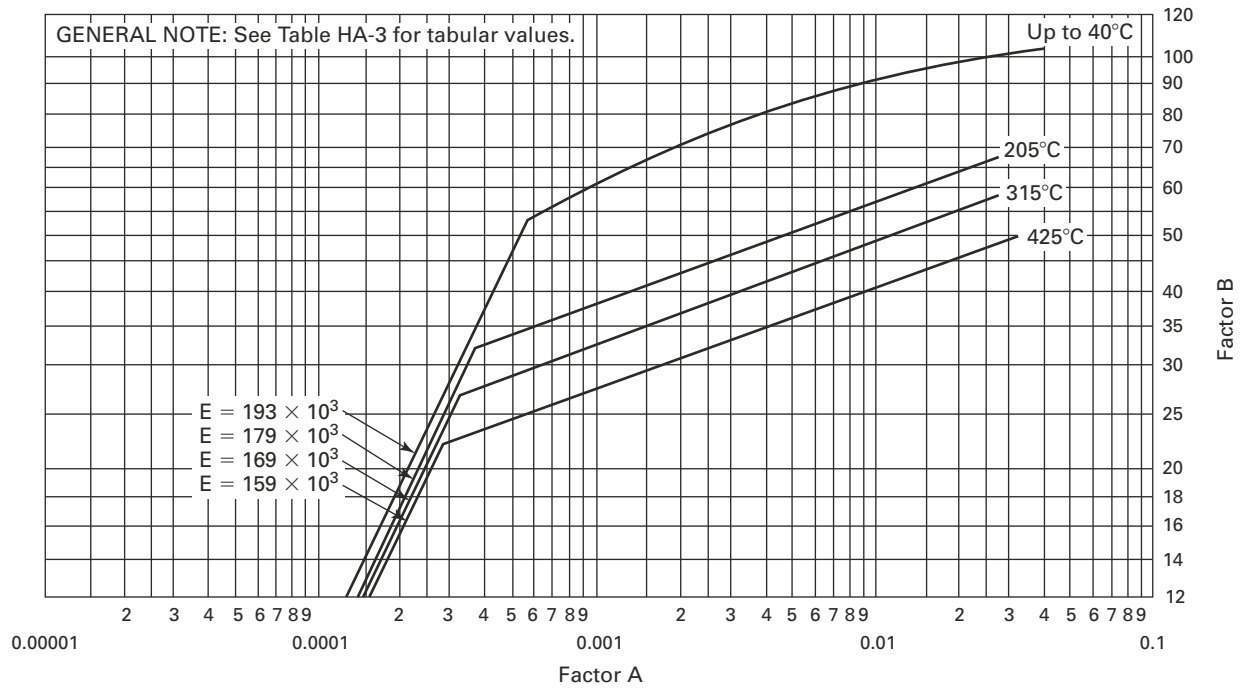
Figure HA-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Steel 16Cr-12Ni-2Mo, Type 316



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

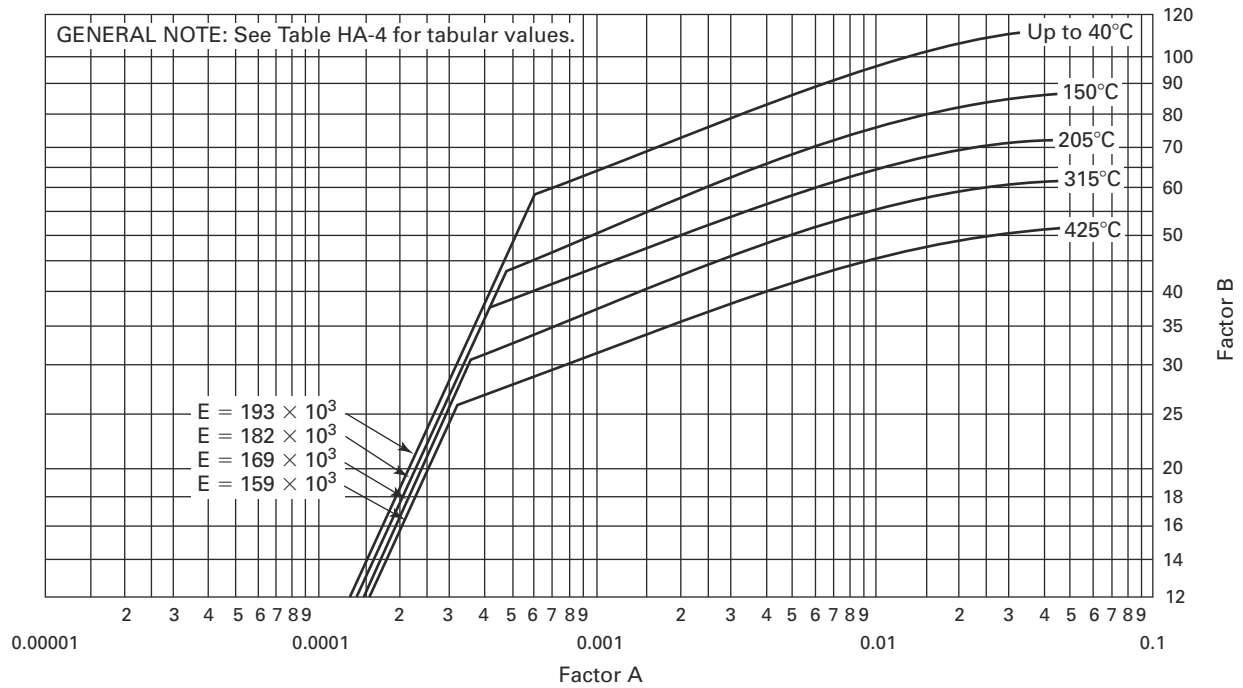
Figure HA-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Steel 18Cr-8Ni-0.035 Maximum Carbon, Type 304L



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

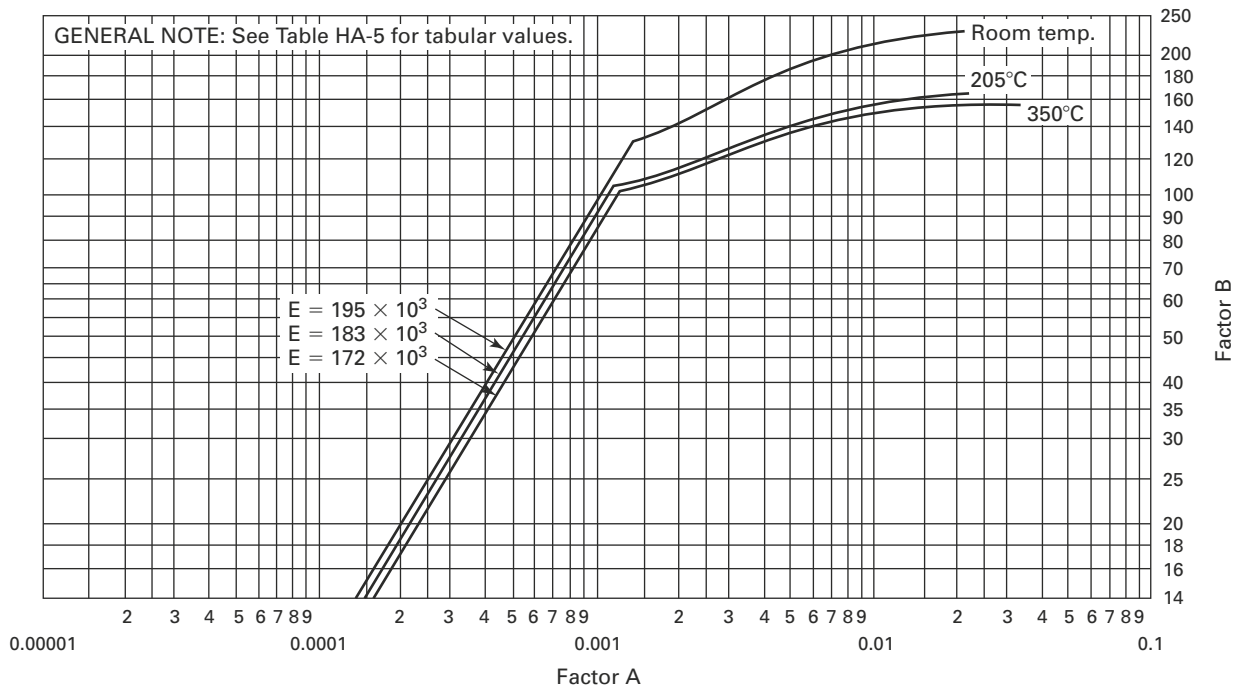
Figure HA-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Austenitic Steel 18Cr-8Ni-Mo-0.035 Maximum Carbon, Type 316L



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

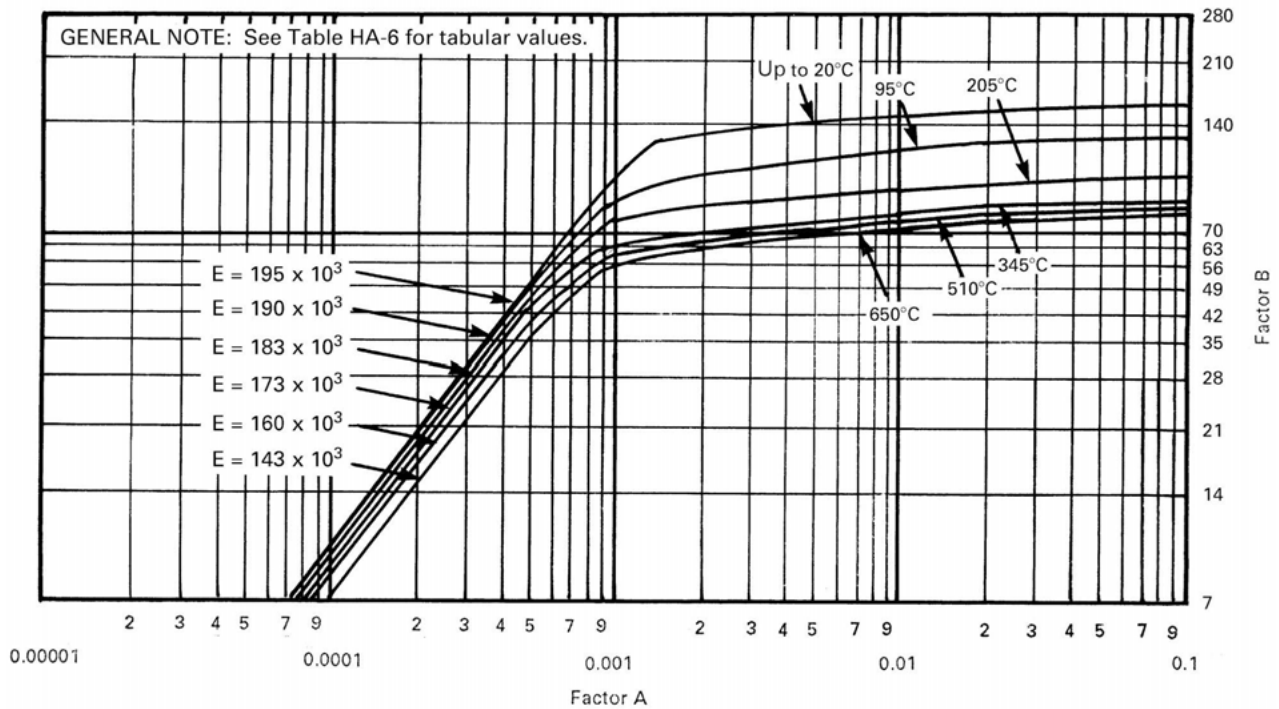
Figure HA-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic-Ferritic Steel 18Cr-5Ni-3Mo S31500 and Austenitic-Ferritic Steel 25Cr-6Ni-Mo-N S32053



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

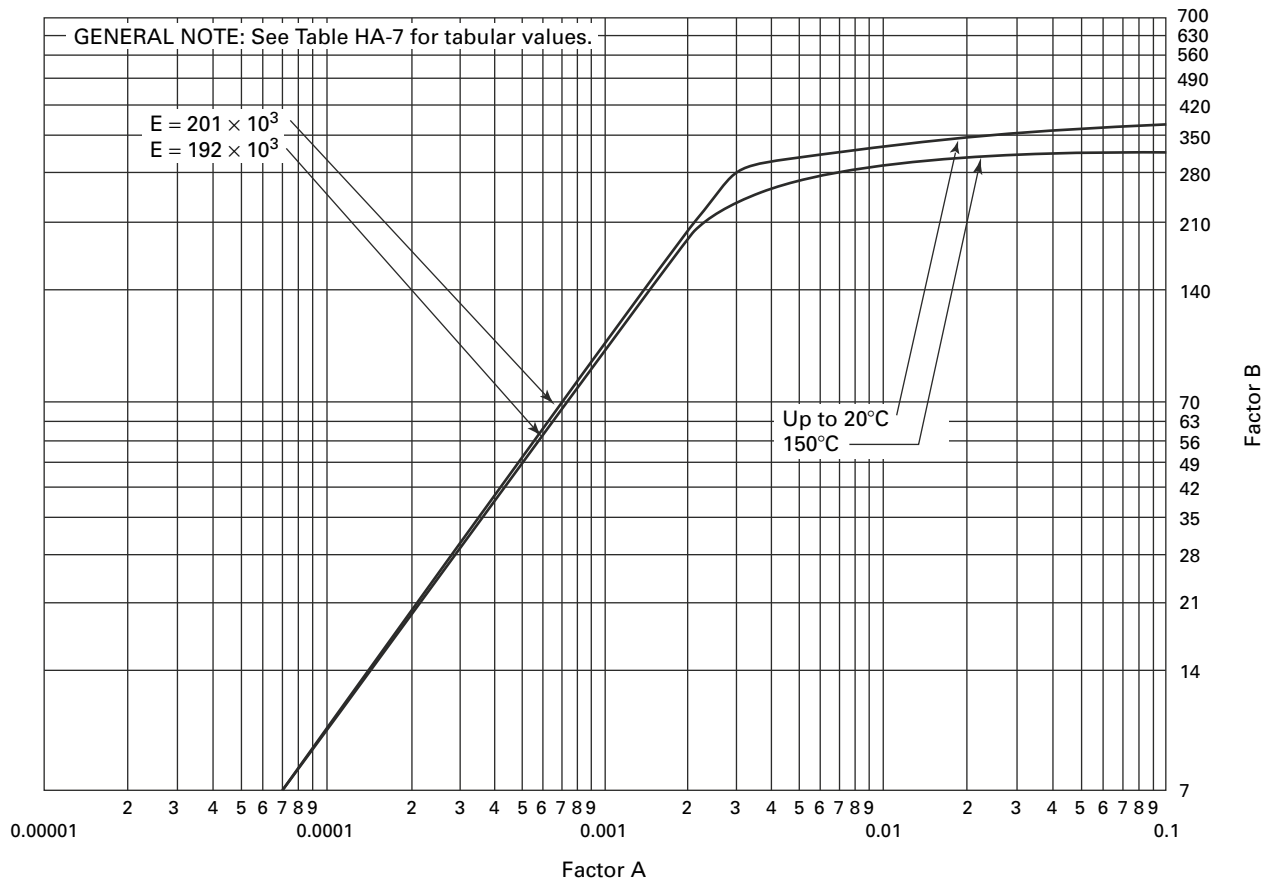
Figure HA-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Steel 21Cr-11Ni-N S30815



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- The external pressure chart does not account for reduction of buckling strength due to creep under long-term loads at temperatures above 540°C.

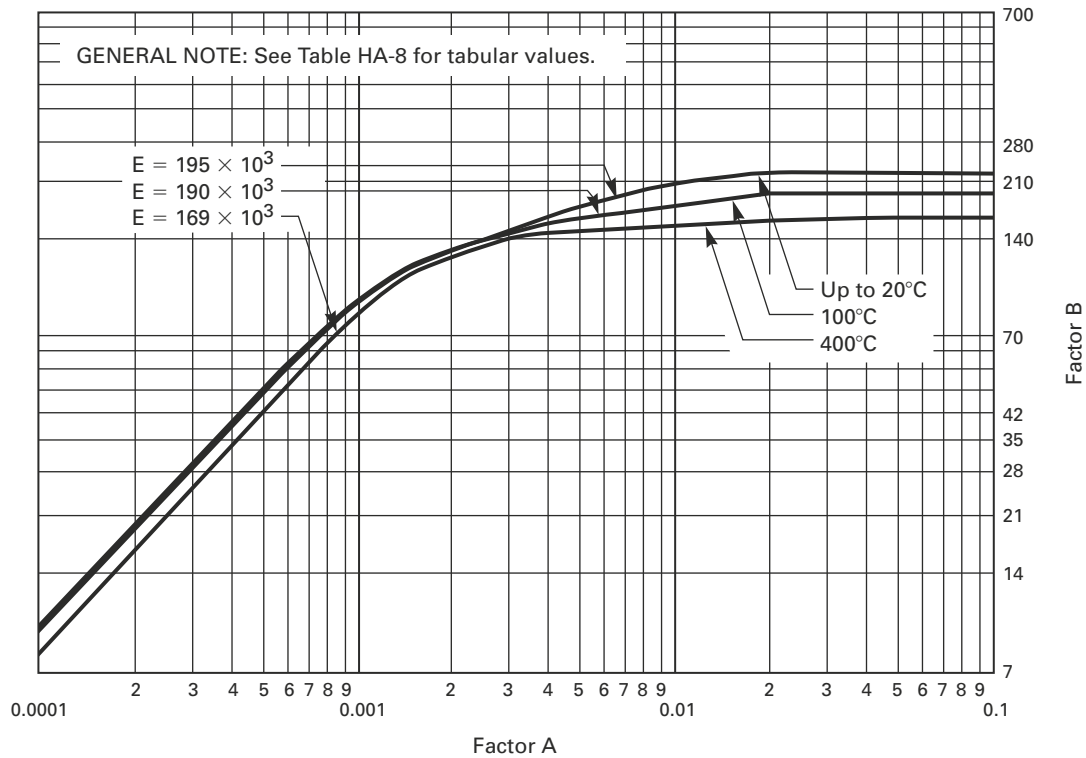
Figure HA-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SA-564
Type 630 H1150 (17Cr-4Ni-4Cu S17400)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

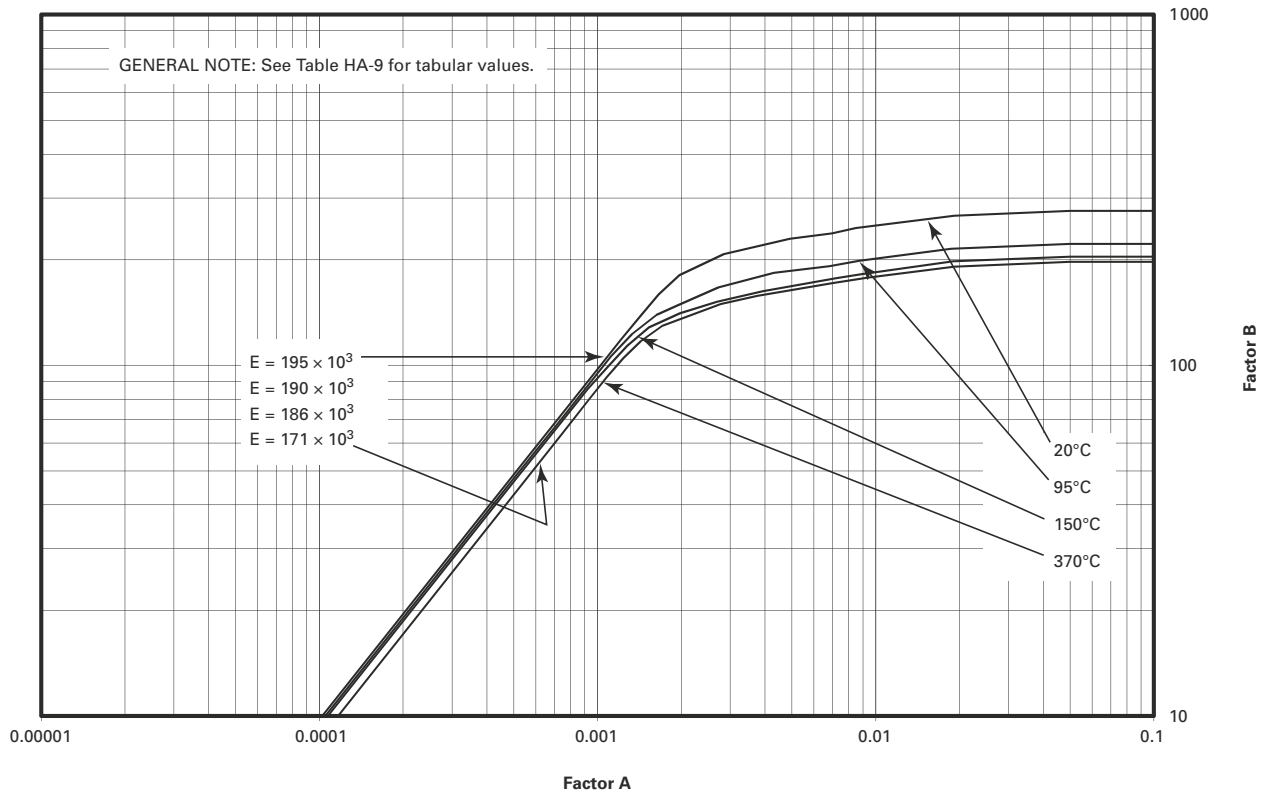
Figure HA-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic-Ferritic Steel 25Cr-7Ni-3Mo-2W-0.28N S39274



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

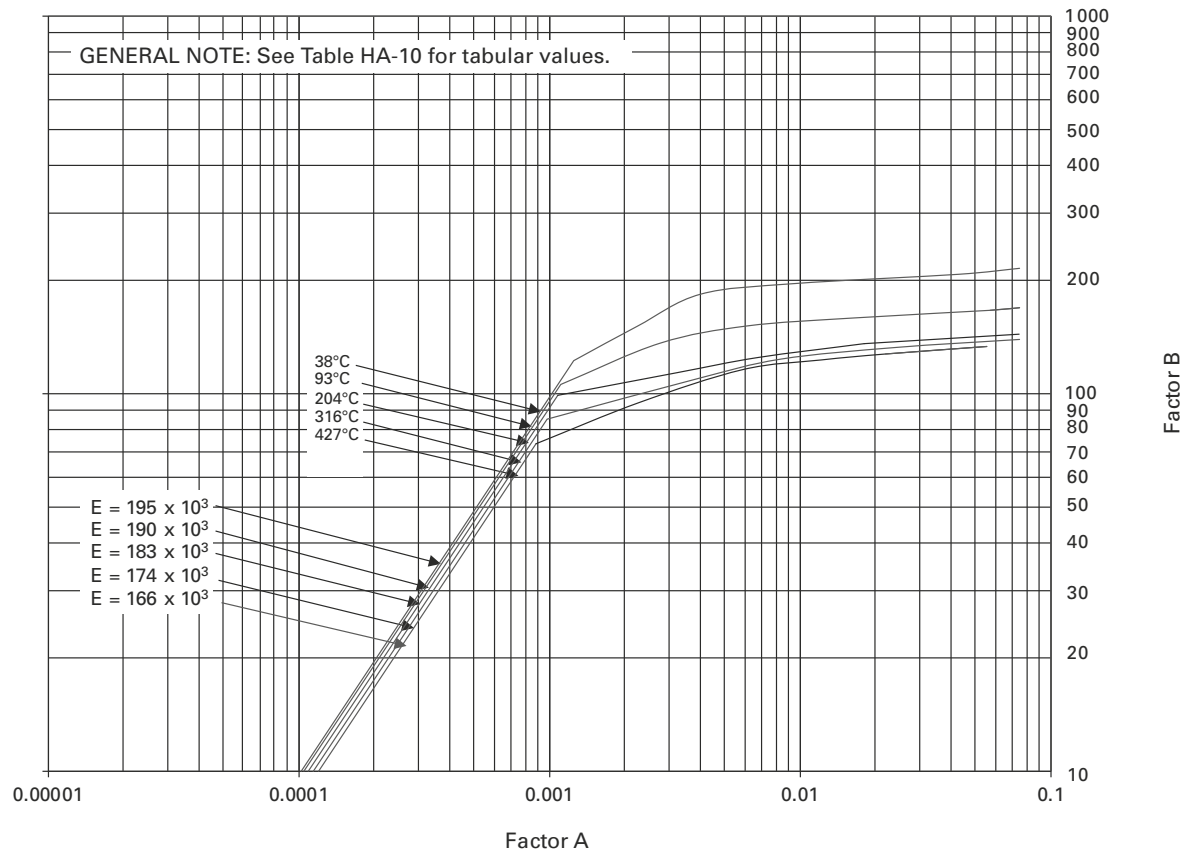
Figure HA-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Steel 25Cr–7.5Ni–3.5Mo–N–Cu–W S32760



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

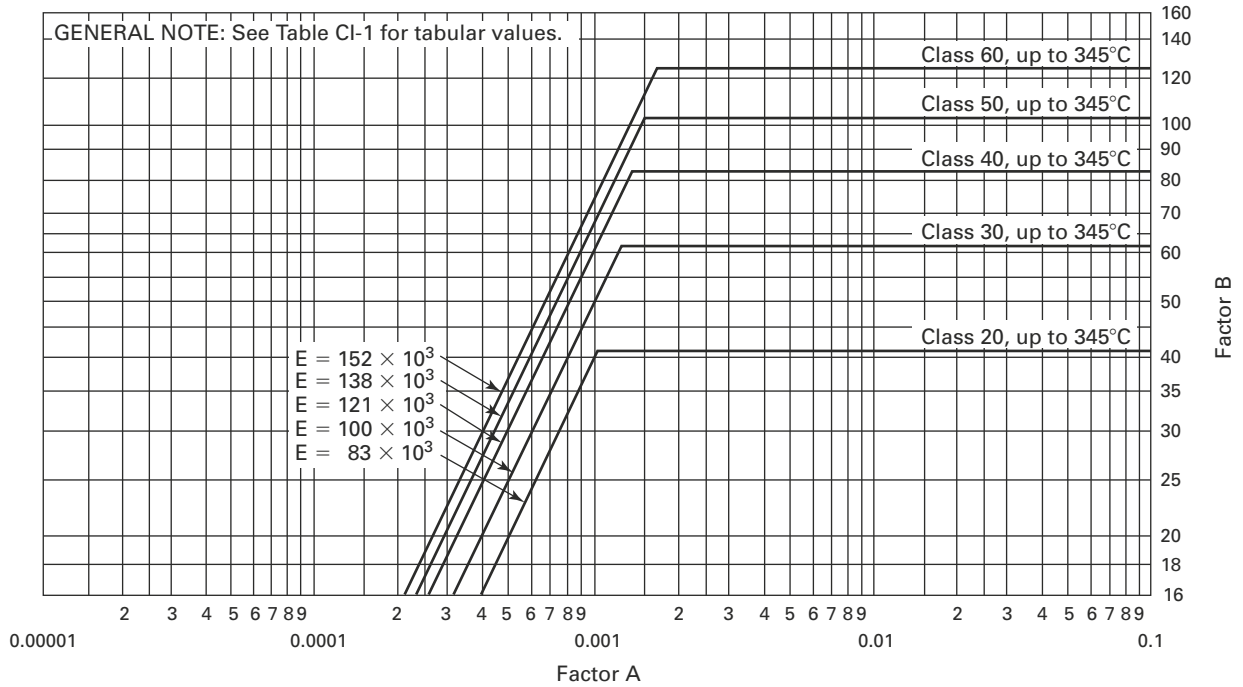
Figure HA-10
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Austenitic Stainless Steel 24Cr–17Ni–6Mn–4.5Mo–N S34565



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

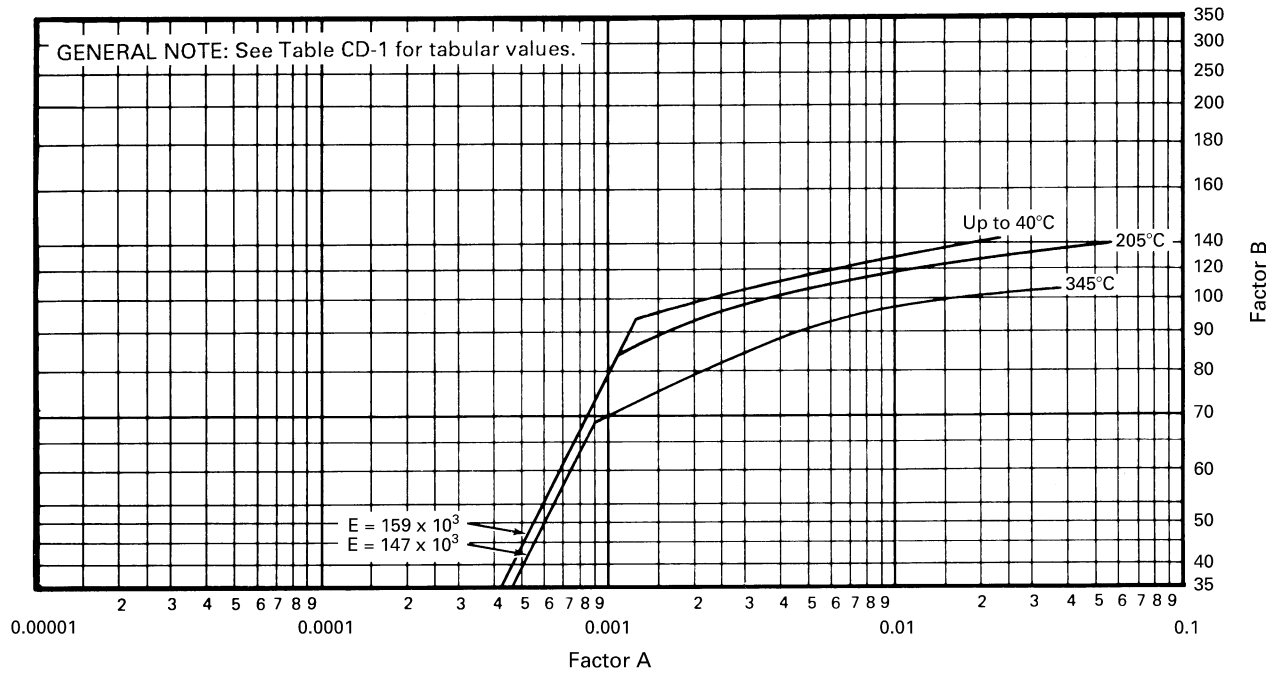
Figure CI-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Iron



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

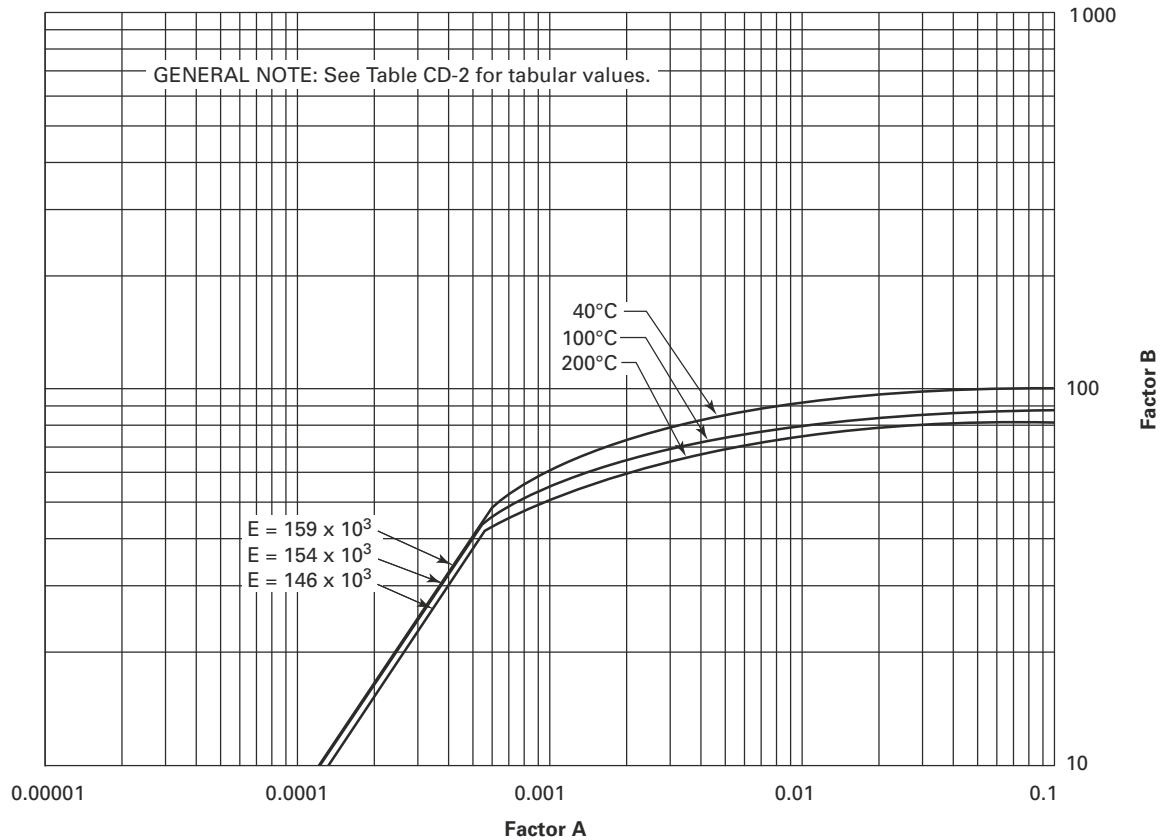
Figure CD-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Ductile Iron With a Specified Minimum Yield Strength of 275 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

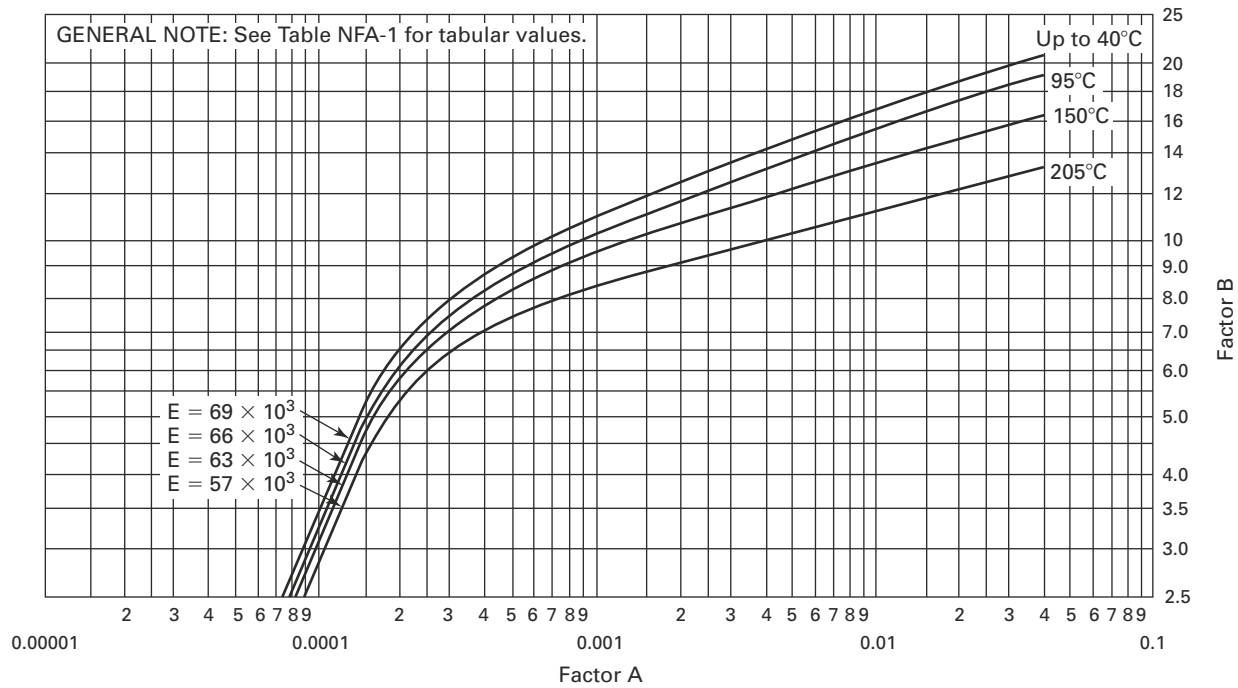
Figure CD-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cast Ductile Iron With a Specified Minimum Yield Strength of 200 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

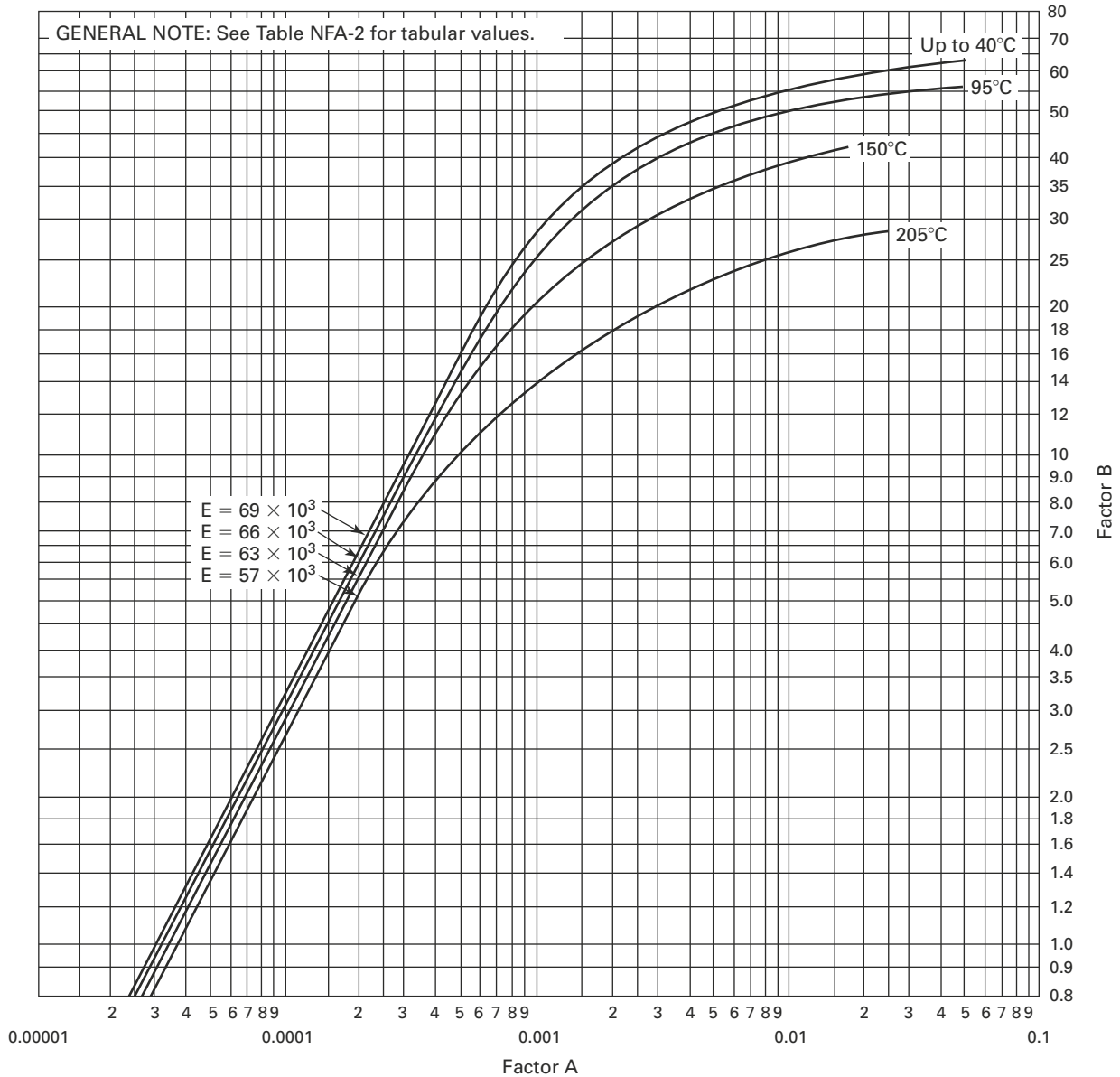
Figure NFA-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 3003 in O Temper



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

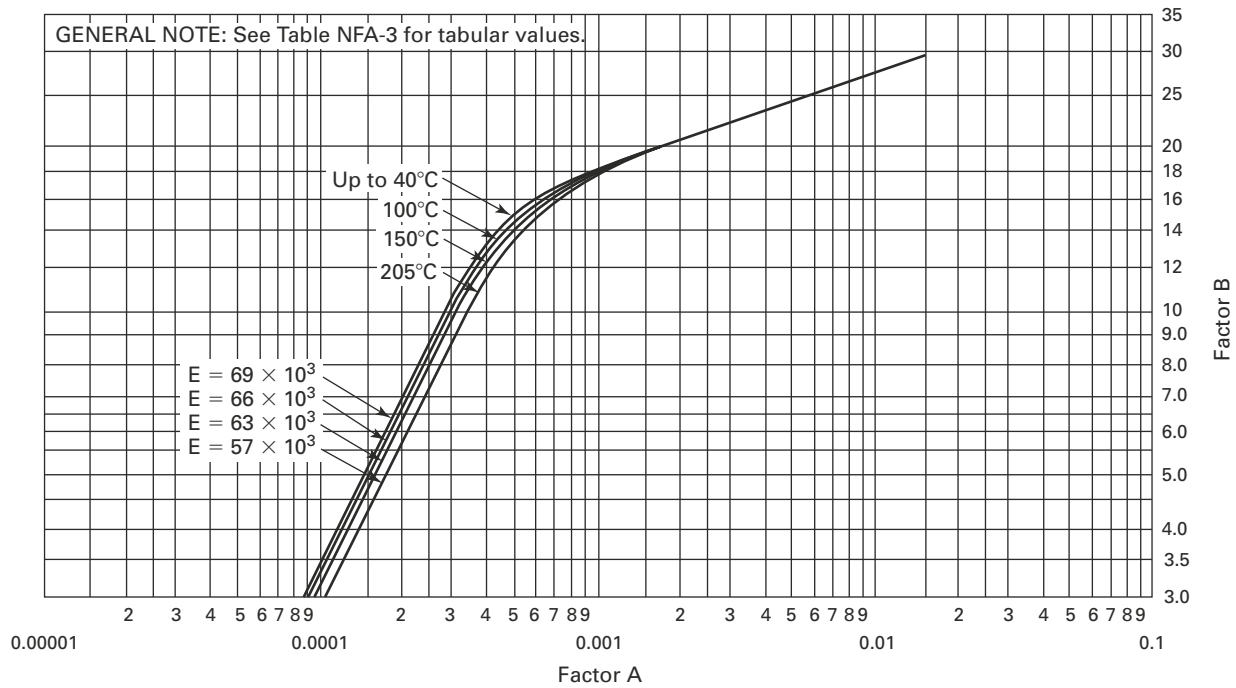
Figure NFA-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 3003 in H14 Temper



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.
- This chart is not to be used for welded construction.

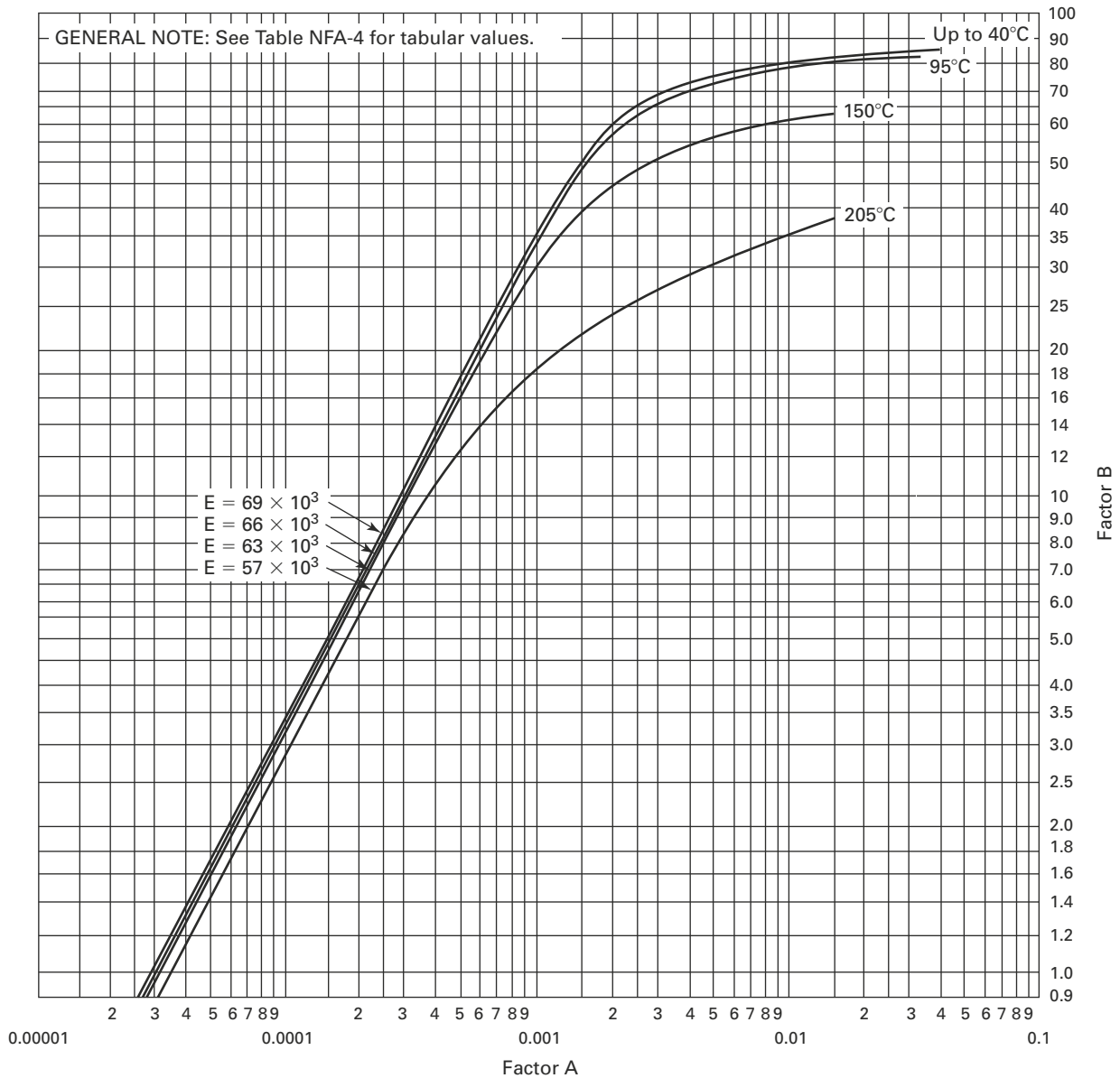
Figure NFA-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 3004 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

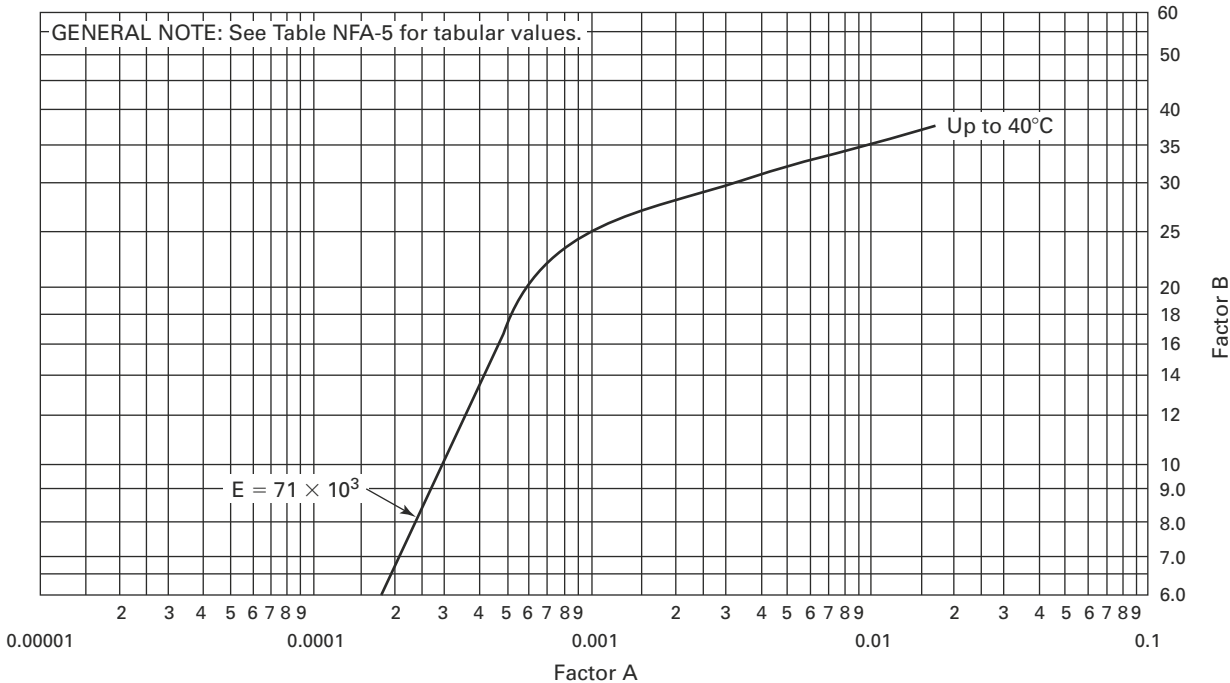
Figure NFA-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 3004 in H34 Temper



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.
- This chart is not to be used for welded construction.

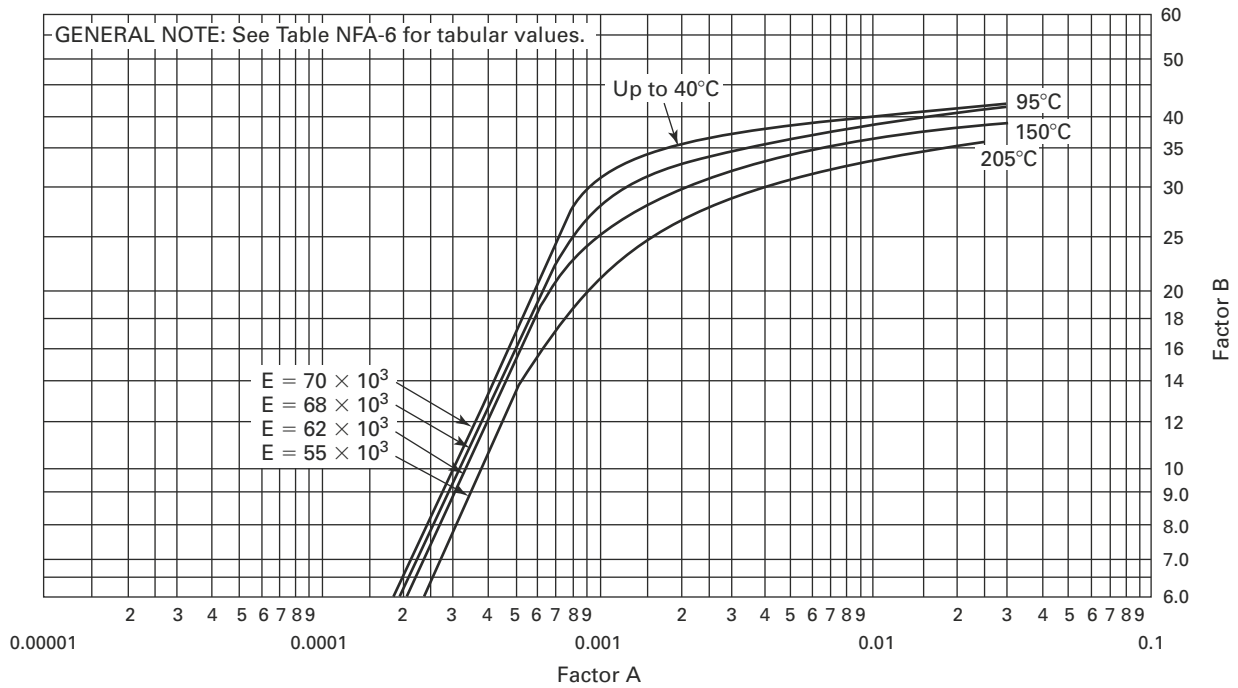
Figure NFA-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5154 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

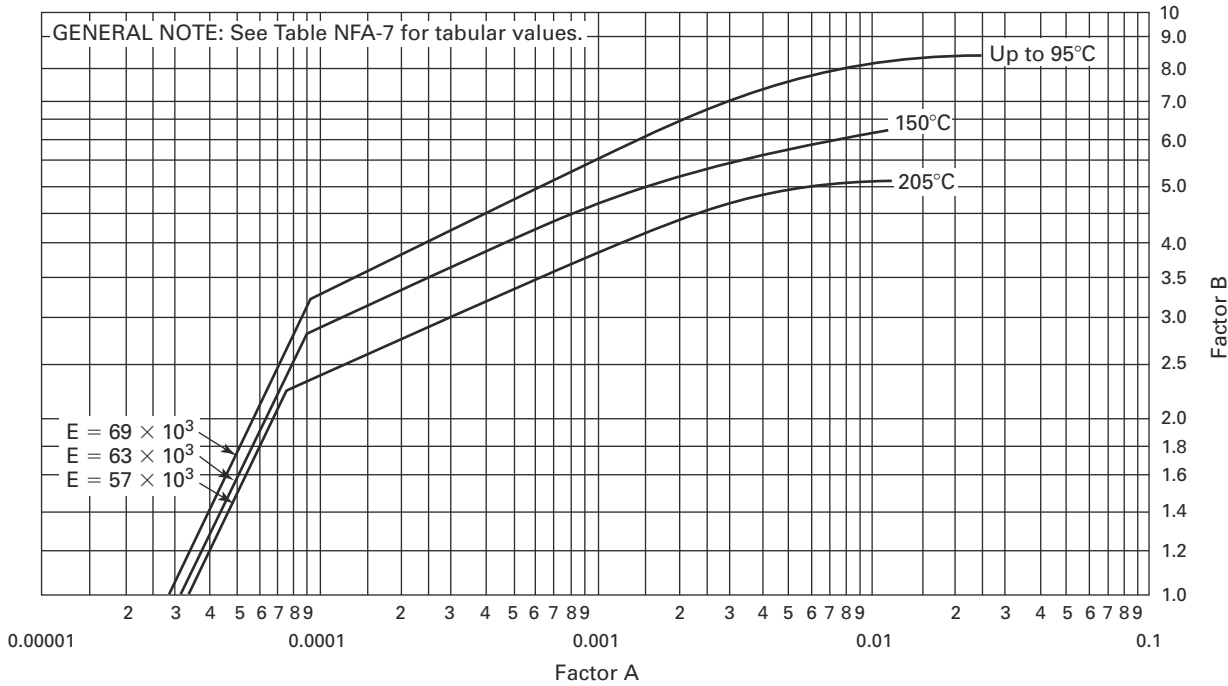
Figure NFA-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5454 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

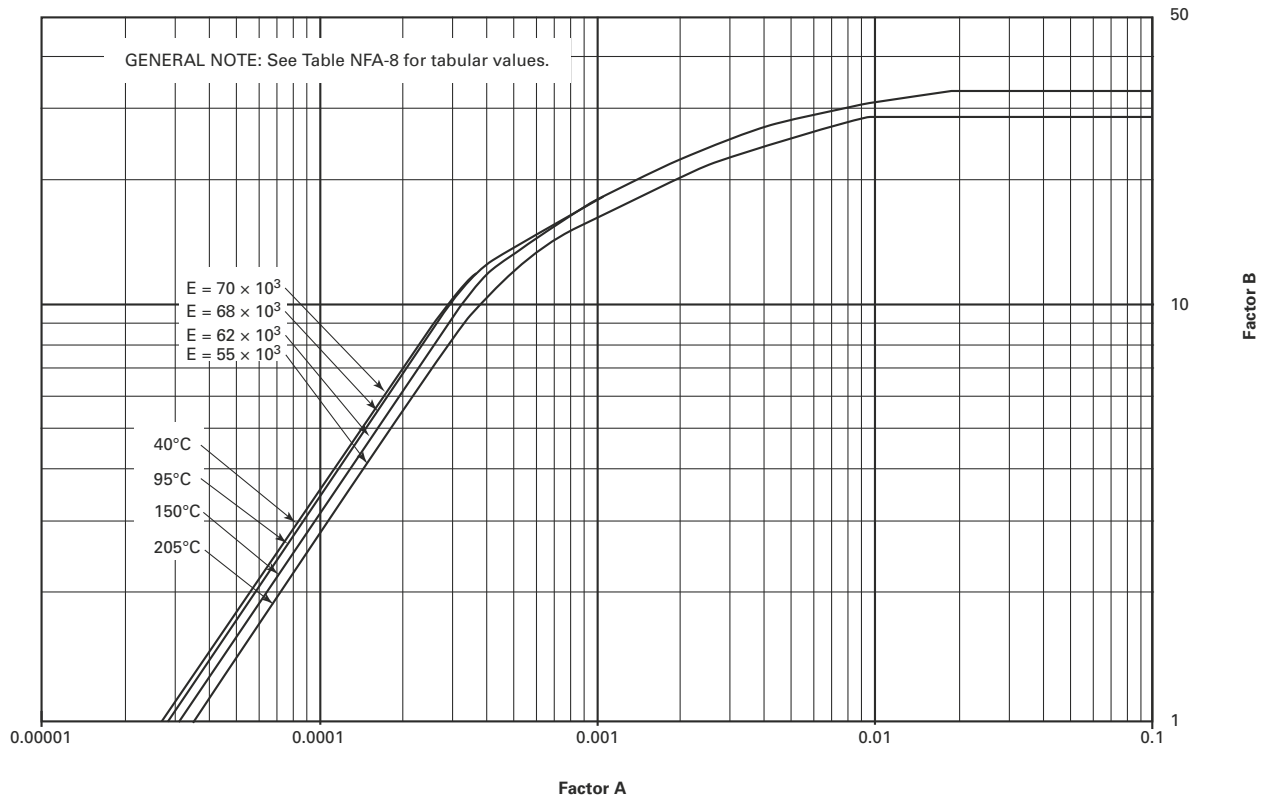
Figure NFA-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Alloy 1060 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

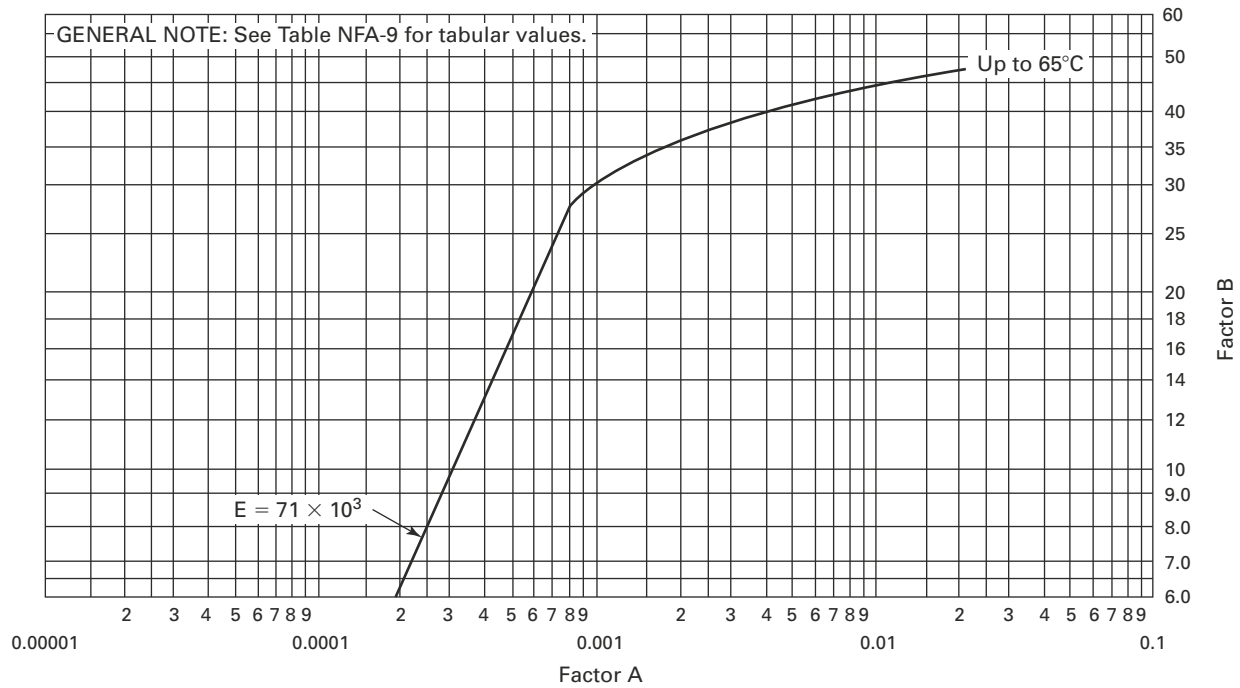
Figure NFA-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5052 in O Temper



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

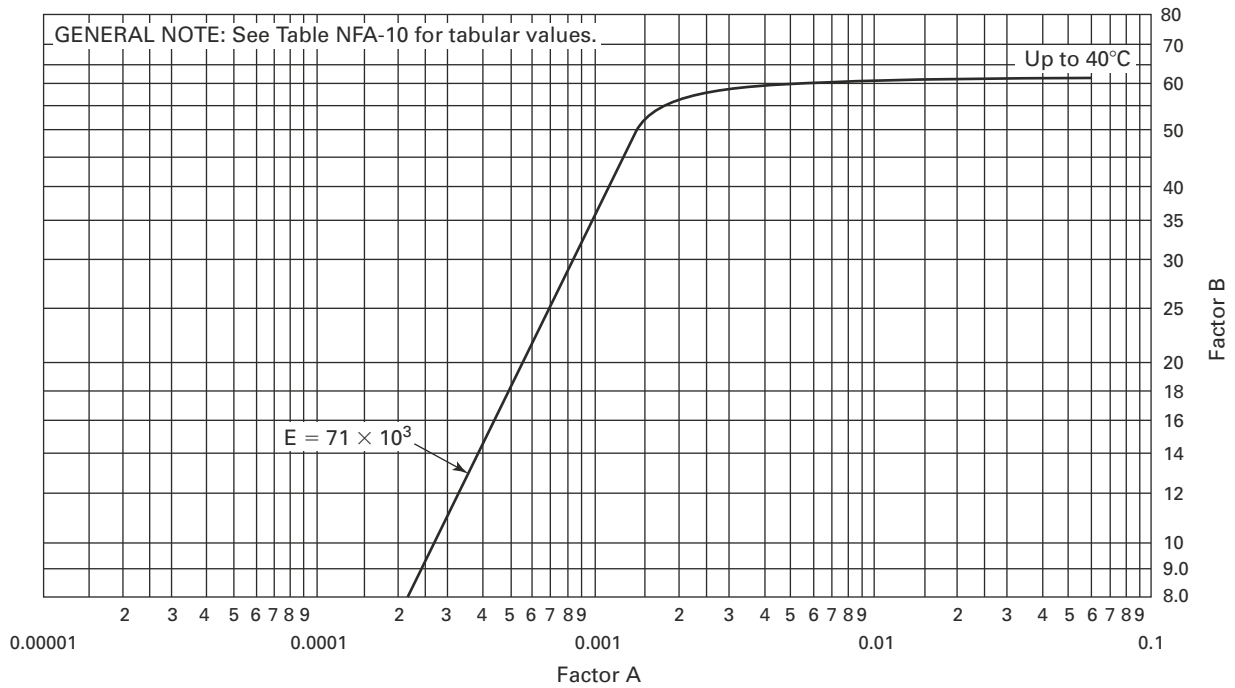
Figure NFA-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5086 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

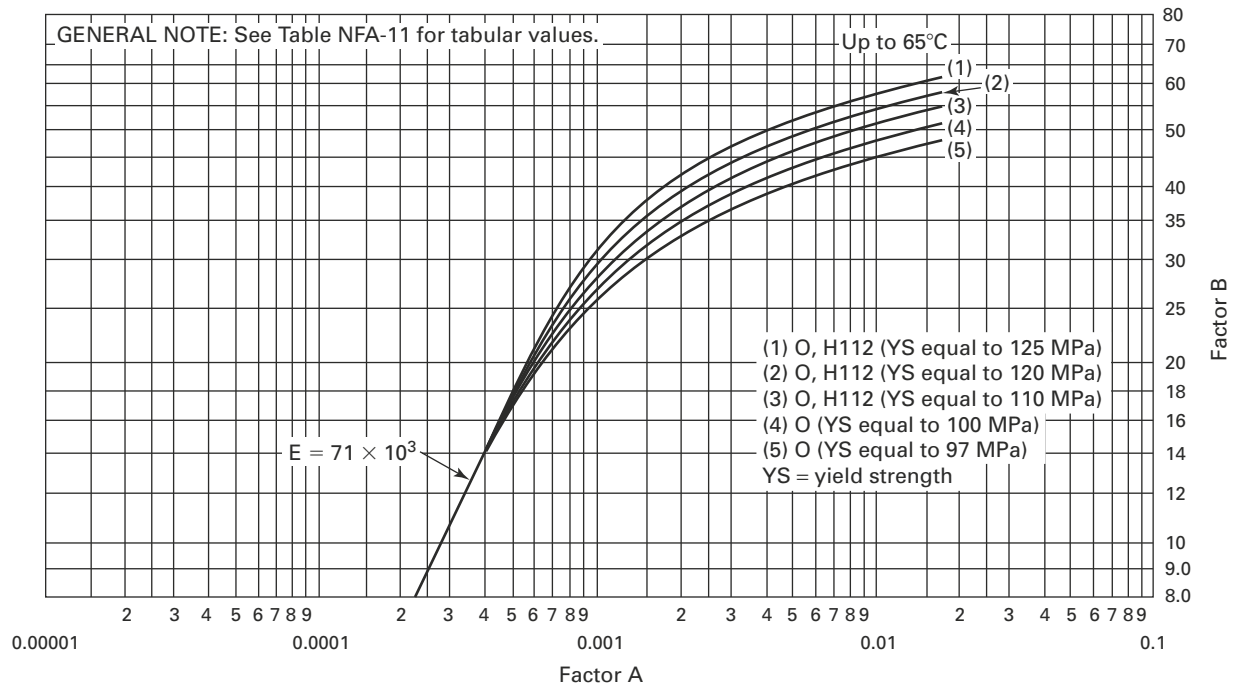
Figure NFA-10
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5456 in 0 Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

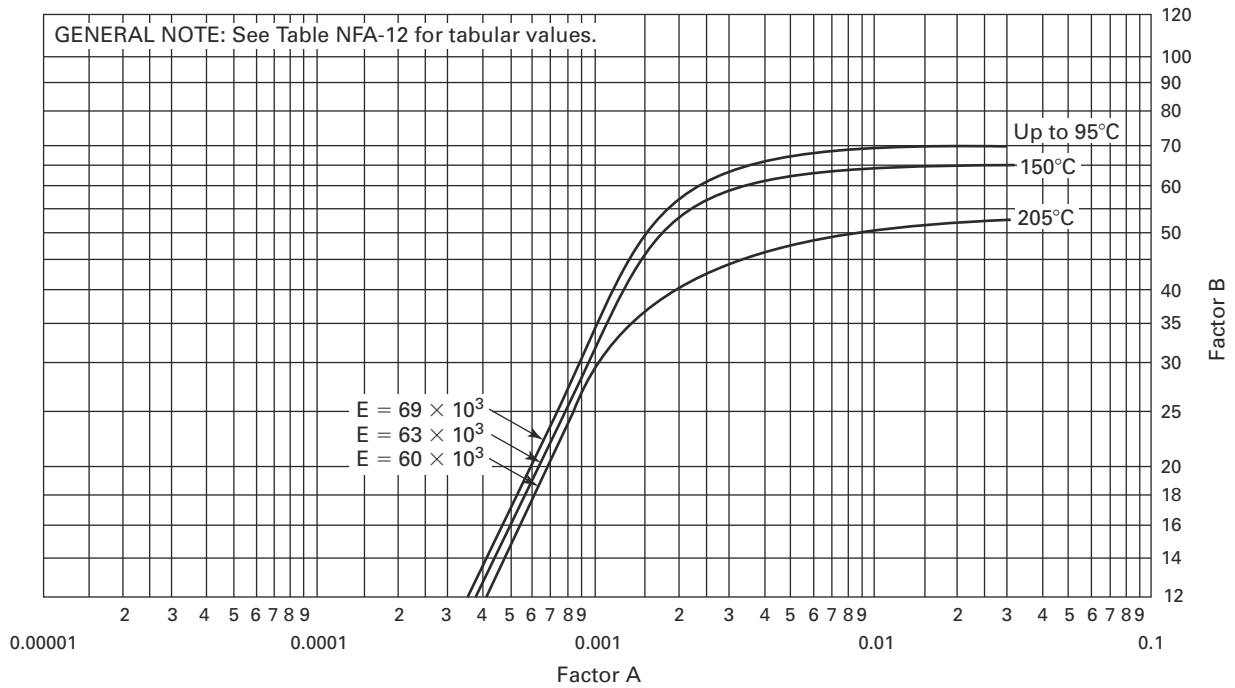
Figure NFA-11
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Aluminum Alloy 5083 in O Temper



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

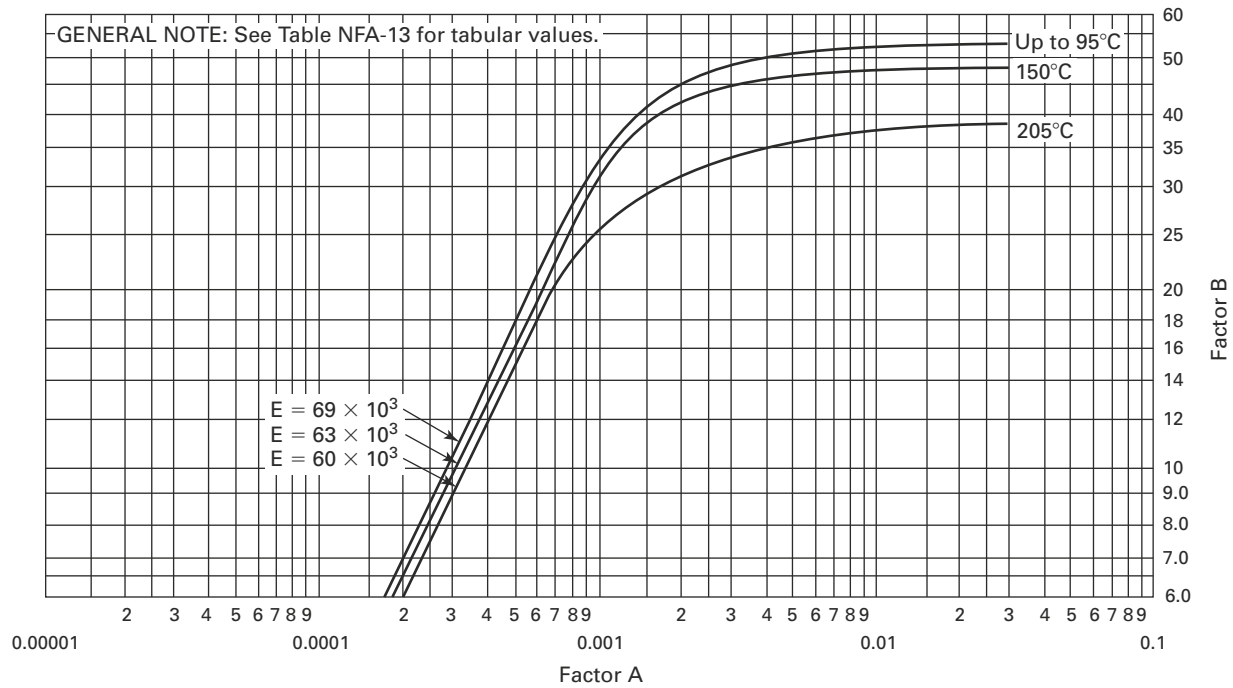
Figure NFA-12
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded
Aluminum Alloy 6061-T6



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

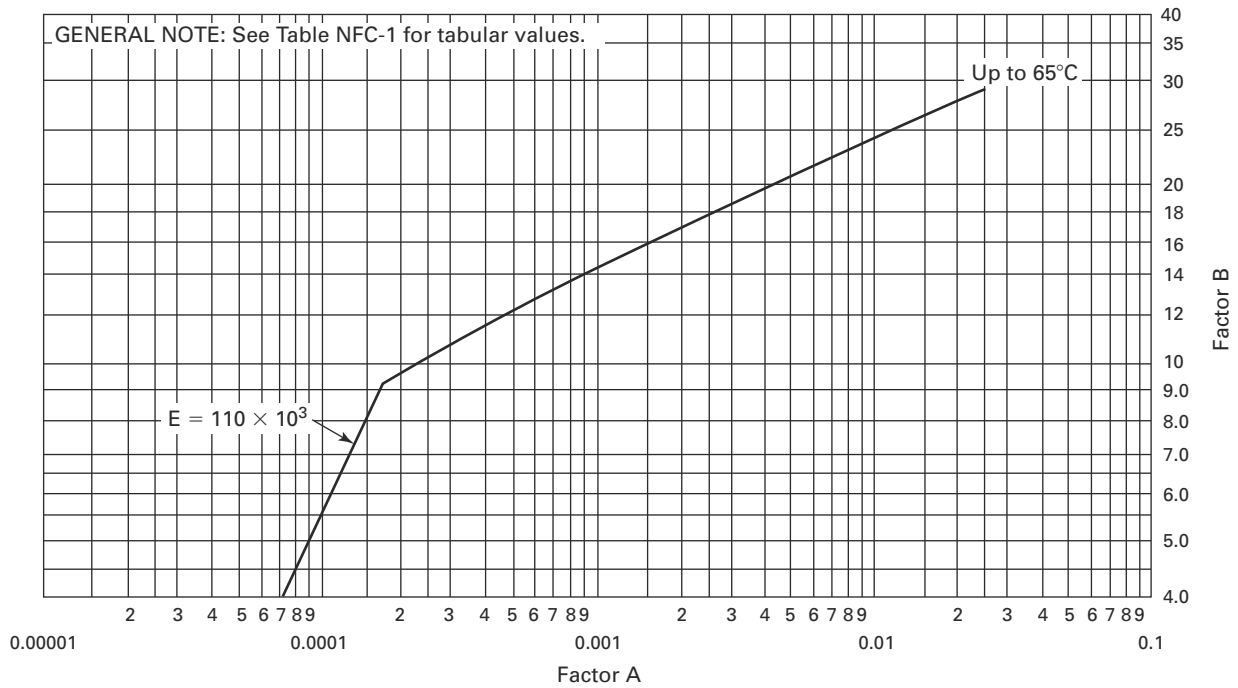
Figure NFA-13
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded
Aluminum Alloy 6061-T4



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

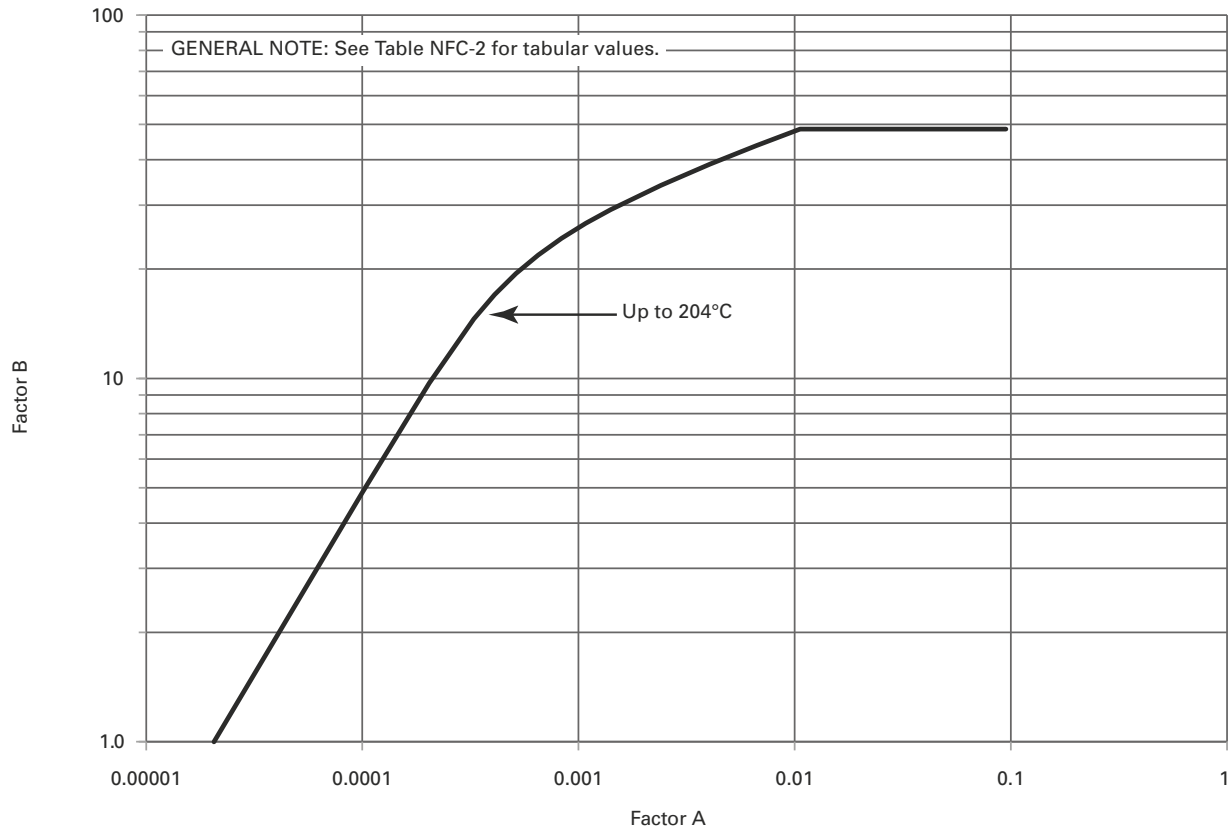
Figure NFC-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Copper, Type DHP



GENERAL NOTES:

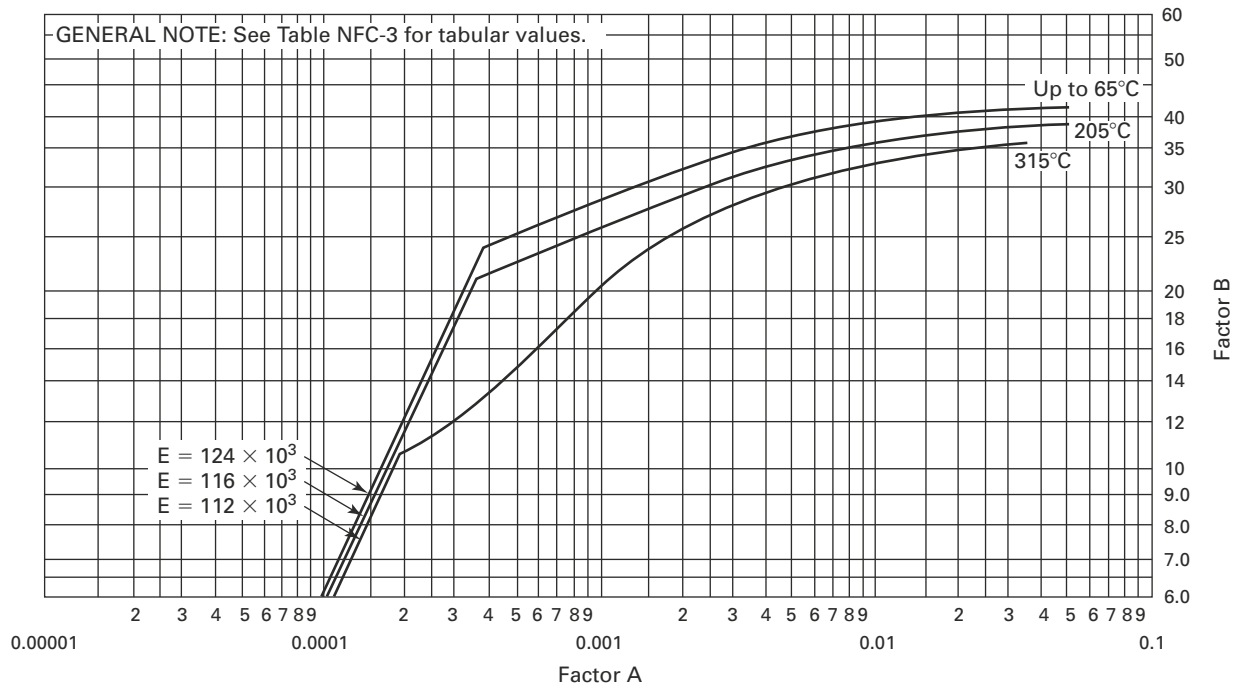
- (a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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 Alloy C65500



- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
 - (b) The external pressure chart assigned for a particular material is obtained from 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.

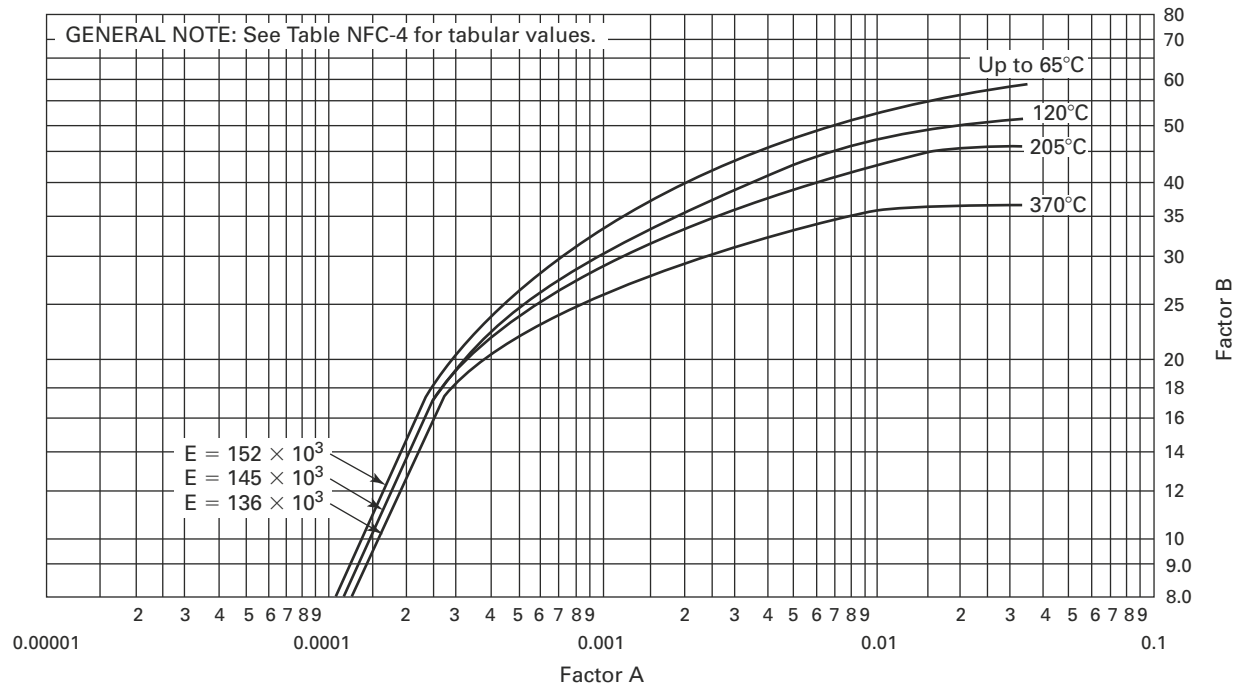
Figure NFC-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed 90-10 Copper-Nickel Alloy



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

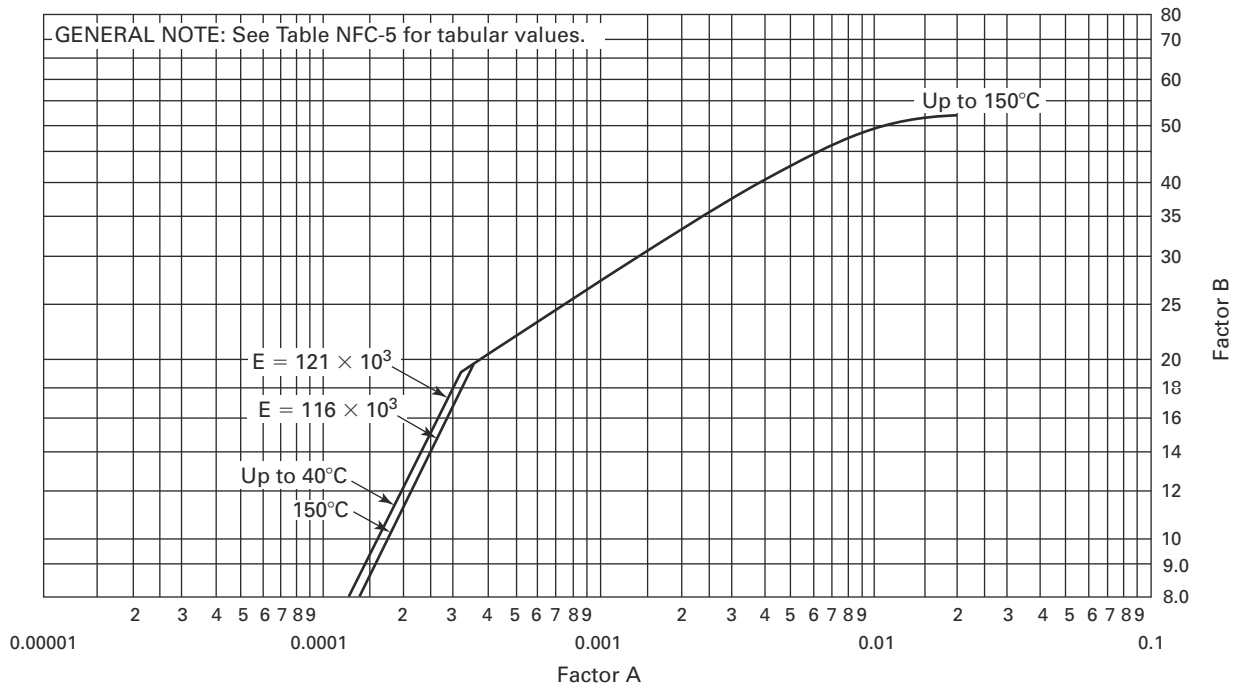
Figure NFC-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed 70-30 Copper-Nickel Alloy



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

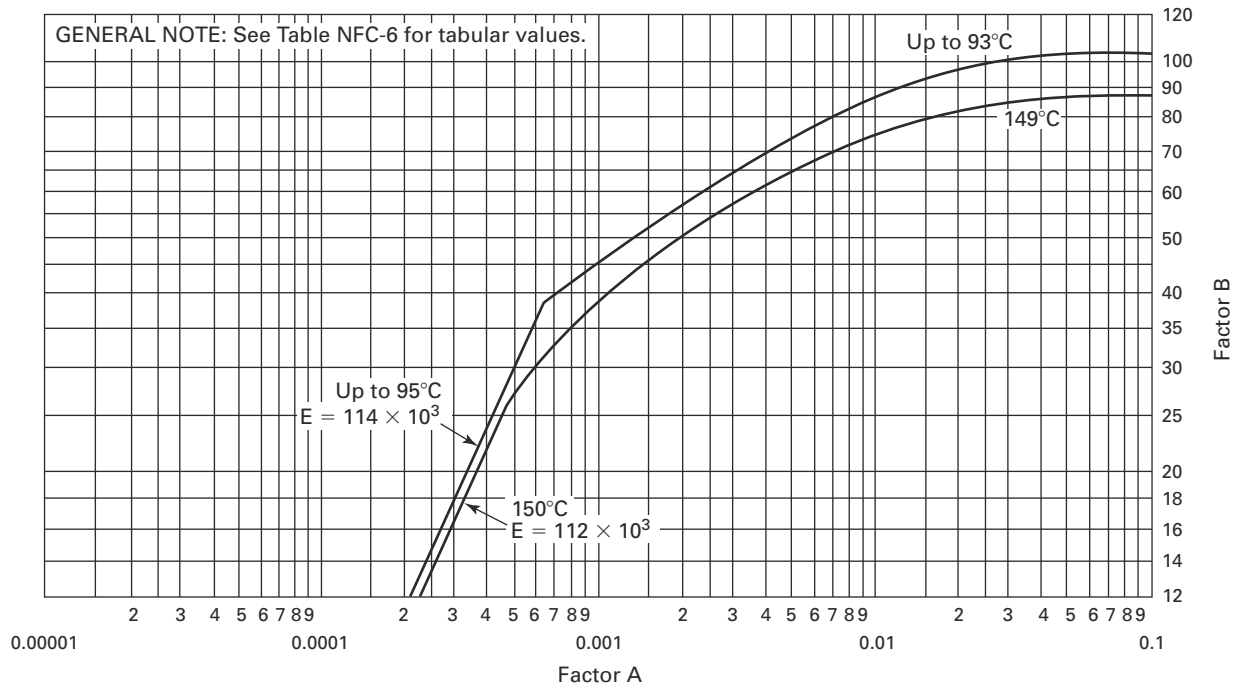
Figure NFC-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Welded
Copper-Iron Alloy Tube C19400 (SB-543 Welded)



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

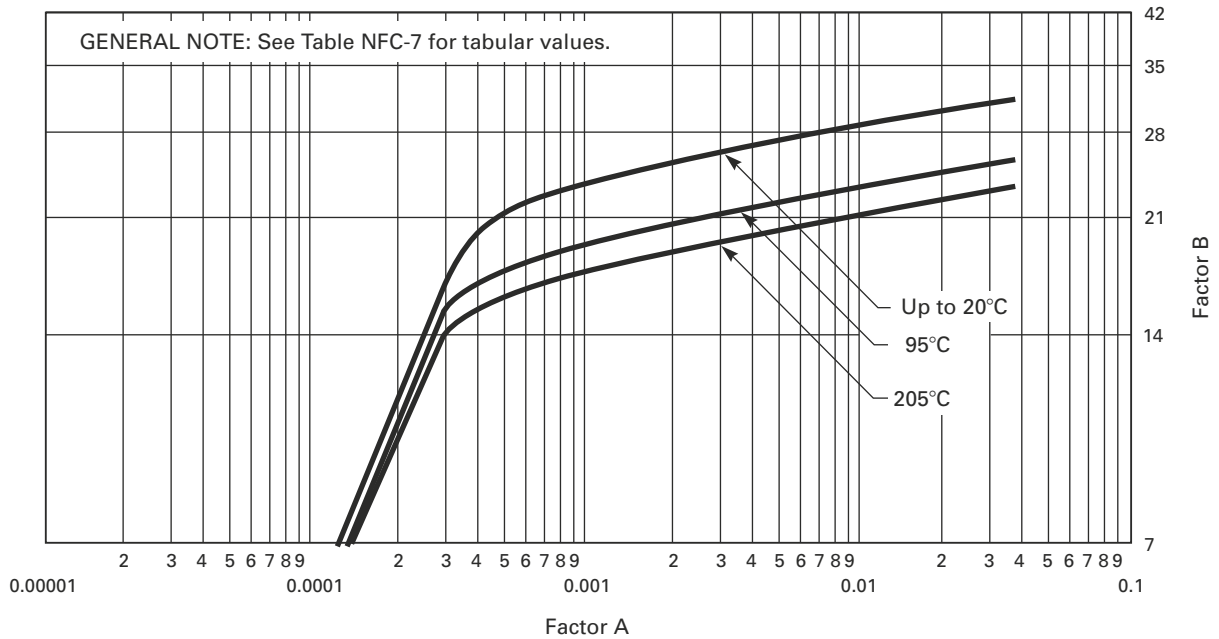
Figure NFC-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for SB-75
and SB-111 Light Drawn Seamless Copper Tubes, Alloys C10200, C12000, C12200, and C14200



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

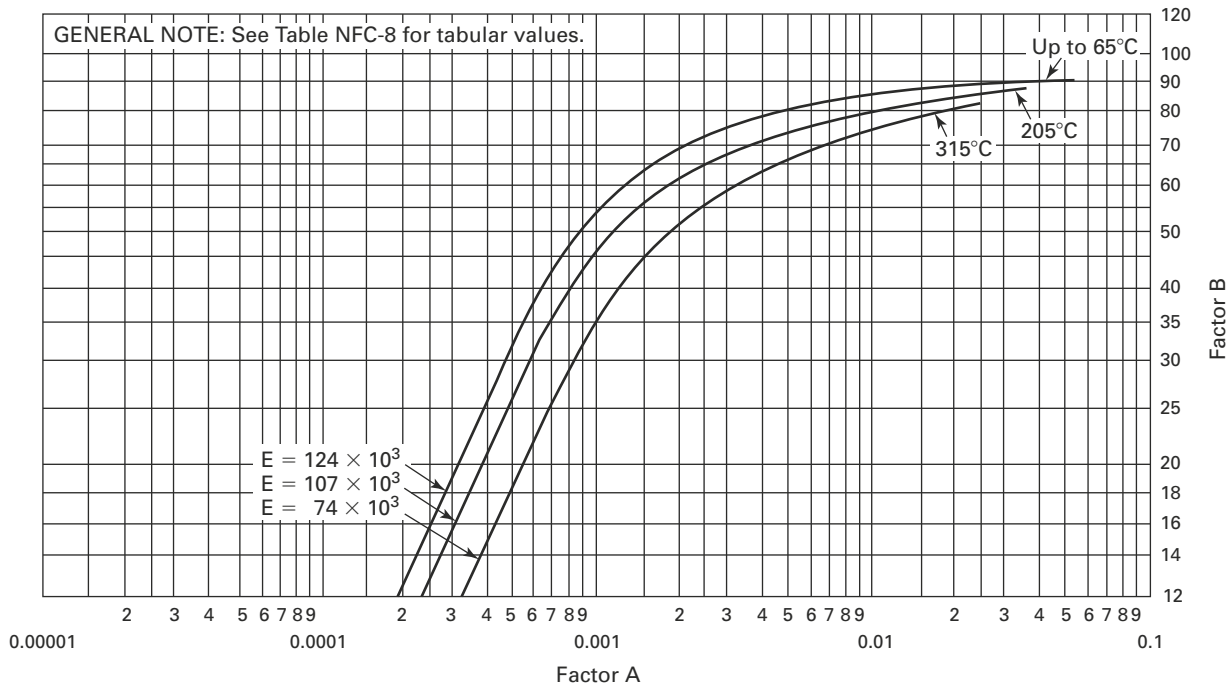
Figure NFC-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Copper, SB-75, UNS C12200, Temper O50



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

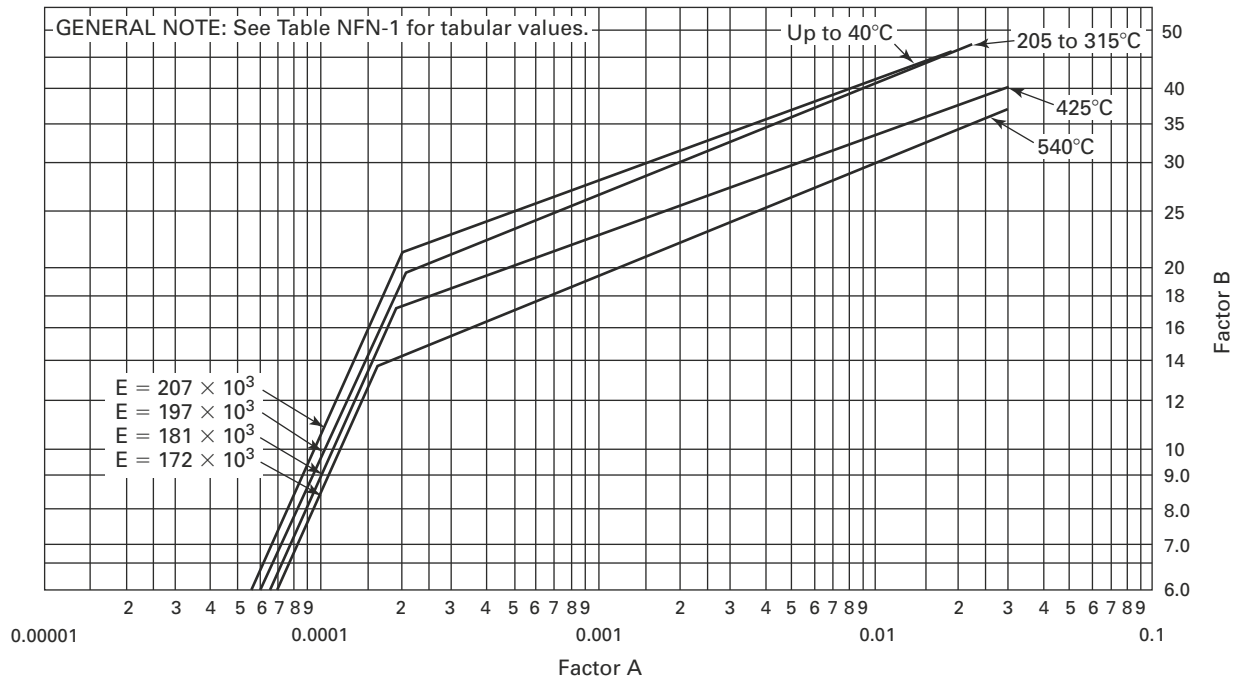
Figure NFC-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Aluminum Bronze Alloy C61400



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

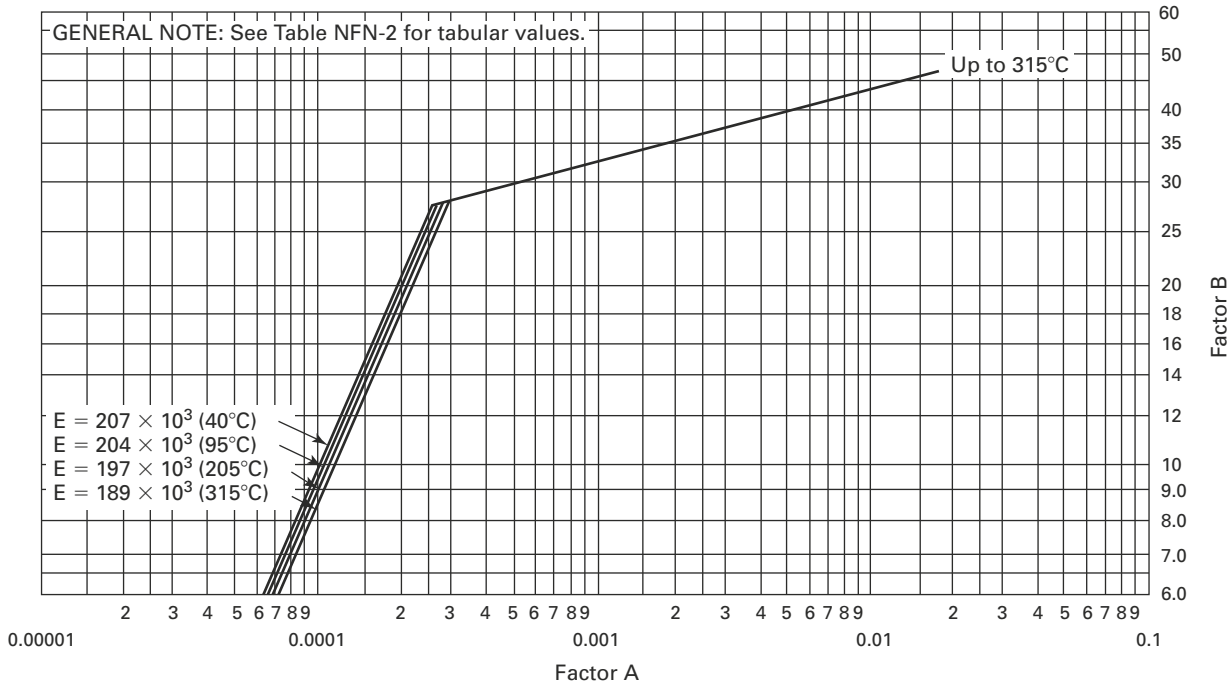
Figure NFN-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Low Carbon Nickel N02201



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

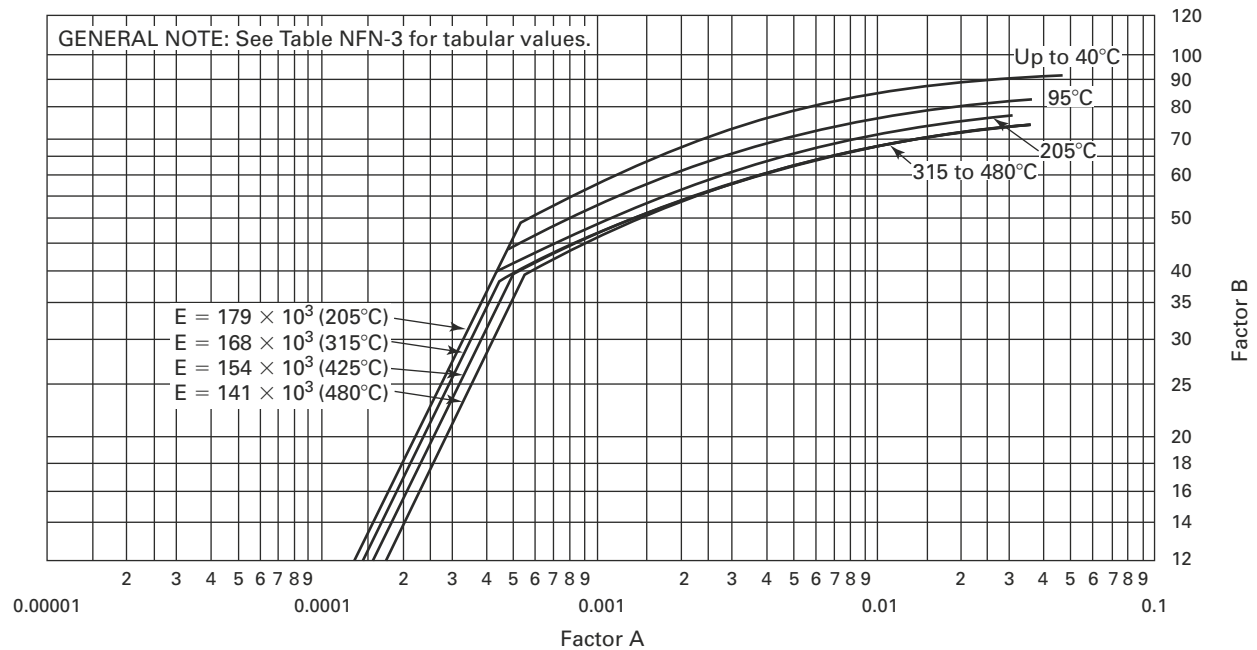
Figure NFN-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Annealed Nickel N02200



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

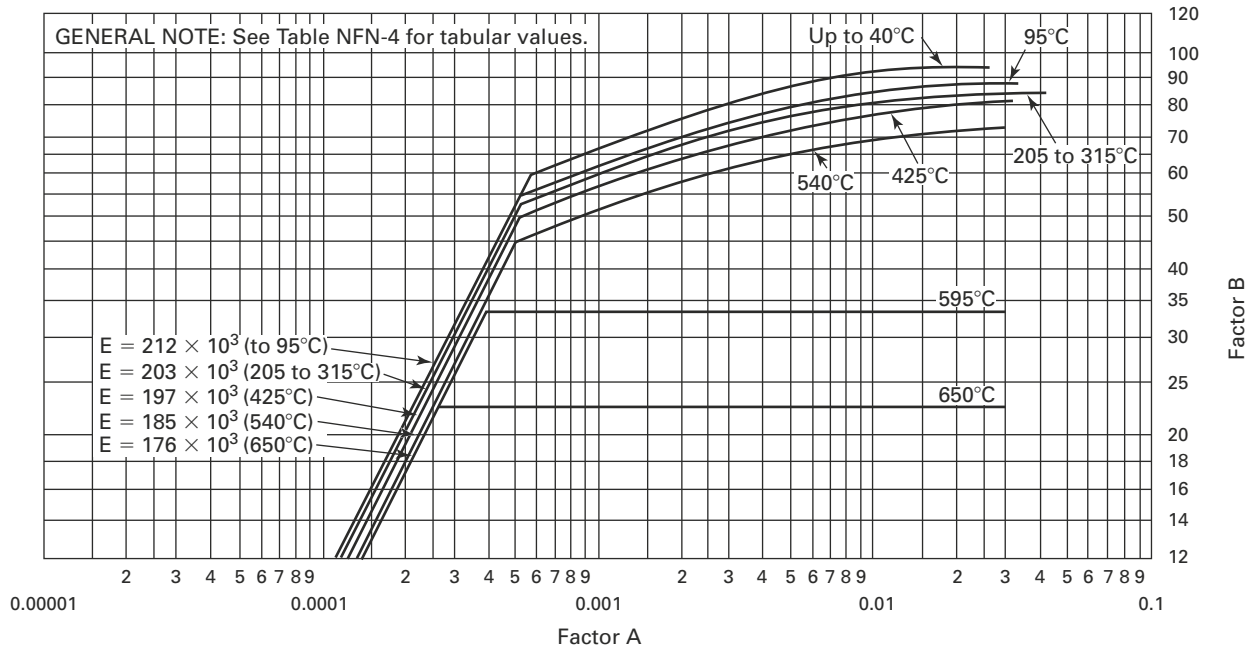
Figure NFN-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Nickel–Copper Alloy N04400



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

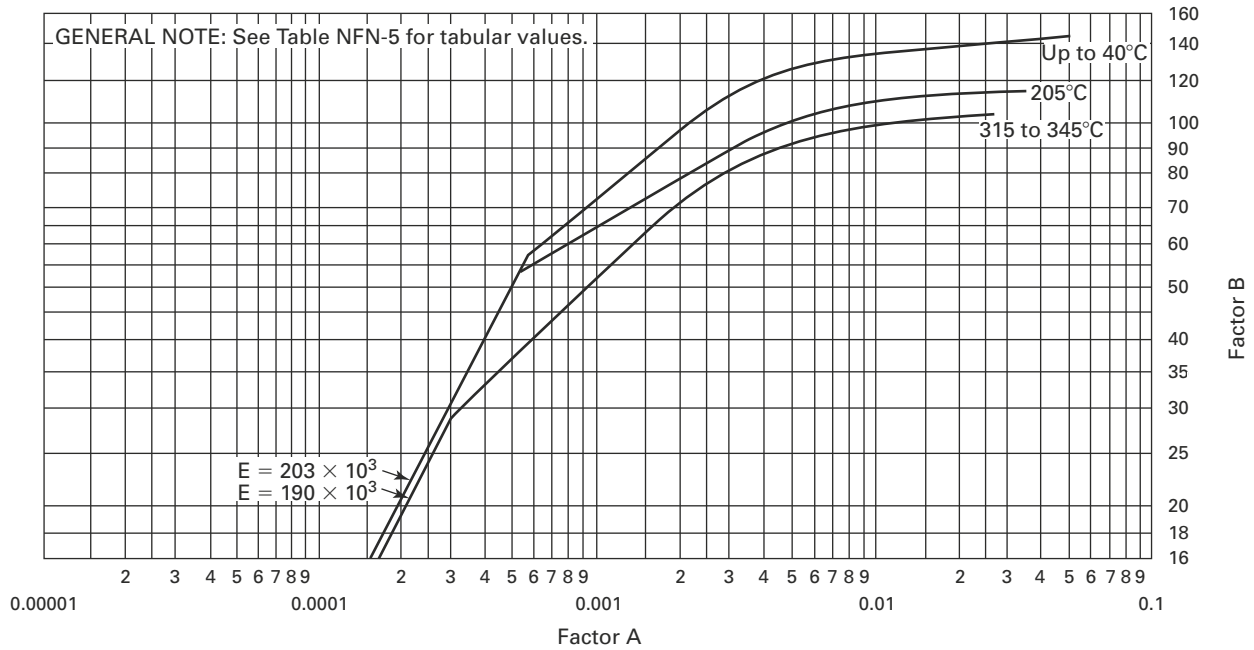
Figure NFN-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Nickel–Chromium–Iron Alloy N06600



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

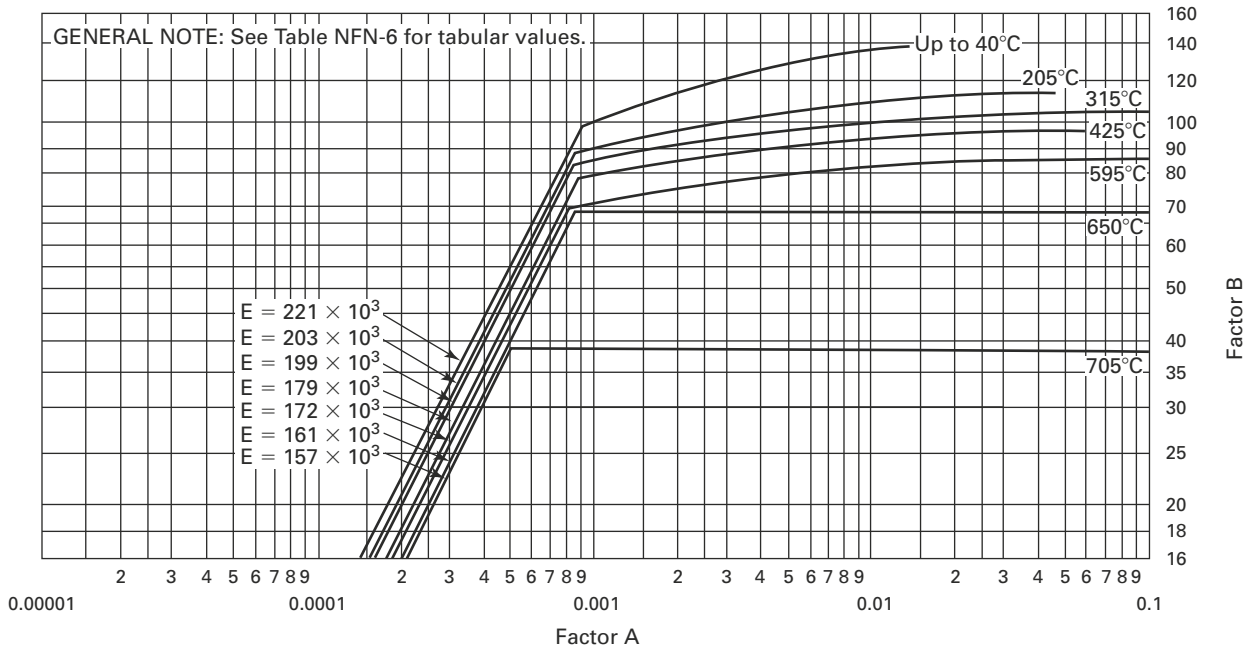
Figure NFN-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Nickel–Molybdenum Alloy N10001



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

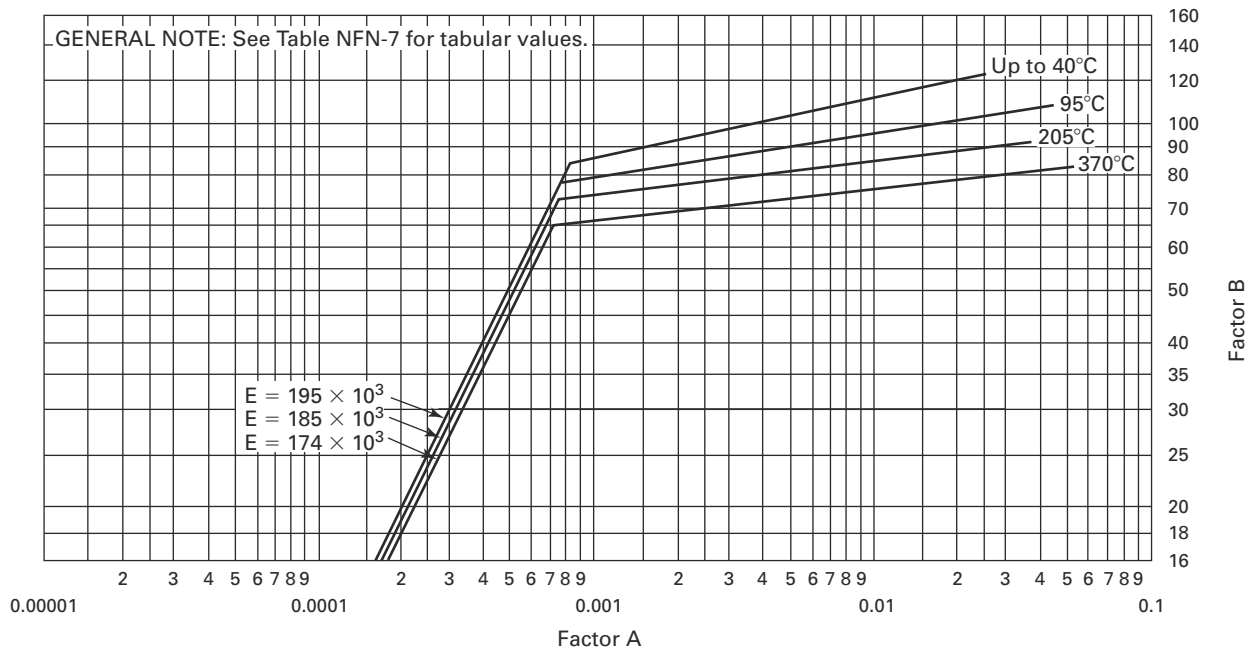
Figure NFN-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron Alloy N10003



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

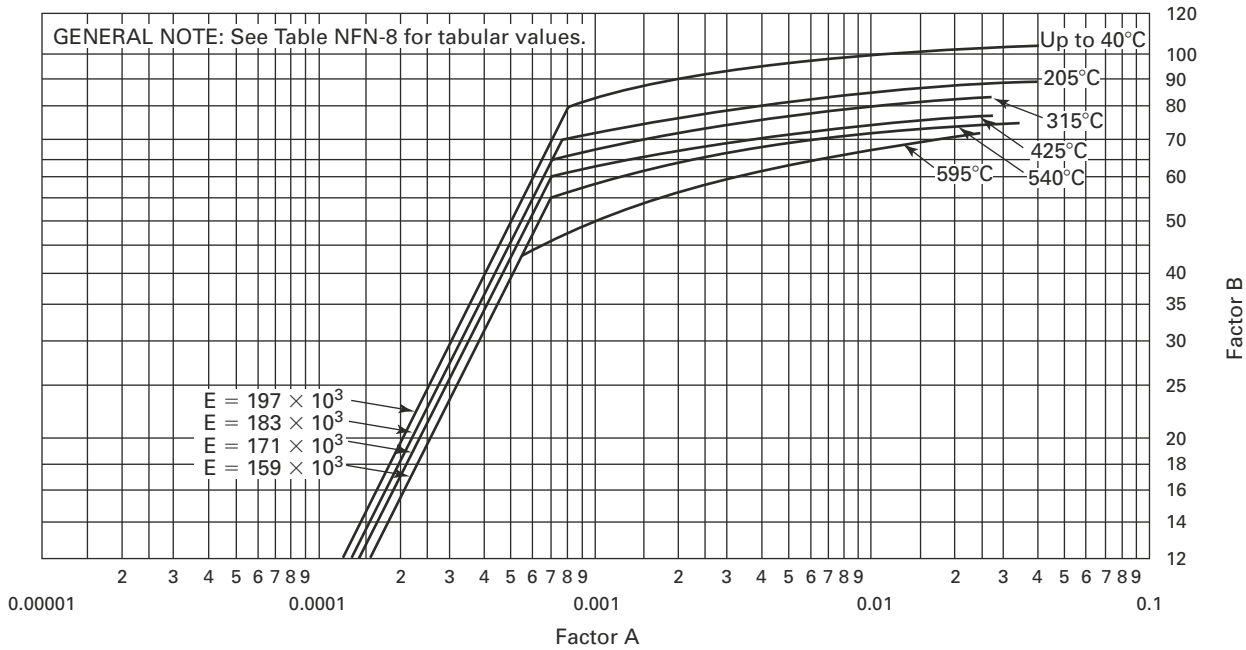
Figure NFN-7
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Iron–Chromium–Molybdenum–Copper Alloy N08825



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

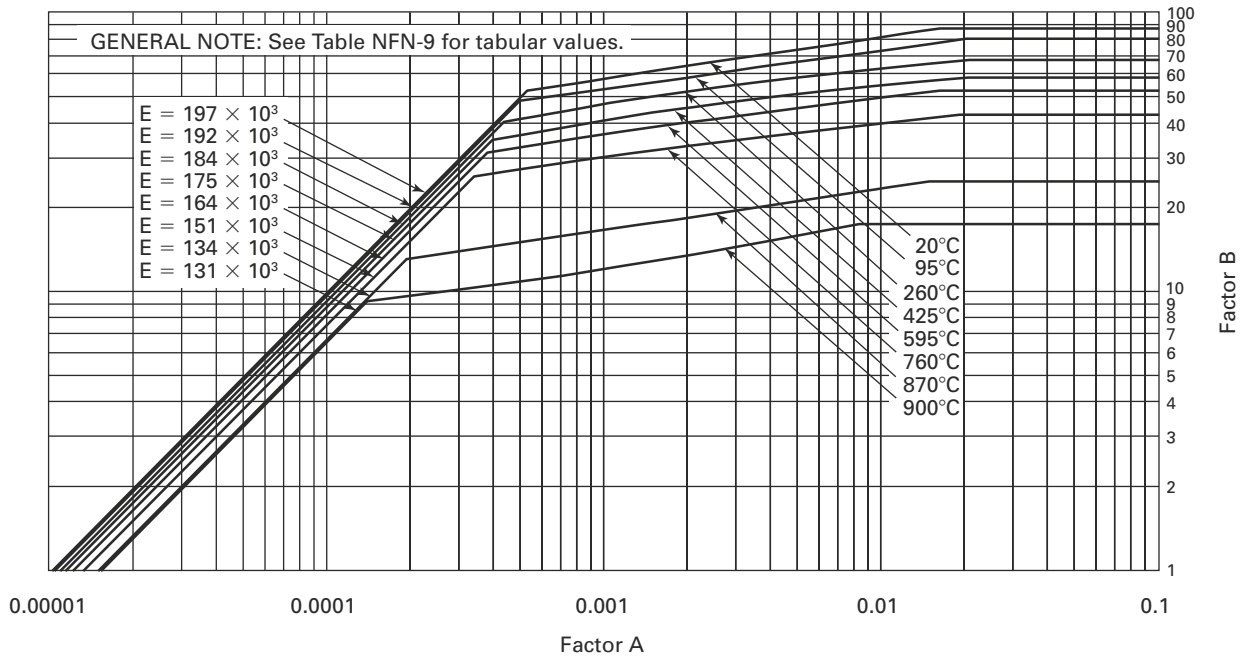
Figure NFN-8
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Nickel-Iron-Chromium Alloy N08800



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

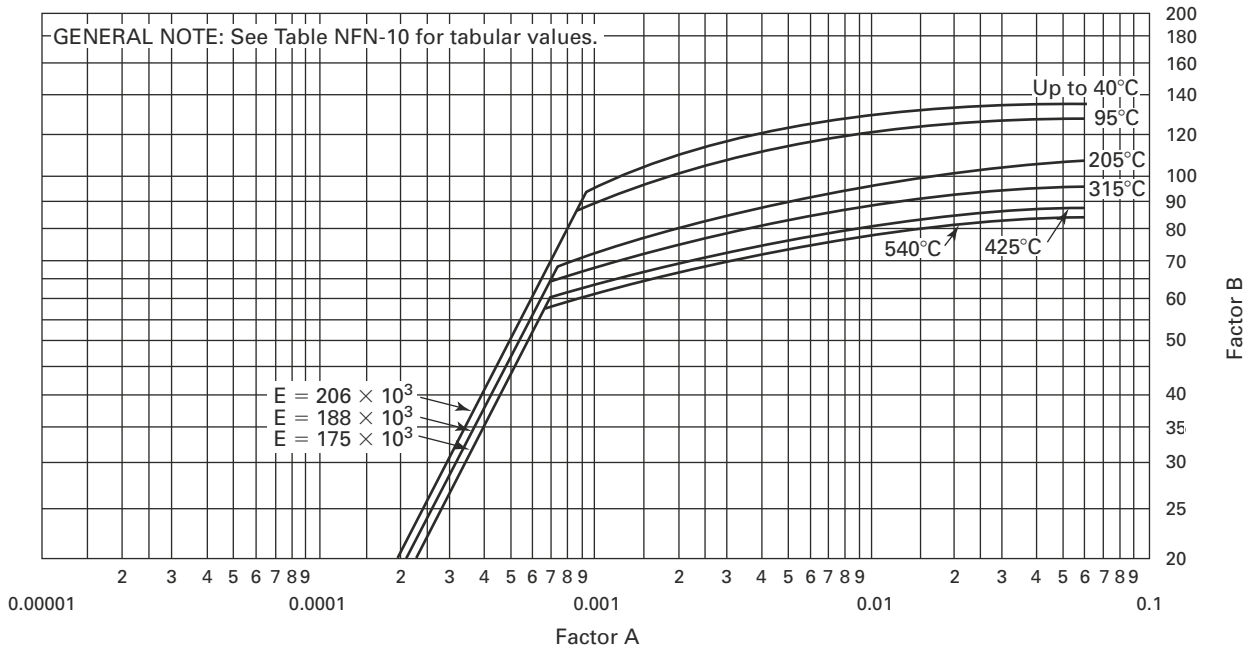
Figure NFN-9
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Nickel-Iron-Chromium Alloy N08810



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

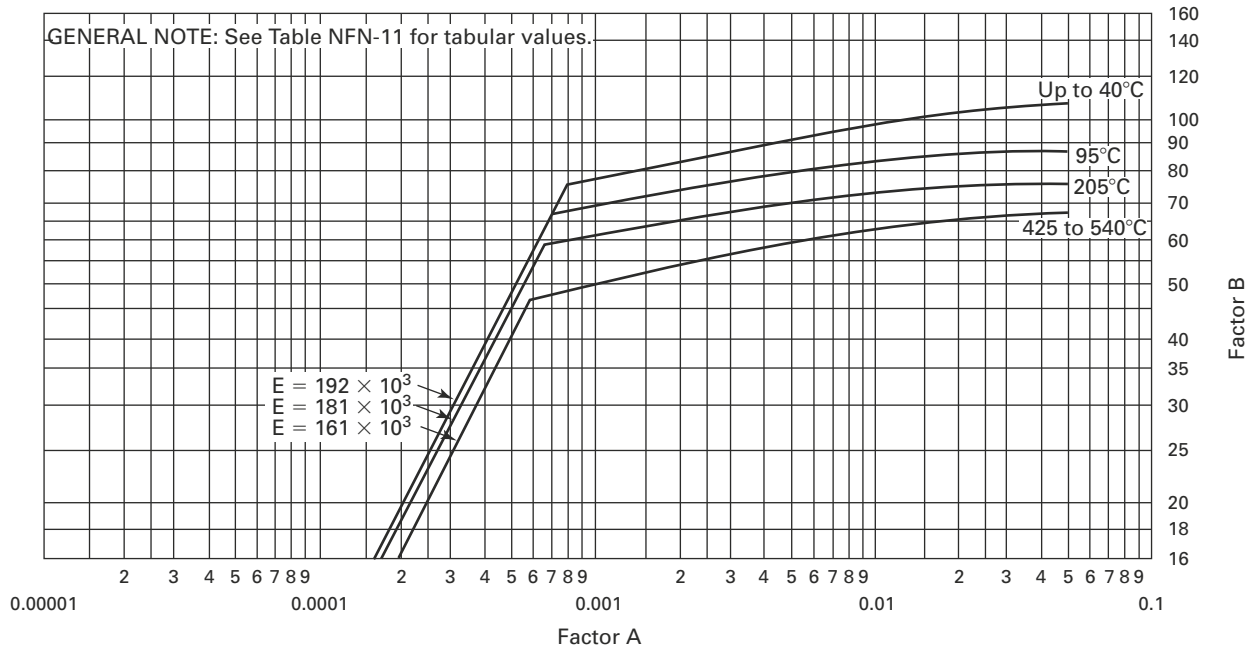
Figure NFN-10
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Low Carbon Nickel–Molybdenum–Chromium Alloy N10276



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

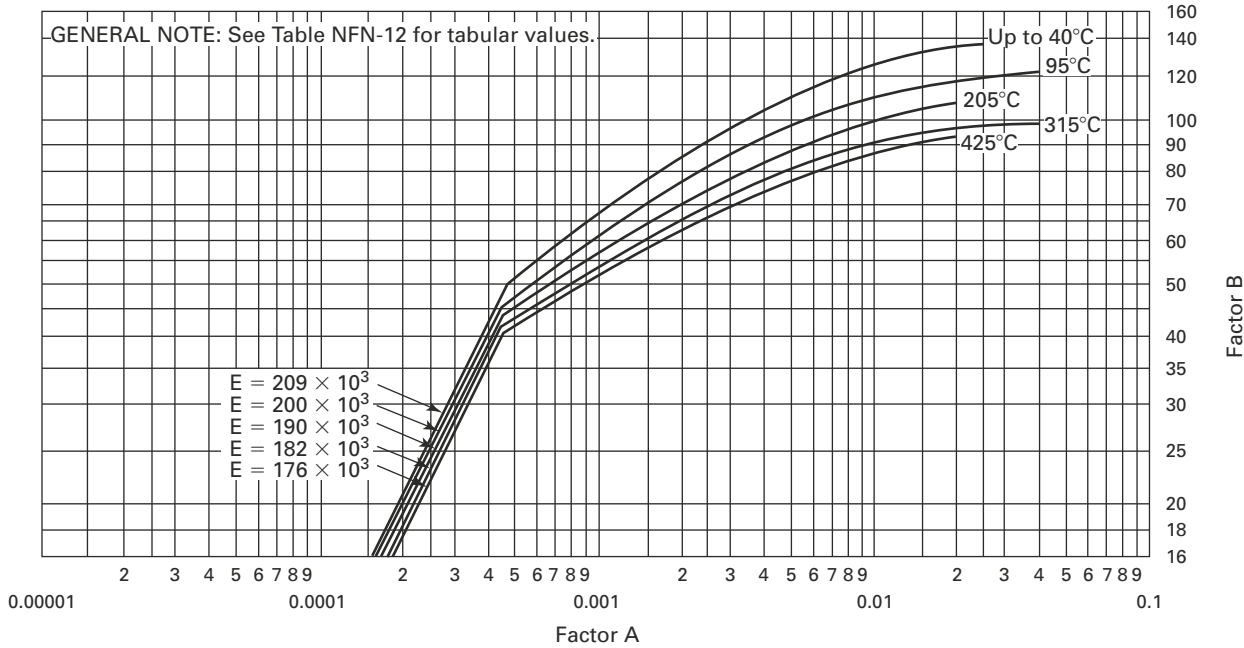
Figure NFN-11
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution Treated Nickel–Chromium–Iron–Molybdenum–Copper Alloy N06007



GENERAL NOTES:

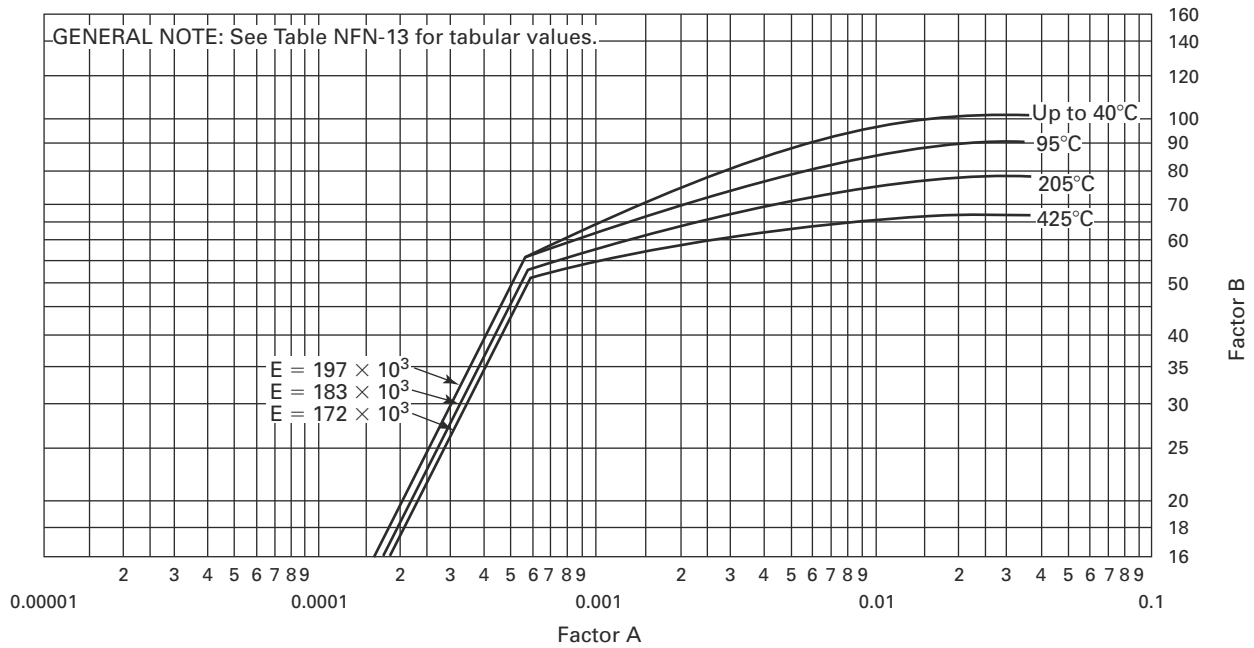
- (a) The external pressure charts do not account for reduction of buckling strength due to creep under long-term loads. The effect of creep on buckling shall be considered at temperatures for which allowable stresses are shown italicized in Tables 1A, 1B, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
 - (b) The external pressure chart assigned for a particular material is obtained from 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.

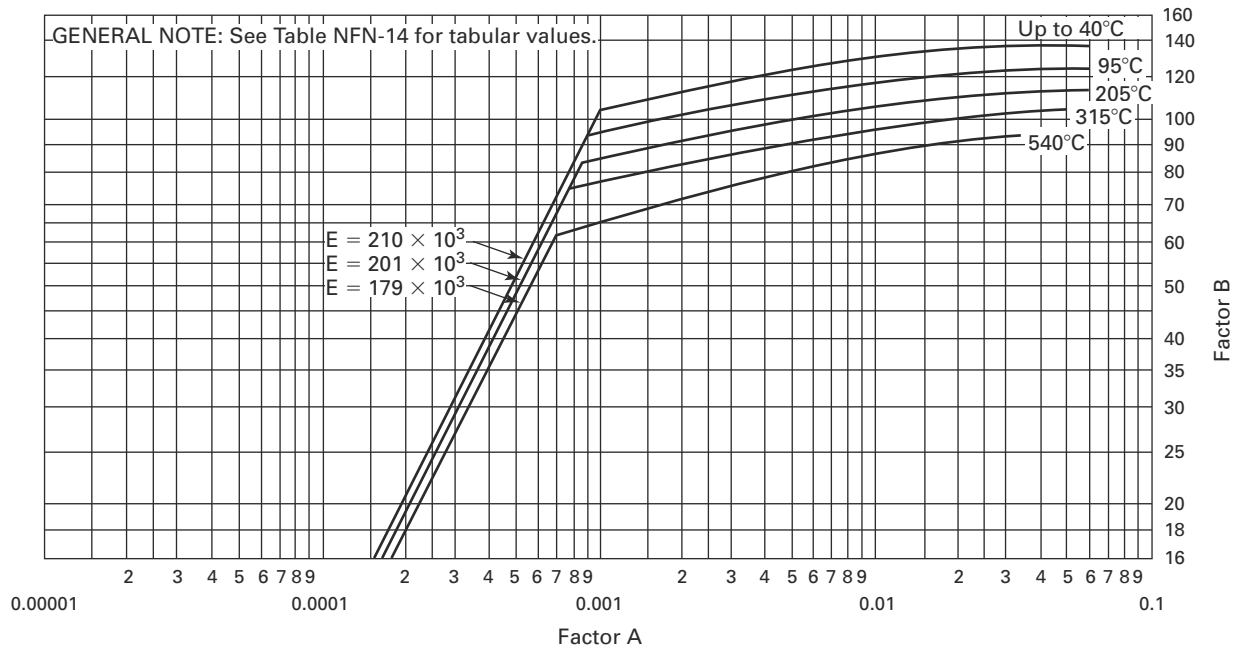
Figure NFN-13
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Iron–Chromium–Silicon Alloy N08330



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

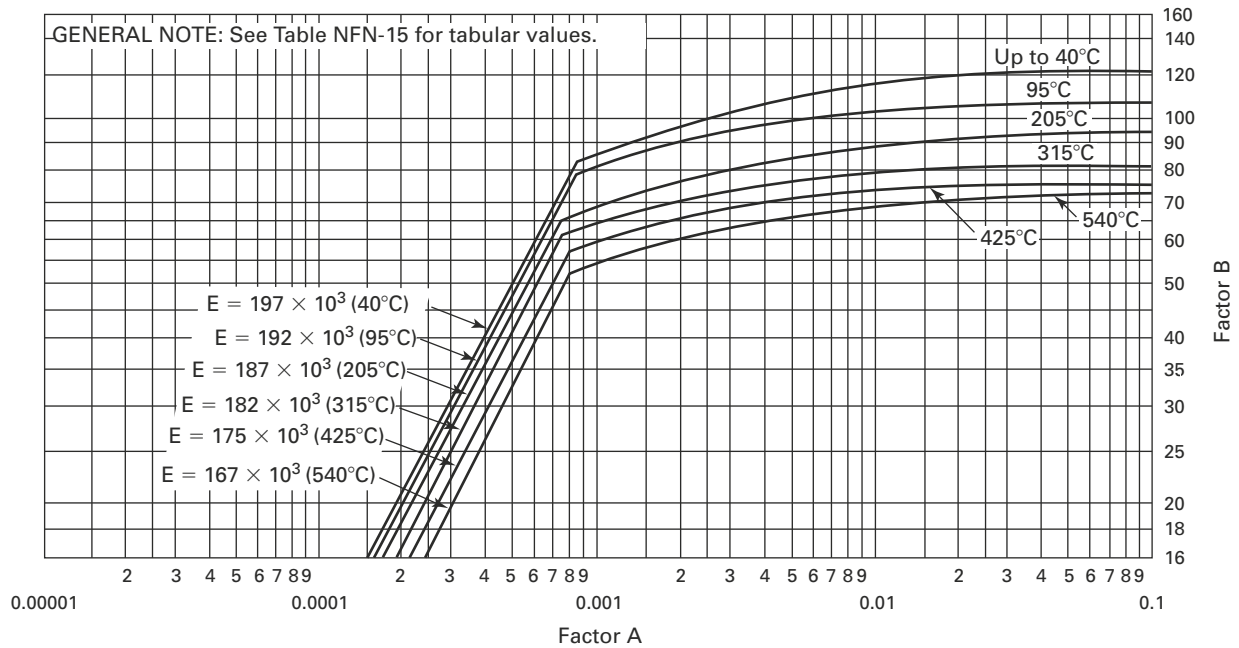
Figure NFN-14
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Chromium–Molybdenum Alloy N06455



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

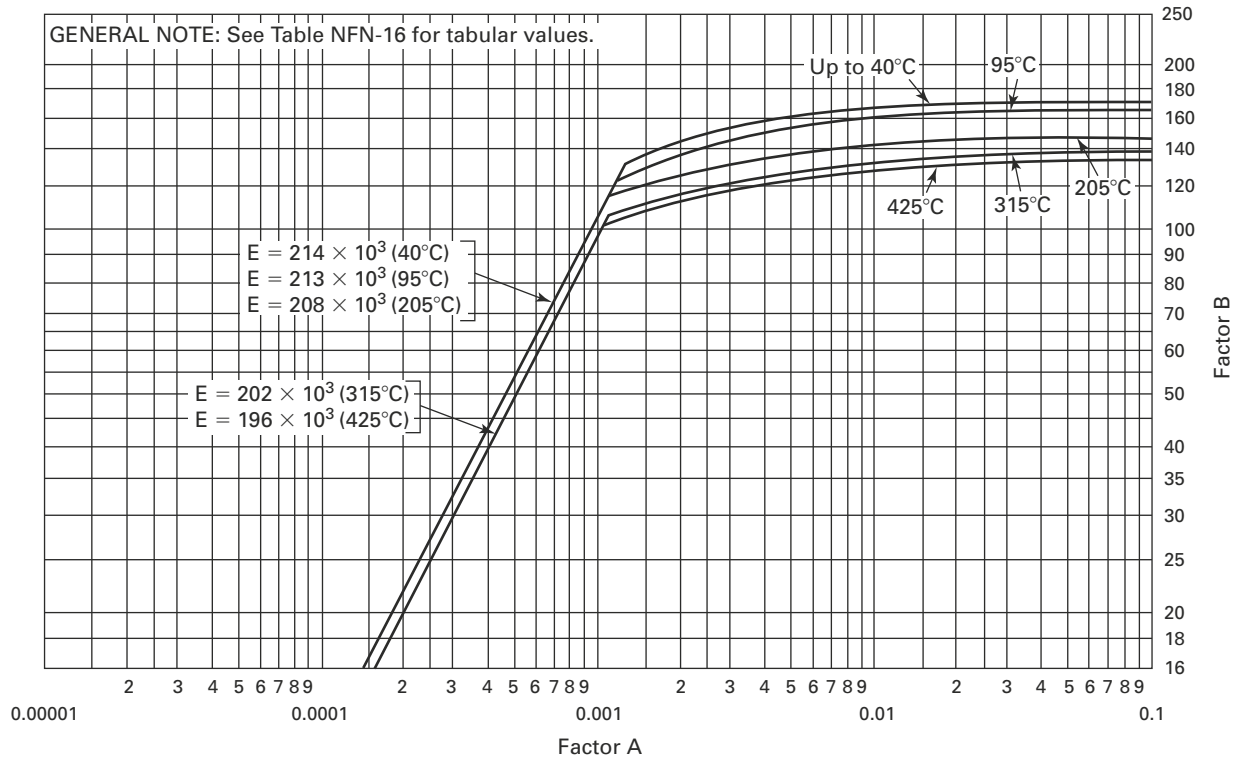
Figure NFN-15
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Nickel–Molybdenum Alloy N06002



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

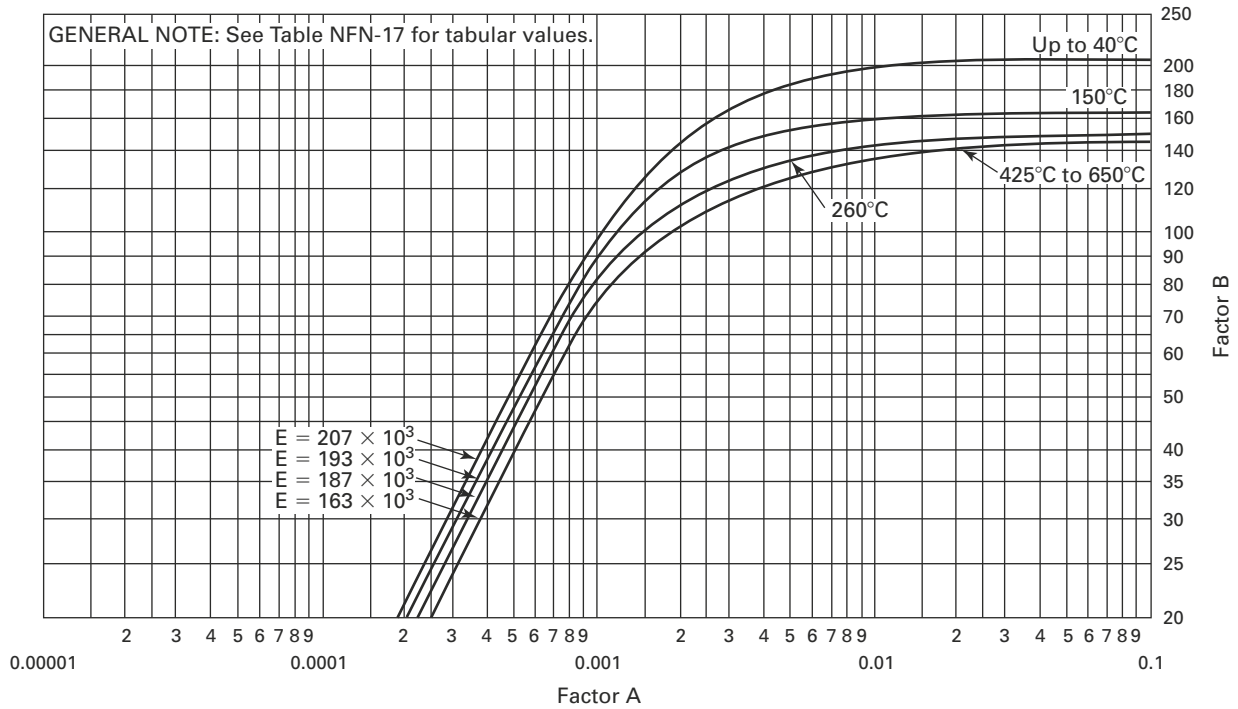
Figure NFN-16
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Nickel–Molybdenum Alloy N10665



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

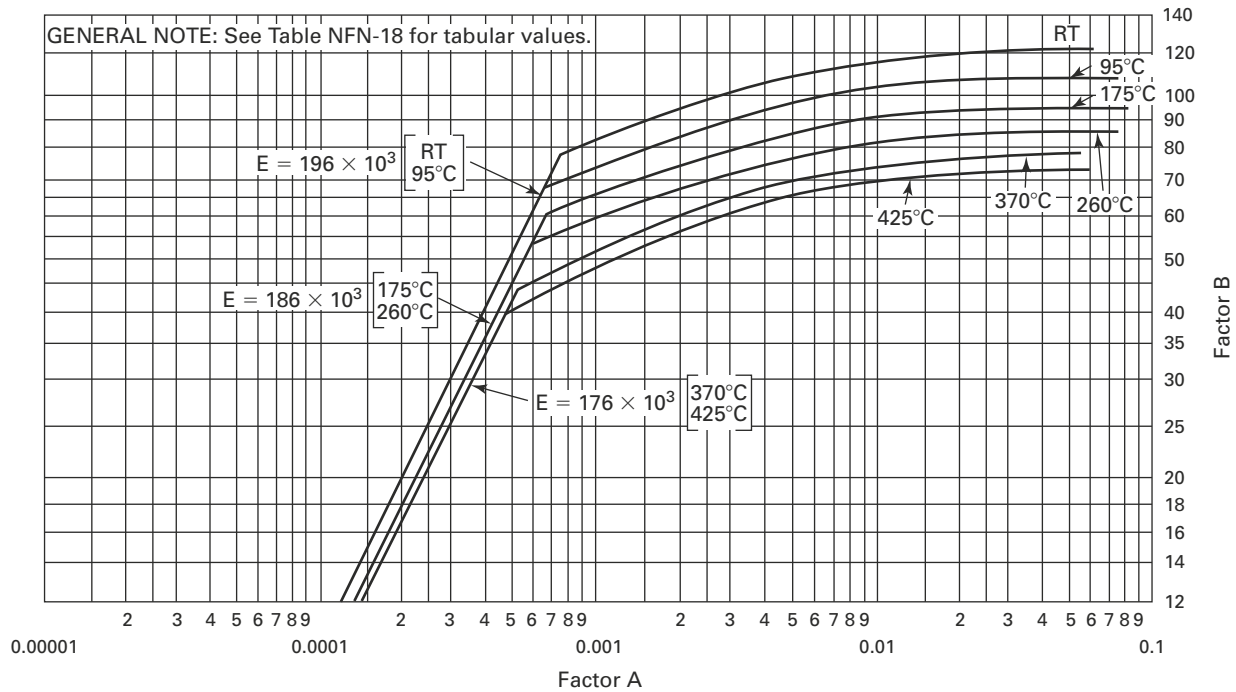
Figure NFN-17
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Annealed Nickel–Chromium–Molybdenum–Columbium Alloy N06625 (SB-443, SB-444, and SB-446)



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

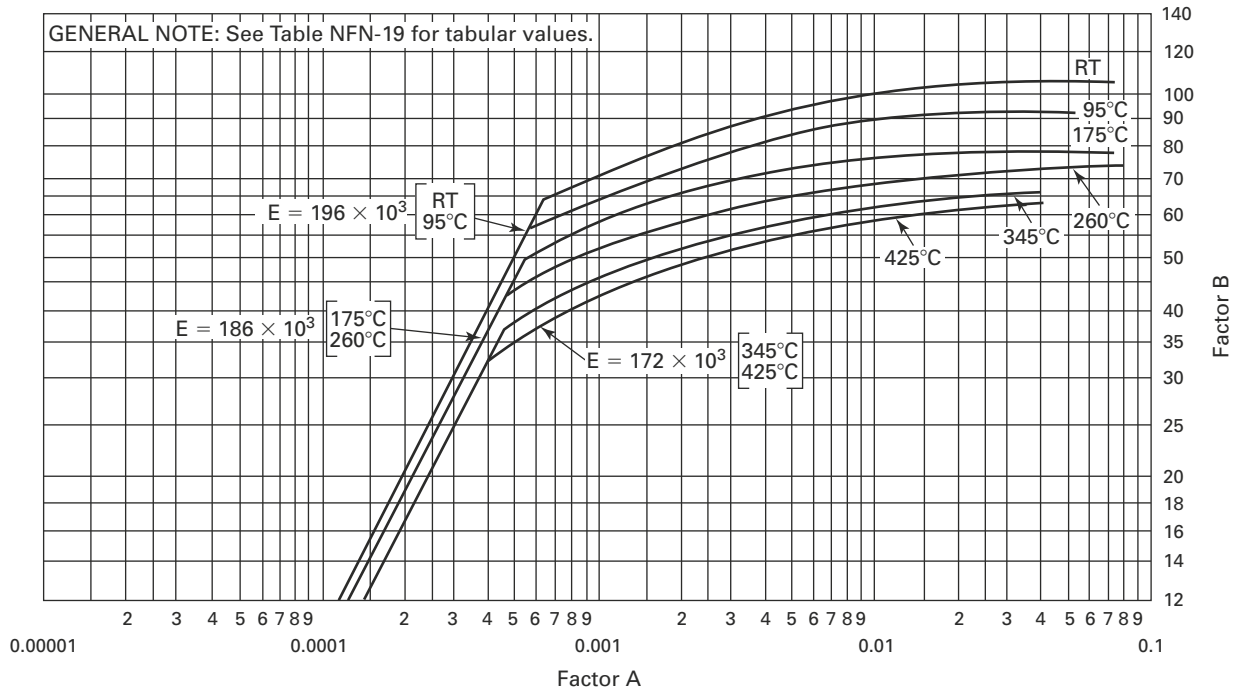
Figure NFN-18
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron–Copper Alloy N06985 Having a Minimum Yield Strength of 240 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

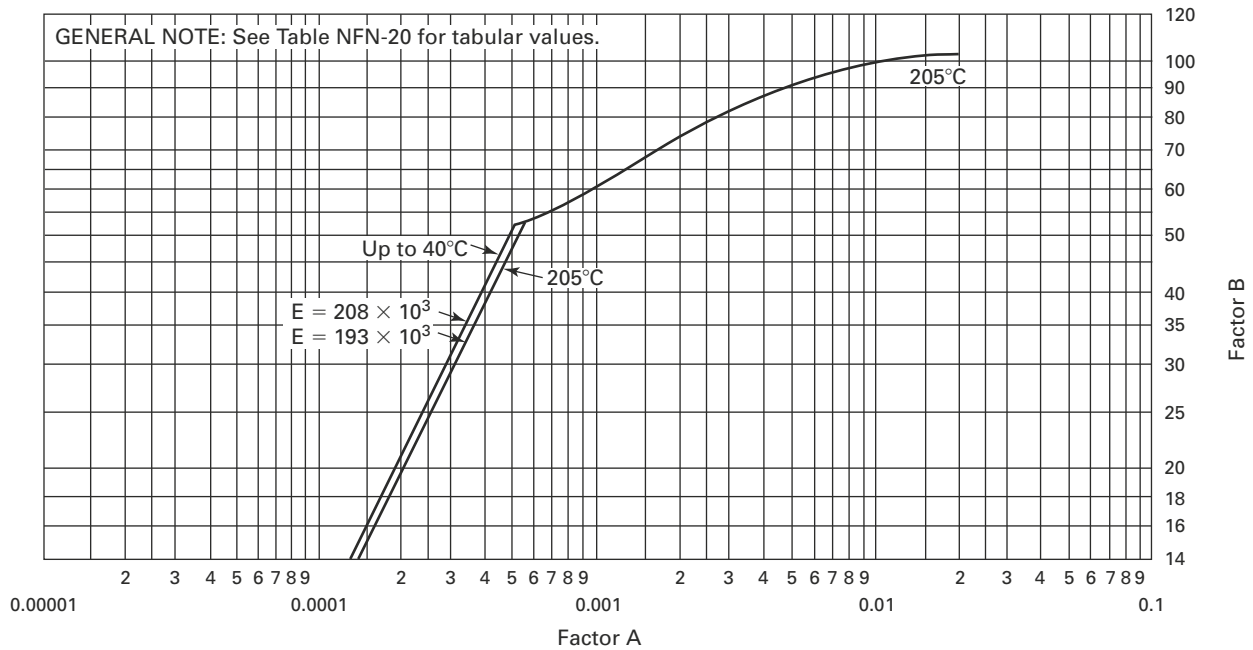
Figure NFN-19
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Molybdenum–Chromium–Iron–Copper Alloy N06985 Having a Minimum Yield Strength of 207 MPa



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

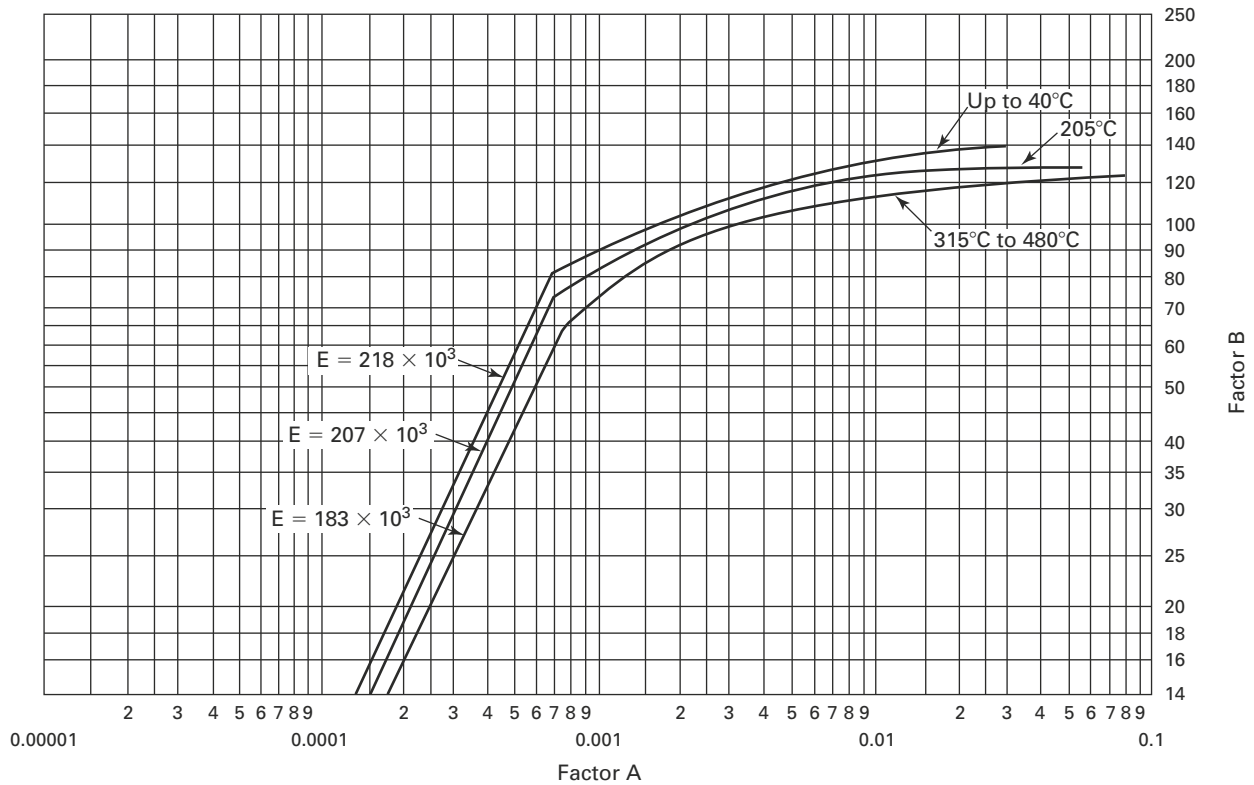
Figure NFN-20
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Work-Hardened Nickel



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

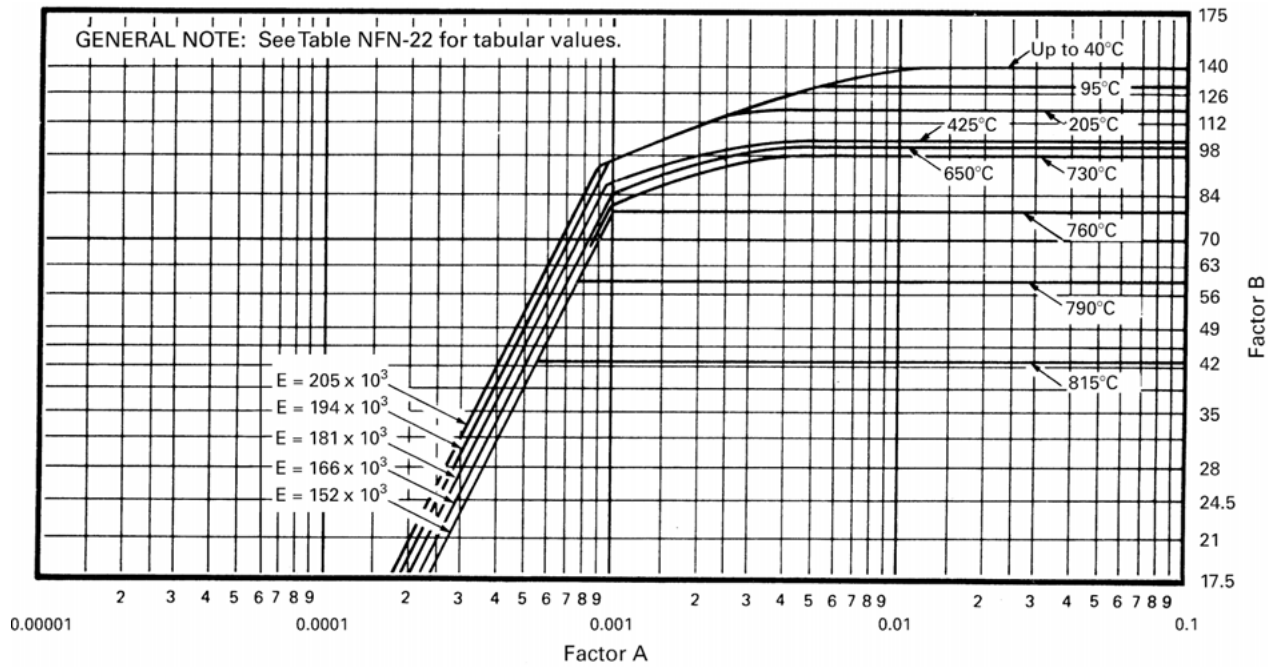
Figure NFN-21
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel–Chromium–Iron Alloy N06600 (Specified Minimum Yield Strength 276 MPa)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

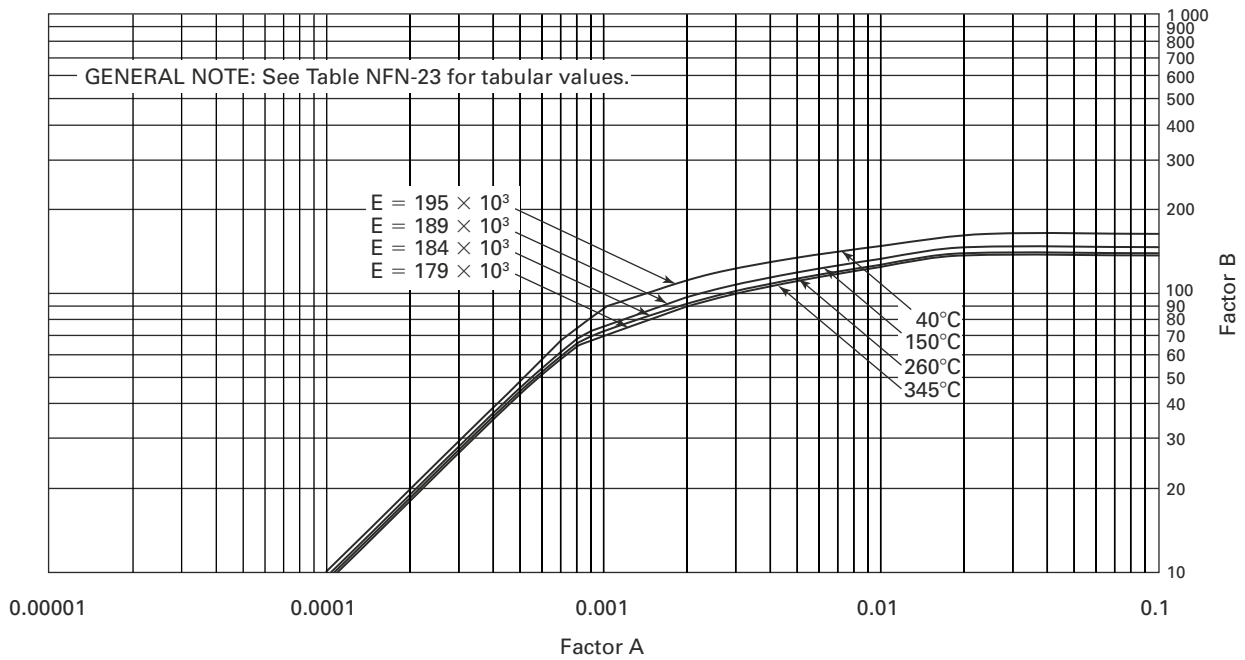
Figure NFN-22
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Solution
Annealed Ni-Cr-Mo-Cb Alloy, Grade 2 N06625



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- The external pressure chart does not account for reduction of buckling strength due to creep under long-term loads at temperatures above 650°C.

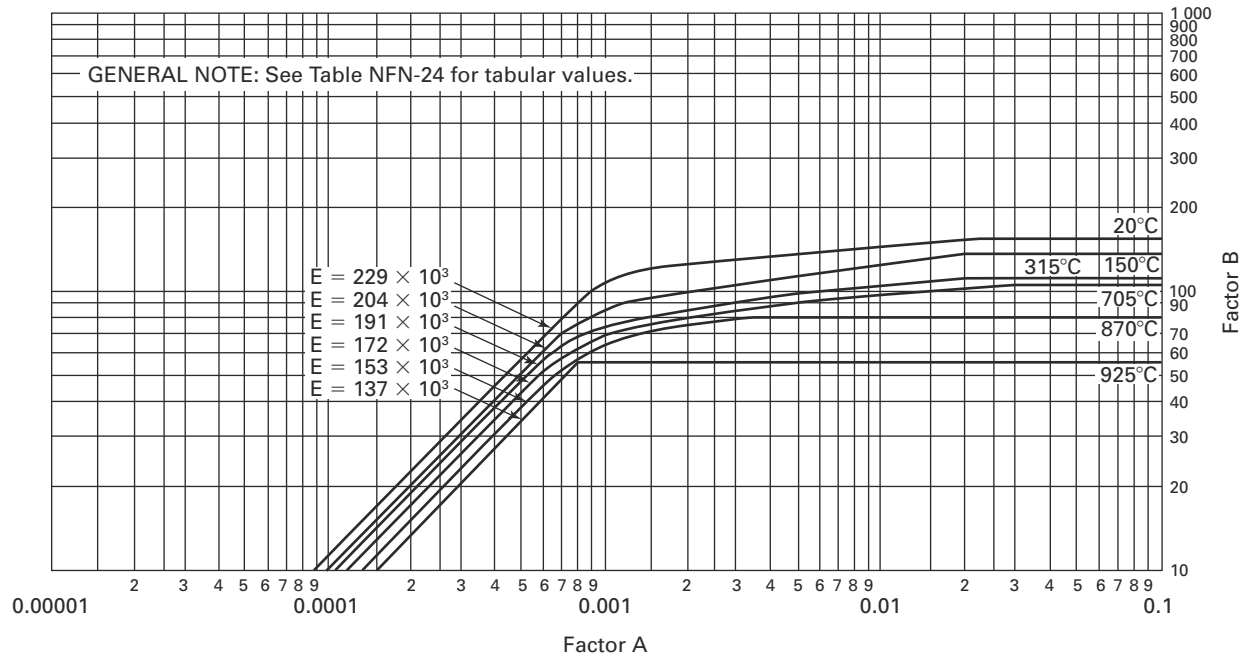
Figure NFN-23
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Cold
Worked Nickel–Iron–Chromium Alloy N08800



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

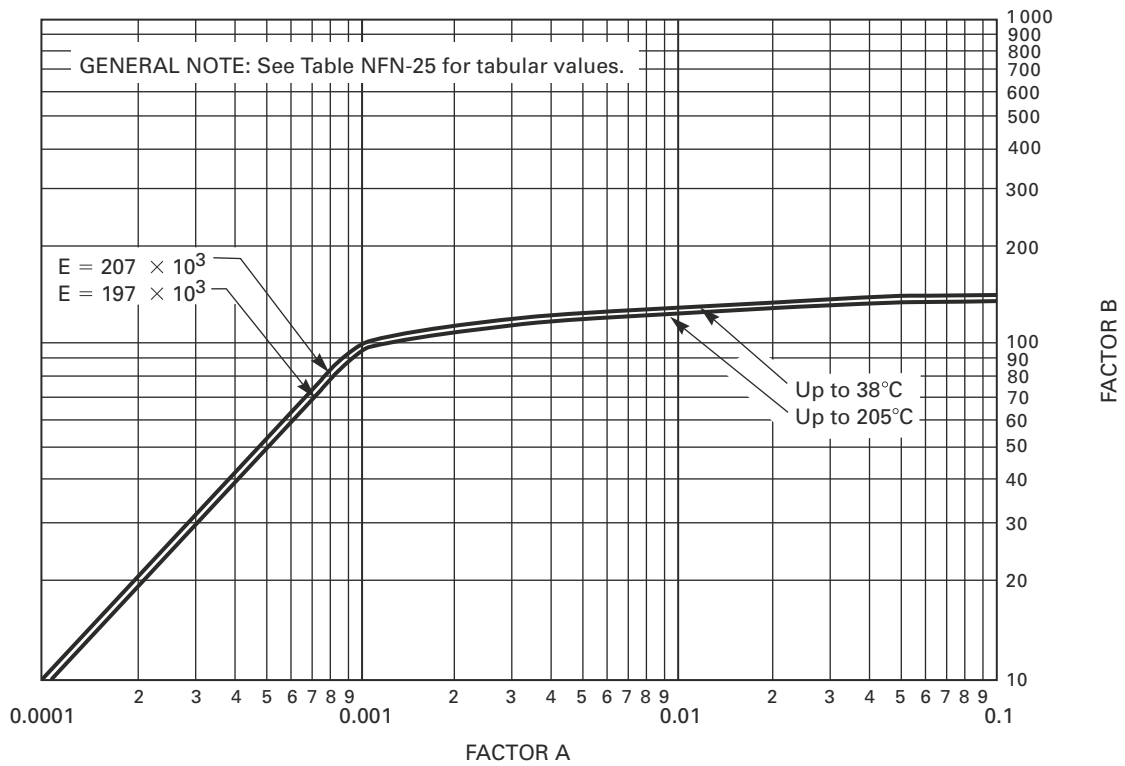
Figure NFN-24
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Nickel Alloy N06230



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

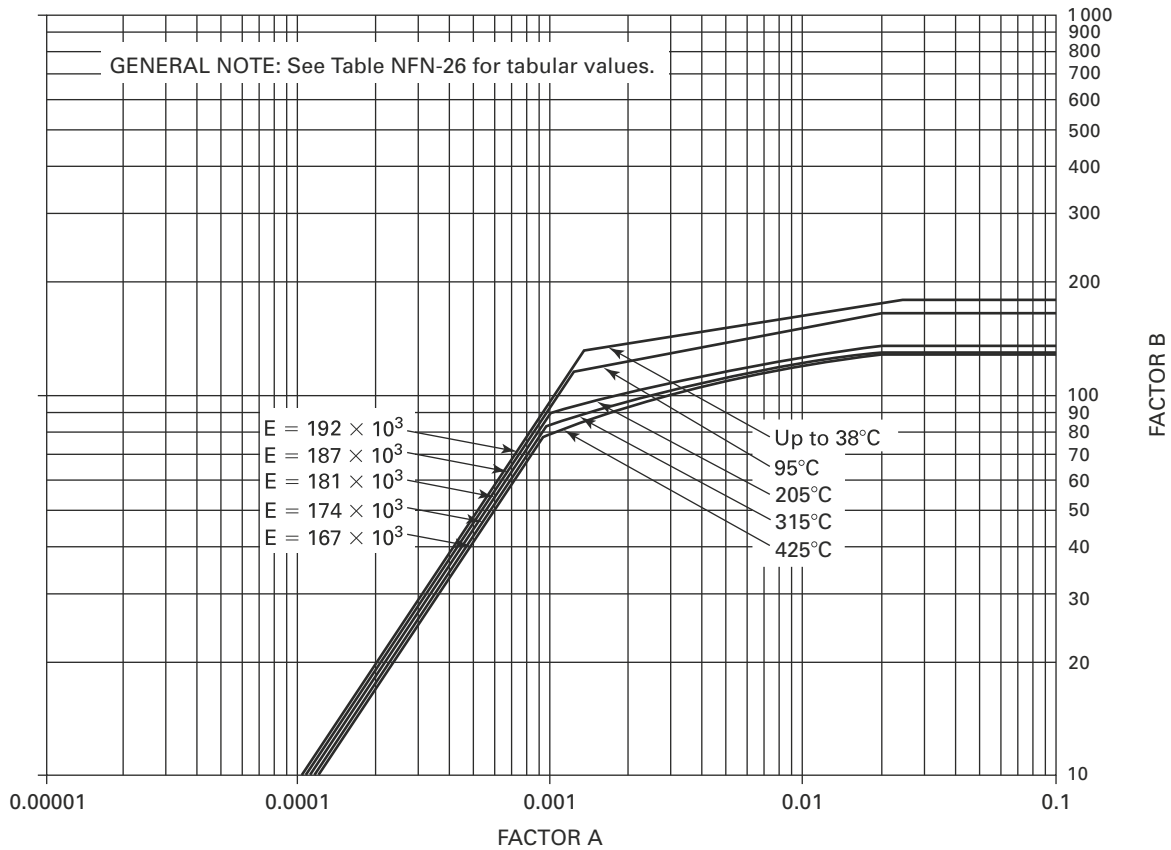
Figure NFN-25
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Stress Relieved Nickel Alloy N02200



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

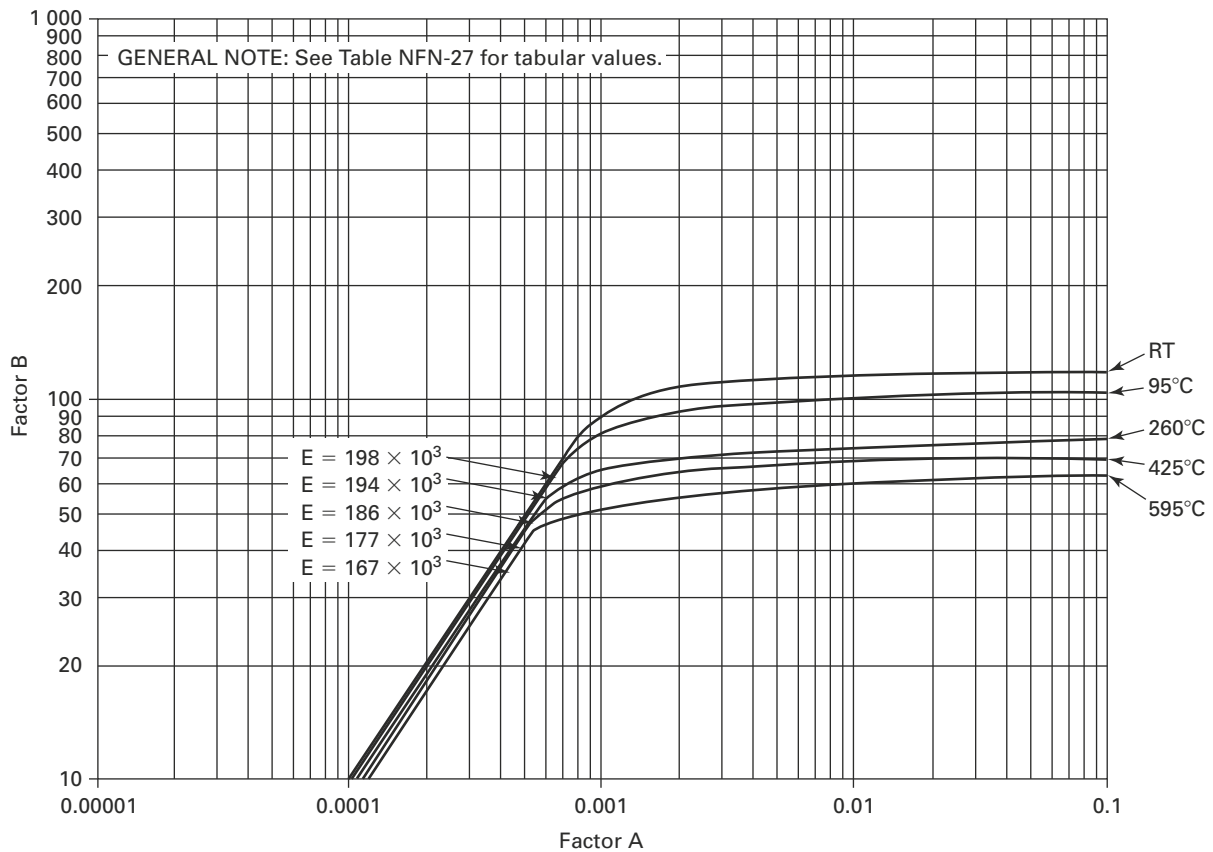
Figure NFN-26
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy S31277



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.

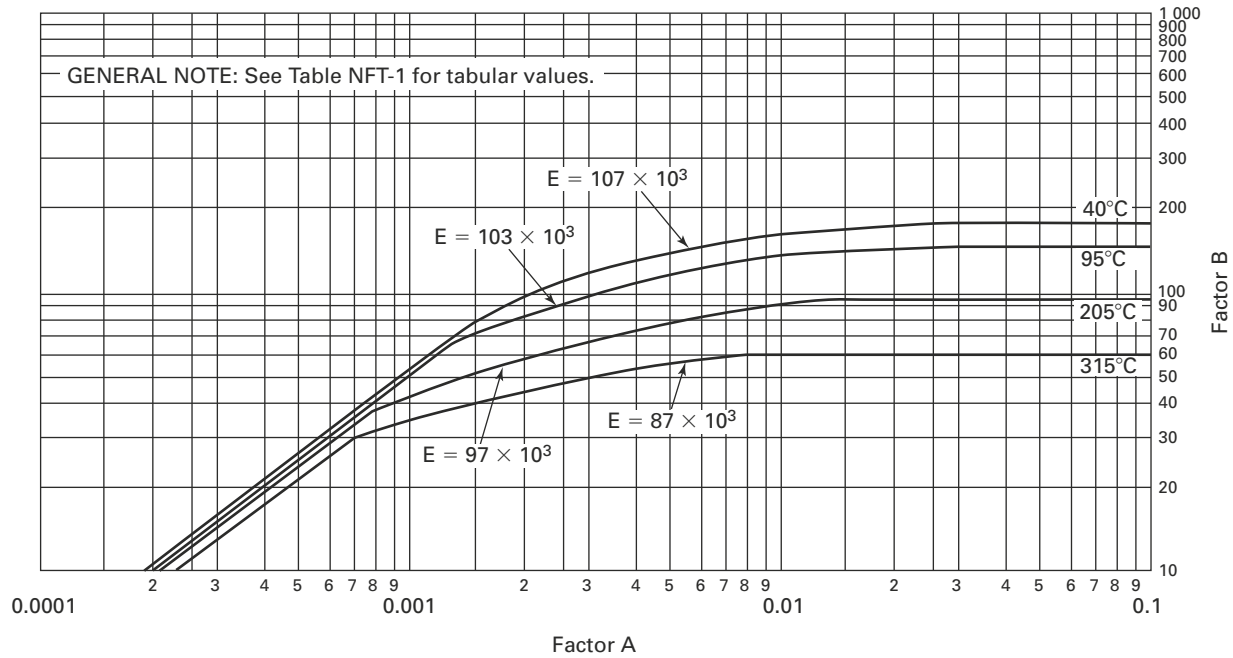
Figure NFN-27
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Alloy
N06035



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

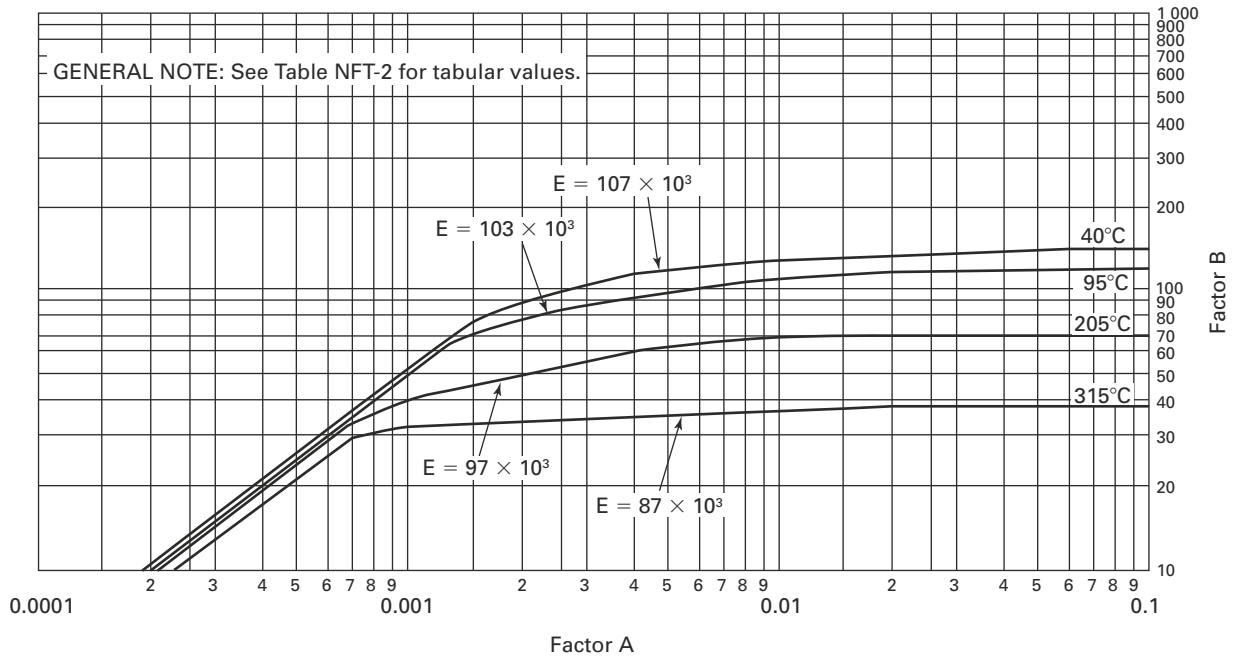
Figure NFT-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Unalloyed Titanium Grade 3 (UNS R50550)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

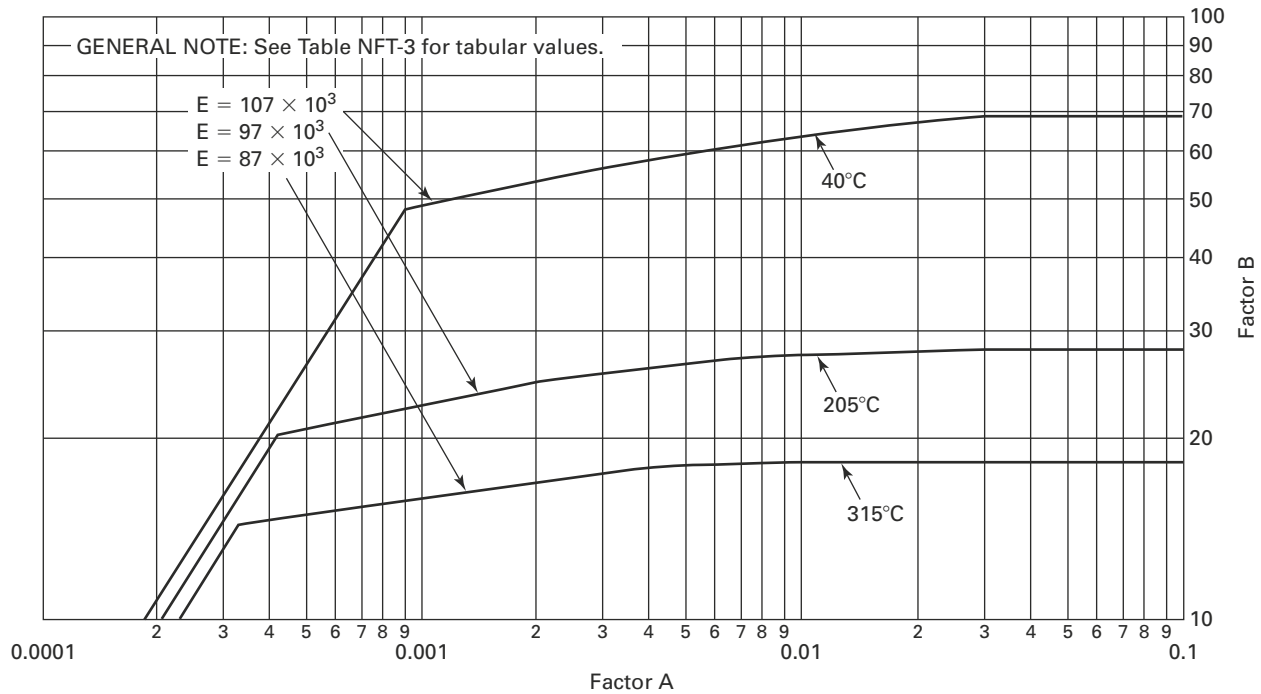
Figure NFT-2
Chart for Determining Shell Thickness of Components Under External Pressure Developed for
Unalloyed Titanium Grade 2 (UNS R50400)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

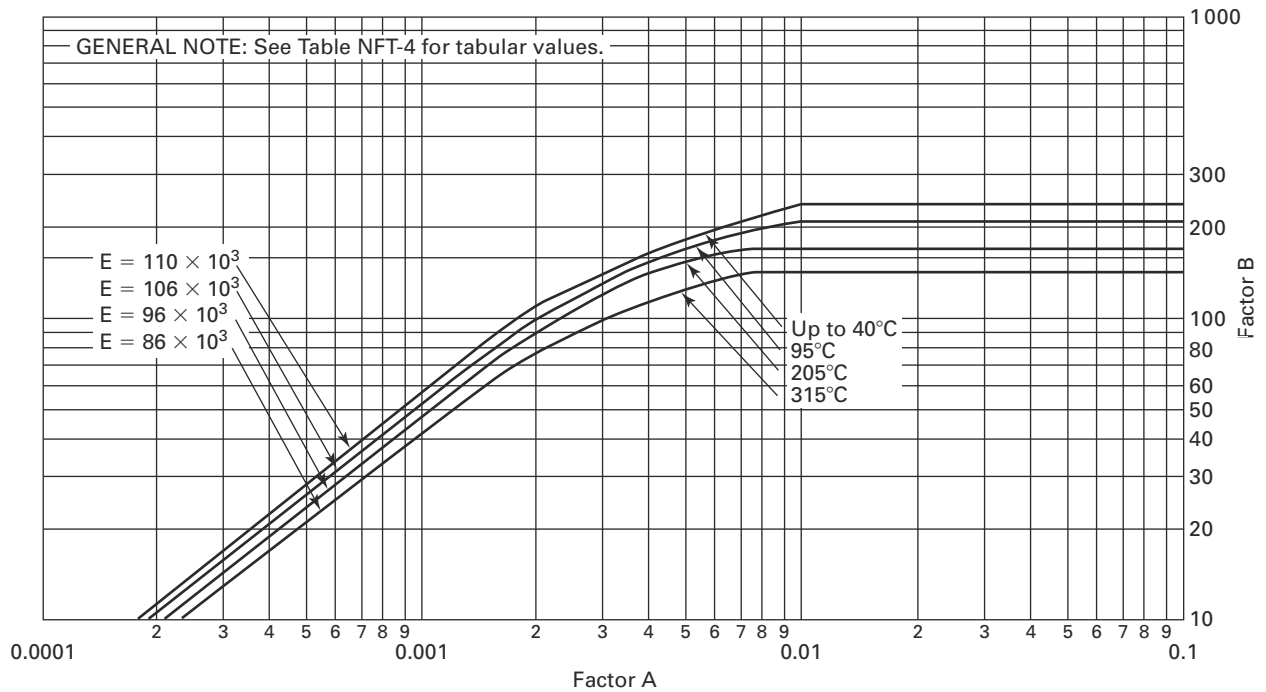
Figure NFT-3
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium
Grade 1 (UNS R50250)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

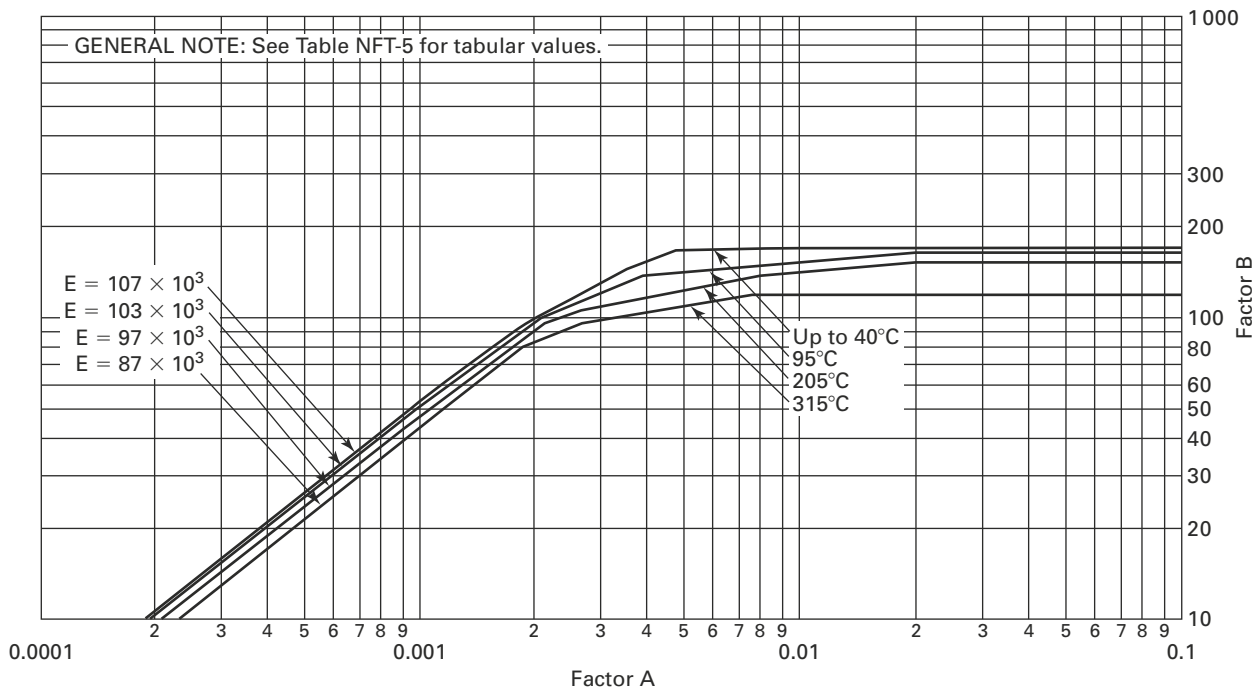
Figure NFT-4
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium
Grade 9 Alloy (UNS R56320)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

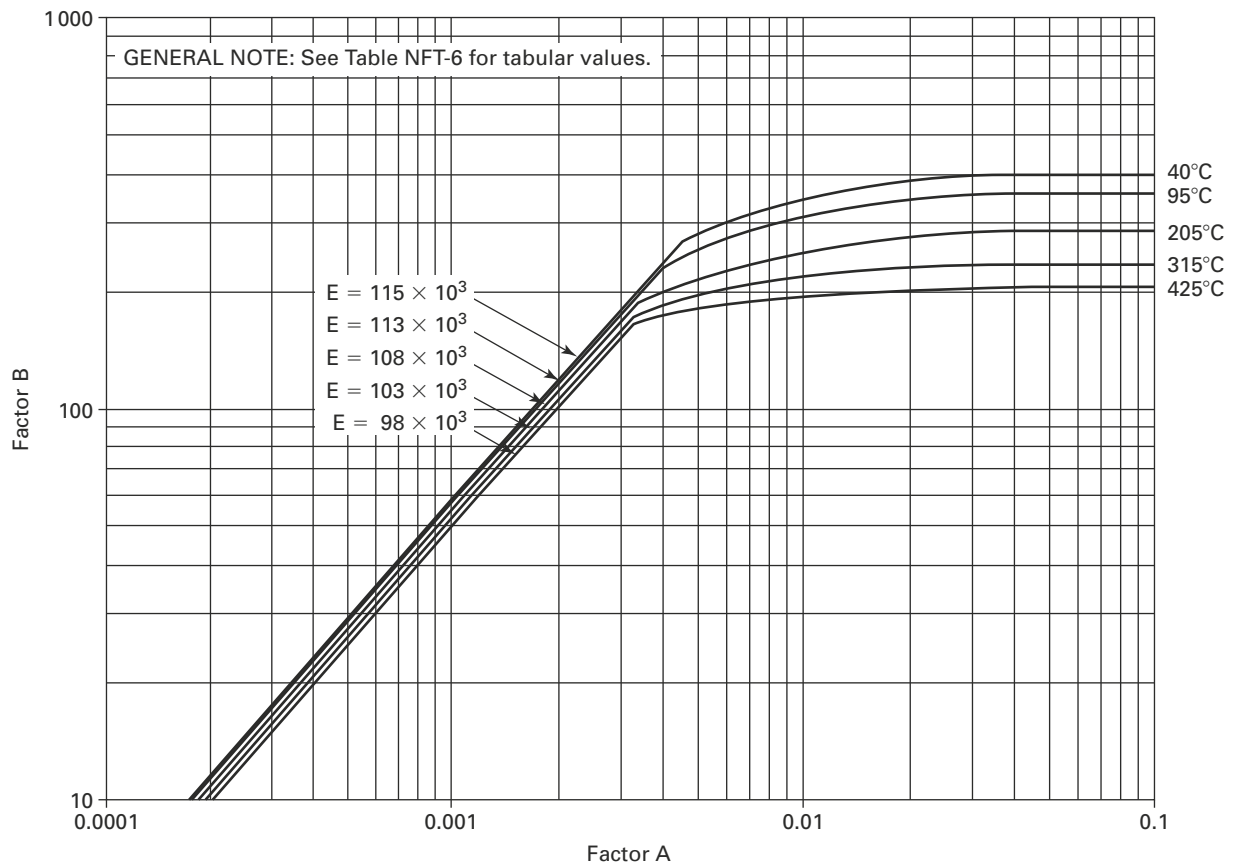
Figure NFT-5
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium
Grade 12 Alloy (UNS R53400)



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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- (b) The external pressure chart assigned for a particular material is obtained from 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.

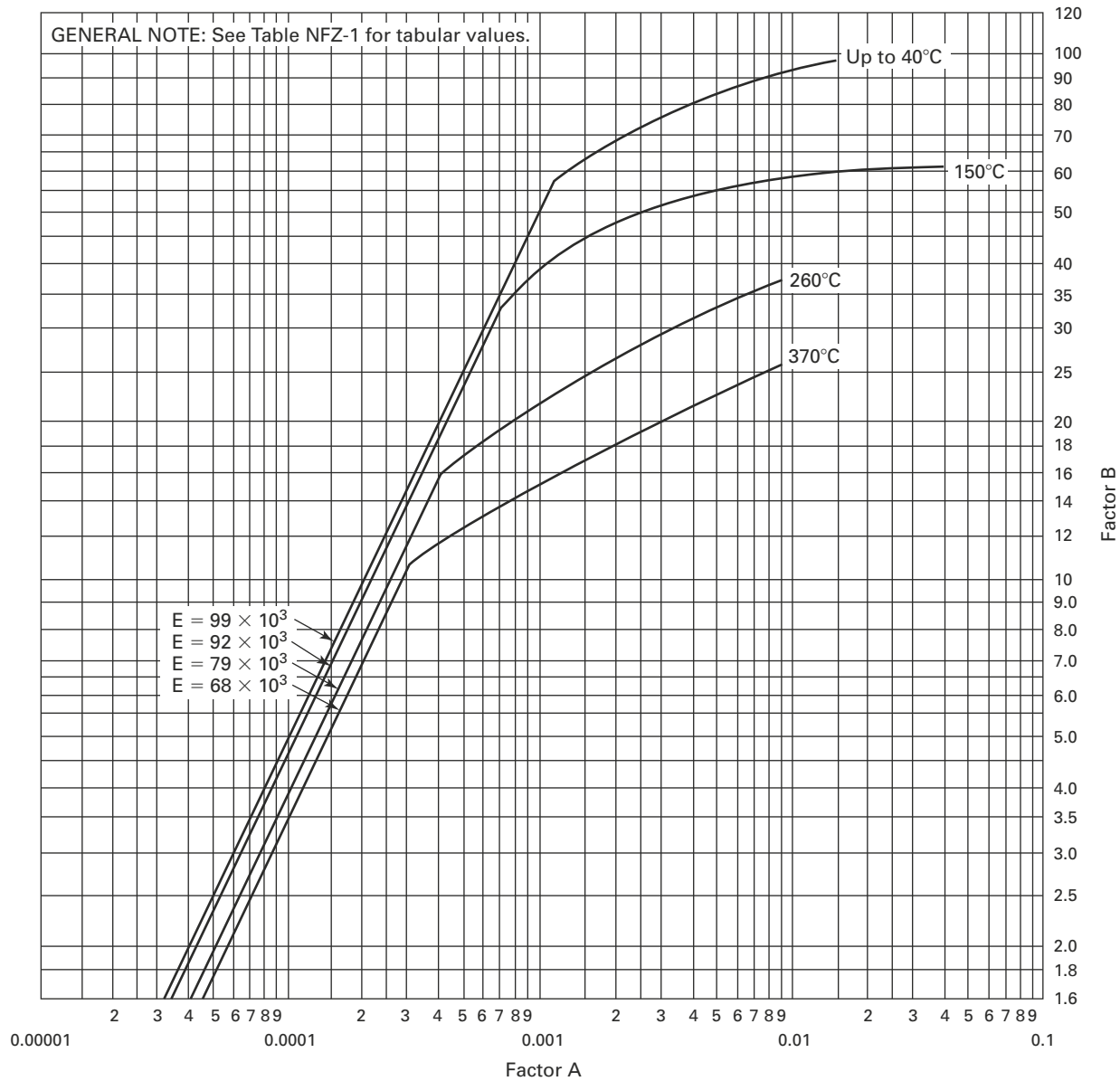
Figure NFT-6
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Titanium Grade 38 (UNS R54250)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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.

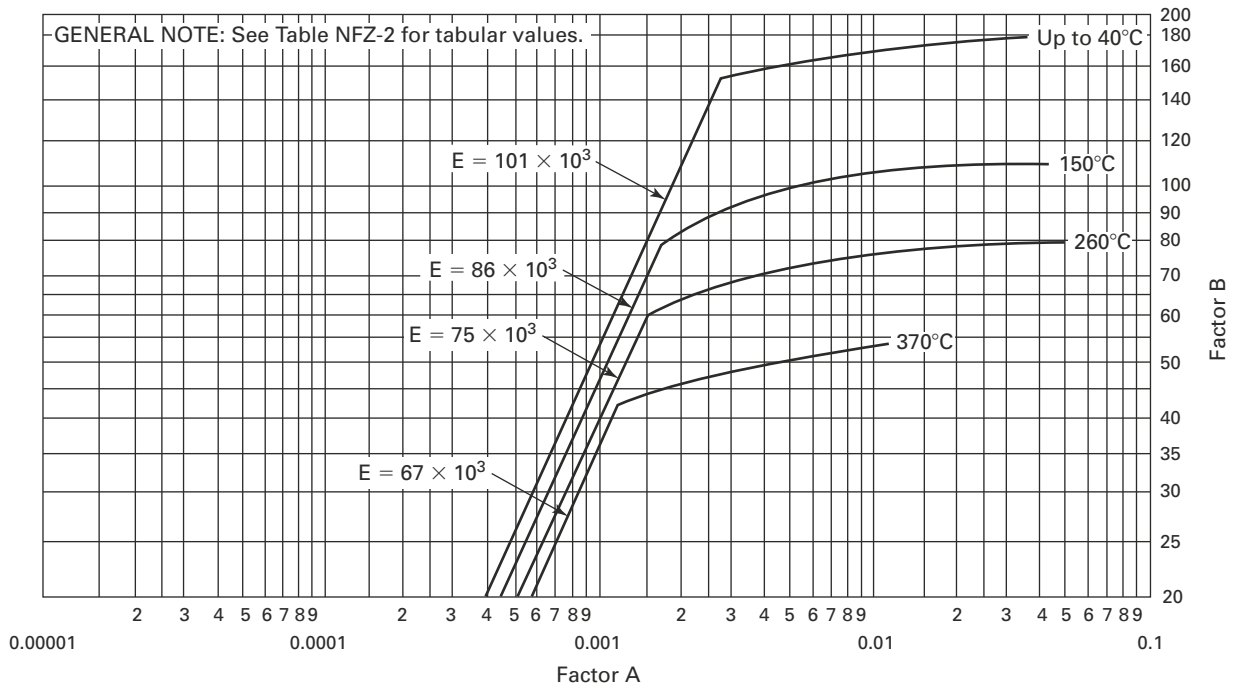
Figure NFZ-1
Chart for Determining Shell Thickness of Components Under External Pressure Developed for Zirconium Alloy (UNS R60702)



GENERAL NOTES:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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:

- 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, 5A, and 5B, and in boldface in Tables 2A and 2B.
- The external pressure chart assigned for a particular material is obtained from 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.
- 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	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
4	2.2	0.959 -01	8	5.0	0.184 -01	20	3.0	0.446 -02	30	30.0	0.122 -02	60	0.074	0.954 -01	100	0.20	0.831 -02
	2.6	0.884		7.0	0.179		3.4	0.388		50.0	0.122		0.10	0.556		0.40	0.364
	3.0	0.839		10.0	0.176		4.0	0.342					0.14	0.323		0.5	0.283
	4.0	0.783		20.0	0.174		5.0	0.308					0.2	0.193		0.8	0.170
	5.0	0.759		50.0	0.174		7.0	0.287	40	0.12	0.864 -01		0.4	0.812 -02		1.0	0.134
	7.0	0.739					10.0	0.280		0.2	0.385		0.6	0.510		2.0	0.641 -03
	10.0	0.729	10	0.56	0.964 -01		40.0	0.275		0.3	0.222		0.8	0.371		4.0	0.305
	30.0	0.720		0.7	0.720		50.0	0.275		0.4	0.155		1.0	0.291		6.0	0.195
	50.0	0.720		1.0	0.463					0.6	0.958 -02		2.0	0.138		8.0	0.142
				1.2	0.371	25	0.2	0.877 -01		0.8	0.691		3.0	0.886 -03		10.0	0.124
				2.0	0.201		0.3	0.484		1.0	0.539		4.0	0.645		14.0	0.114
5	1.4	0.929 -01		2.4	0.165		0.5	0.250		1.2	0.441		6.0	0.409		25.0	0.110
	1.6	0.802		3.0	0.139		0.8	0.143		2.0	0.252		7.0	0.364		50.0	0.110
	2.0	0.658		4.0	0.124		1.0	0.111		4.0	0.117		8.0	0.341			
	2.4	0.586		5.0	0.118		1.2	0.902 -02		5.0	0.912 -03		10.0	0.322	125	0.05	0.480 -01
	3.0	0.532		7.0	0.114		2.0	0.508		6.0	0.804		14.0	0.310		0.06	0.344
	4.0	0.494		10.0	0.112		3.0	0.323		7.0	0.756		40.0	0.306		0.08	0.210
	5.0	0.478		16.0	0.111		3.4	0.278		8.0	0.731		50.0	0.306		0.10	0.148
	7.0	0.465		50.0	0.111		4.0	0.235		10.0	0.708					0.14	0.917 -02
	10.0	0.459					4.4	0.219		16.0	0.692					0.2	0.578
	30.0	0.454					5.0	0.204		40.0	0.688	80	0.054	0.990 -01		0.4	0.257
	50.0	0.453	15	0.34	0.968 -01		6.0	0.191		50.0	0.688		0.07	0.608		0.6	0.165
				0.4	0.770		7.0	0.186					0.09	0.391		0.8	0.121
				0.6	0.453		10.0	0.180	50	0.088	0.930 -01		0.10	0.328		1.0	0.955 -03
6	1.2	0.837 -01		1.0	0.244		30.0	0.176		0.1	0.782		0.14	0.196		2.0	0.459
	1.6	0.584		1.2	0.197		50.0	0.176		0.2	0.263		0.20	0.120		4.0	0.220
	2.0	0.469		2.0	0.109					0.3	0.154		0.24	0.950 -02		6.0	0.141
	2.4	0.411		2.4	0.890 -02					0.4	0.108		0.4	0.516		9.0	0.904 -04
	3.0	0.369		3.0	0.691	30	0.16	0.904 -01		0.6	0.677 -02		0.6	0.328		10.0	0.837
	4.0	0.341		4.0	0.573		0.2	0.635		0.8	0.490		0.8	0.239		12.0	0.770
	5.0	0.329		5.0	0.534		0.3	0.357		1.0	0.384		1.0	0.188		14.0	0.740
	7.0	0.320		6.0	0.516		0.4	0.246		2.0	0.181		2.0	0.895 -03		20.0	0.713
	10.0	0.316		10.0	0.497		0.6	0.150		4.0	0.842 -03		4.0	0.424		40.0	0.704
	30.0	0.312		40.0	0.490		0.8	0.108		5.0	0.652		6.6	0.241		50.0	0.704
	50.0	0.312		50.0	0.490		1.0	0.838 -02		6.0	0.548		8.0	0.205			
							1.2	0.683		7.0	0.502		10.0	0.186			
8	0.74	0.968 -01					2.0	0.388		8.0	0.478		14.0	0.176	150	0.05	0.338 -01
	0.8	0.875	20	0.24	0.982 -01		3.0	0.246		10.0	0.458		30.0	0.172		0.06	0.244
	1.0	0.660		0.4	0.477		4.0	0.177		12.0	0.449		50.0	0.172		0.08	0.151
	1.6	0.372		0.6	0.286		4.4	0.161		16.0	0.444					0.10	0.108
	2.0	0.285		0.8	0.203		5.0	0.147		40.0	0.440	100	0.05	0.741 -01		0.12	0.833 -02
	2.4	0.242		1.0	0.156		6.0	0.136		50.0	0.440		0.07	0.398		0.16	0.569
	3.0	0.212		1.2	0.127		7.0	0.130					0.10	0.220		0.2	0.431
	4.0	0.192		2.0	0.713 -02		10.0	0.125					0.14	0.133		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	1 000	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	800	0.05	0.165 -02		4.0	0.101
	0.5	0.976 -03		8.0	0.377					0.6	0.199		0.06	0.129		4.2	0.957 -05
	0.8	0.592		10.0	0.293	400	0.05	0.549 -02		0.8	0.148		0.08	0.892 -03			
	1.0	0.469		12.0	0.238		0.06	0.417		1.0	0.118		0.10	0.682			
	2.0	0.227		14.0	0.210		0.08	0.278		2.0	0.579 -04		0.12	0.551			
	4.0	0.110		16.0	0.196		0.10	0.208		4.0	0.282		0.16	0.398			
	6.0	0.711 -04		20.0	0.184		0.12	0.166		6.0	0.185		0.2	0.312			
	8.0	0.520		40.0	0.176		0.16	0.118		8.0	0.137		0.4	0.149			
	10.0	0.403		50.0	0.176		0.2	0.914 -03		10.0	0.107						

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	1.00 -05	1.00 +00	370	9.00	4.48
	1.20 -04	1.20 +01		1.00 -03	4.59
	6.45 -04	6.48 +01		1.50	5.00
	7.00	6.83		2.00	5.24
	8.00	7.24		2.12 -02	7.58
	9.00	7.52		1.00 -01	7.58
	1.00 -03	7.72	425	1.00 -05	7.85 -01
	1.50	8.23		1.53 -04	1.20 +01
	2.00	8.48		3.67 -04	2.87 +01
	9.50	9.51		4.00	3.00
	2.00 -02	9.51		5.00	3.21
	1.00 -01	9.51		6.00	3.34
260	1.00 -05	9.30 -01		7.00	3.52
	1.29 -04	1.20 +01		1.00 -03	3.86
	5.13 -04	4.83 +01		1.50	4.17
	6.00	5.15		2.00	4.41
	8.00	5.58		2.25 -02	6.72
	1.00 -03	5.86		1.00 -01	6.72
	1.50	6.45	480	1.00 -05	7.15 -01
	2.50	6.86		1.68 -04	1.20 +01
	1.95 -02	9.03		3.31 -04	2.41 +01
	1.00 -01	9.03		5.00	2.72
	1.00 -05	8.45 -01		7.00	2.96
	1.42 -04	1.20 +01		1.00 -03	3.25
	4.13 -04	3.54 +01		1.50	3.56
	5.00	3.83		2.50	3.96
	6.00	4.00		2.13 -02	5.86
	7.00	4.21		1.00 -01	5.86
	8.00	4.34			

Table CS-2
Tabular Values for Figure CS-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
150	1.00 -05	1.00 +00	370	1.89 -04	1.60 +01
	1.60 -04	1.60 +01		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	425	1.00 -05	7.85 -01
	4.00	1.16		2.04 -04	1.60 +01
	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
260	1.00 -05	9.30 -01		2.00	5.79
	1.72 -04	1.60 +01		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	480	1.00 -05	7.15 -01
	2.50	8.27		2.24 -04	1.60 +01
	3.00	8.55		4.28 -04	3.10 +01
	8.00	9.79		1.00 -03	4.14
	1.00 -02	1.01 +02		1.50	4.69
	1.50	1.07		2.00	5.07
	2.00	1.11		3.00	5.45
	2.80	1.17		8.00	6.34
	1.00 -01	1.17		3.00 -02	7.65
				1.00 -01	7.65
370	1.00 -05	8.45 -01			

Table CS-3
Tabular Values for Figure CS-3

Yield Strength, MPa	A	B, MPa
414	1.00 -05	1.00 +00
	3.00 -04	3.00 +01
	1.00 -03	1.00 +02
	1.66	1.65
	1.00 -01	2.07
379	1.00 -05	1.00 +00
	3.00 -04	3.00 +01
	1.00 -03	1.00 +02
	1.52	1.52
	1.00 -01	1.86
345	1.00 -05	1.00 +00
	3.00 -04	3.00 +01
	1.00 -03	1.00 +02
	1.38	1.38
	1.00 -01	1.72
310	1.00 -05	1.00 +00
	3.00 -04	3.00 +01
	1.00 -03	1.00 +02
	1.24	1.24
	1.00 -01	1.55
262 to 276	1.00 -05	1.00 +00
	3.00 -04	3.00 +01
	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 (Cl. 2)	1.00 -05	1.03 +00	150 (Cl. 2)	1.00 -05	9.95 -01
	3.38 -04	3.50 +01		3.52 -04	3.50 +01
	1.56 -03	1.74 +02		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	150 (Cl. 1)	1.00 -05	9.95 -01
40 (Cl. 1)	1.00 -01	2.12		3.52 -04	3.50 +01
	1.00 -05	1.03 +00		1.18 -03	1.22 +02
	3.38 -04	3.50 +01		3.00	1.29
	1.36 -03	1.49 +02		4.00	1.31
	4.00	1.61		3.00 -02	1.39
	1.00 -02	1.68		7.00	1.41
	3.00	1.74		1.00 -01	1.41
	1.00 -01	1.74			

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	290	2.15 -04	2.07 +01
	5.00 -02	1.72		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	345	2.20 -04	2.07 +01
	3.00	1.55		1.21 -03	1.03 +02
	6.00	1.55		2.00	1.13
	5.00 -02	1.55		4.00	1.23
				1.00 -02	1.34
205	2.10 -04	2.07 +01		5.00	1.43
	1.54 -03	1.43 +02			

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 95	1.00 -05	1.01 +00
	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
205	1.59 -05	1.38 +00	650	7.84	5.47
	3.91 -04	3.45 +01		1.00 -01	5.47
	2.00 -03	5.65		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
370	1.00 -01	8.00		2.00	4.38
	1.70 -05	1.38 +00		4.88	4.62
	3.38 -04	2.76 +01		1.00 -01	4.62
	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			

(25)

Table HA-2
Tabular Values for Figure HA-2

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 -05	0.965	370	5.00	8.76
	1.66 -04	1.6 +01		5.92	8.89
	6.05 -04	5.79 +01		1.00 -01	8.89
	1.50 -03	7.65	480	1.00 -05	0.770
	2.00	8.07		2.08 -04	1.6 +01
	2.50	8.41		5.10 -04	3.90 +01
	3.00	8.69		6.00	4.21
	4.00	8.96		1.00 -03	4.96
	5.00	9.17		3.00	6.24
	7.00	9.38		4.00	6.48
	1.00 -02	9.65		1.00 -02	7.10
	2.00	1.01 +02		5.22	8.07
	7.26	1.08		1.00 -01	8.07
	1.00 -01	1.08	650	1.00 -05	0.700
205	1.00 -05	0.895		2.29 -04	1.6 +01
	1.79 -04	1.6 +01		4.60 -04	3.21 +01
	5.85 -04	5.17 +01		1.00 -03	4.14
	1.00 -03	6.00		2.00	4.96
	1.50	6.69		3.00	5.38
	2.00	7.17		4.00	5.65
	3.00	7.72		5.00	5.79
	4.00	8.07		1.00 -02	6.17
	5.00	8.27		7.00	6.89
	6.00	8.41		1.00 -01	6.89
	1.00 -02	8.76	815	1.00 -05	0.625
	5.74	9.86		2.56 -04	16.0
	1.00 -01	9.86		3.95	24.6
370	1.00 -05	0.820		1.45 -03	29.3
	1.95 -04	1.6 +01		2.54	31.0
	5.33 -04	4.31 +01		5.62	33.2
	7.00	4.83		3.50 -02	37.6
	1.00 -03	5.38		1.00 -01	37.6
	3.00	6.89			
	4.00	7.24			
	1.00 -02	7.86			

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	315	1.69 -05	1.38 +00
	5.00	1.12		3.63 -04	3.02 +01
	1.00 -01	1.12		5.00 -03	4.96
				1.00 -02	5.45
150	1.53 -05	1.38 +00		4.56	6.21
	4.75 -04	4.31 +01		1.00 -01	6.21
	5.00 -03	6.86	425	1.76 -05	1.38 +00
	6.00	7.03		3.17 -04	2.50 +01
	1.00 -02	7.58		5.00 -03	4.10
	4.58	8.69		1.00 -02	4.55
	1.00 -01	8.69		4.68	5.31
205	1.54 -05	1.38 +00		1.00 -01	5.31
	4.10 -04	3.71 +01			

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	345	0.00016	14
	0.004	179		0.0012	103 P.L.
	0.006	195		0.0015	107
	0.01	210		0.002	112
	0.015	217		0.0025	117
	0.021	225		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	400	8.78 -05	6.89 +00
	3.46	1.56		5.00 -04	4.21 +01
	4.87	1.72		7.50	6.32
	7.30	1.92		1.00 -03	8.27
	9.89	2.06		1.25	9.65
	2.00 -02	2.24		1.47	1.07 +02
	5.00	2.24		1.70	1.15
	1.00 -01	2.24		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			

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 HA-10
Tabular Values for Figure HA-10

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
Up to 38	1.00 -05	9.75 -01	204	6.78	1.24
	1.03 -04	1.00 +01		1.80 -02	1.35
	1.25 -03	1.22 +02		7.47	1.43
	2.24	1.51	316	1.00 -05	8.72 -01
	4.01	1.83		1.15 -04	1.00 +01
	9.49	1.95		9.79	8.54
	4.29 -02	2.07		3.77 -03	1.09 +02
	7.50	2.14		8.38	1.23
93	1.00 -05	9.51 -01		2.41 -02	1.32
	1.05 -04	1.00 +01	427	7.50	1.39
	1.11 -03	1.06 +02		1.00 -05	8.30 -01
	2.76	1.36		1.20 -04	1.00 +01
	6.14	1.51		8.84	7.35
	1.64 -02	1.58		2.28 -03	9.46
	5.72	1.66		5.90	1.16 +02
	7.50	1.69		1.21 -02	1.23
204	1.00 -05	9.51 -01		2.19	1.27
	1.09 -04	1.00 +01		5.55	1.33
	1.08 -03	9.88		7.50	1.36
	3.23	1.13 +02			

Table CI-1
Tabular Values for Figure CI-1

Class/Temp., °C	A	B, MPa	Class/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	345	1.00 -05	7.72 -01
	4.00	1.19		8.92 -04	6.77 +01
	1.00 -02	1.32		2.00 -03	8.20
	2.50	1.43		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			

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	200	1.00 -05	7.31 -01
	7.00	8.96		1.37 -04	1.00 +01
	3.50 -02	1.00 +02		5.57	4.07
	1.00 -01	1.00		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	205	1.19 -05	3.45 -01
	1.00 -01	2.08		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	205	1.18 -05	3.45 -01
	4.00	6.10		1.47 -04	4.16 +00
	5.00	6.19		2.00	5.48
	1.00 -01	6.19		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
				1.00 -01	2.75
150	1.10 -05	3.45 -01			

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
				1.00 -01	2.92
150	1.07 -05	3.45 -01			

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	205	1.17 -05	3.45 -01
	1.00 -01	8.55		2.48 -04	7.31 +00
95	1.01 -05	3.45 -01		3.00	8.69
	1.31 -03	4.50 +01		4.00	1.10 +01
	1.50	4.96		5.00	1.28
	2.00	5.77		6.00	1.42
	2.50	6.25		7.00	1.54
	3.00	6.60		9.00	1.75
	4.00	6.96		1.00 -03	1.85
	5.00	7.24		1.50	2.17
	6.00	7.45		2.00	2.41
	7.00	7.58		2.50	2.60
	1.00 -02	7.79		3.00	2.72
	2.50	8.14		4.00	2.94
	3.00	8.20		1.00 -02	3.53
	4.00	8.27		1.50	3.79
	1.00 -01	8.27		1.00 -01	3.79
150	1.07 -05	3.45 -01			

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	205	1.26 -05	3.45 -01
	4.99 -04	1.68 +01		3.98 -04	1.10 +01
	7.00	2.22		5.00	1.30
	8.00	2.44		7.00	1.65
	9.00	2.63		1.00 -03	2.03
	1.00 -03	2.74		1.50	2.42
	1.50	3.08		2.00	2.62
	2.00	3.25		3.00	2.83
	3.00	3.45		5.00	3.05
	1.00 -02	3.90		1.00 -02	3.26
	3.00	4.21		2.50	3.52
150	1.10 -05	3.45 -01			

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	205	1.19 -05	3.45 -01
	1.00 -02	8.27		7.46	2.25 +00
	1.50	8.48		1.50 -03	4.16
	2.00	8.62		3.00	4.69
	1.00 -01	8.62		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

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			
95	1.00 -05	3.40 -01	205	1.00 -05	2.75 -01
	2.94	1.00 +00		3.64	1.00 +00
	2.83 -04	9.72		2.88 -04	8.00
	3.00	1.02 +01		3.00	8.34
	4.00	1.25		4.00	1.05 +01
	1.00 -03	1.83		6.00	1.36
	2.50	2.44		1.00 -03	1.65
	5.00	2.86		2.50	2.21
	6.00	2.95		3.00	2.32
	7.00	3.02		4.00	2.48
	8.00	3.06		5.00	2.61
	9.00	3.12		6.00	2.68
	1.00 -02	3.14		7.00	2.76
	1.50	3.28		8.00	2.83
	2.00	3.35		9.00	2.88
	1.00 -01	3.35		1.00 -02	2.92
				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	Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
65 (Curve 1)	1.00 -05	3.51 -01	65 (Curve 2)	9.00	5.45	65 (Curve 4)	2.00	3.52
	3.01 -04	1.08 +01		1.00 -02	5.53		2.50	3.75
	5.00	1.78		1.74	5.94		3.00	3.92
	6.00	2.12		1.00 -01	5.94		4.00	4.18
	7.00	2.43	65 (Curve 3)	1.00 -05	3.51 -01		9.00	4.78
	1.00 -03	3.19		3.01 -04	1.08 +01		1.00 -02	4.87
	1.50	3.84		5.00	1.73		1.50	5.16
	2.00	4.23		6.00	2.00		1.74	5.19
	2.50	4.50		7.00	2.25		1.00 -01	5.19
	3.00	4.73		1.00 -03	2.80	65 (Curve 5)	1.00 -05	3.51 -01
	4.00	5.03		1.50	3.39		3.01 -04	1.08 +01
	5.00	5.23		2.00	3.71		5.00	1.66
	9.00	5.76		2.50	3.95		6.00	1.90
	1.50 -02	6.16		3.00	4.16		7.00	2.10
	1.74	6.25		9.00	5.10		1.00 -03	2.56
	1.00 -01	6.25		1.00 -02	5.19		1.50	3.03
65 (Curve 2)	1.00 -05	3.51 -01		1.74	5.59		2.00	3.31
	3.01 -04	1.08 +01		1.00 -01	5.59		2.50	3.50
	5.00	1.78	65 (Curve 4)	1.00 -05	3.51 -01		3.00	3.68
	8.00	2.58		3.01 -04	1.08 +01		4.00	3.90
	1.00 -03	2.96		5.00	1.69		9.00	4.45
	1.50	3.62		6.00	1.95		1.00 -02	4.54
	2.00	3.96		7.00	2.18		1.50	4.81
	2.50	4.23		1.00 -03	2.70		1.74	4.87
	3.00	4.43		1.50	3.21		1.00 -01	4.87
	4.00	4.73						
	5.00	4.94						

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	205	1.14 -05	3.45 -01
	4.00	6.67		8.91 -04	2.79 +01
	7.00	6.89		1.00 -03	3.05
	1.00 -02	7.03		1.50	3.76
	2.00	7.17		2.00	4.10
150	1.07 -05	3.45 -01		3.00	4.54
	1.22 -03	4.05 +01		5.00	4.90
	1.50	4.70		1.00 -02	5.17
	2.00	5.42		3.00	5.43
	2.50	5.78			

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	205	1.13 -05	3.45 -01
	1.50	4.30		4.95 -04	1.55 +01
	2.00	4.63		6.00	1.85
	2.50	4.80		7.00	2.09
	3.00	4.91		8.00	2.29
	4.00	5.04		1.00 -03	2.57
	1.00 -02	5.23		1.50	2.97
	2.50	5.39		2.00	3.19
				2.50	3.33
150	1.07 -05	3.45 -01		3.00	3.43
	7.87 -04	2.65 +01		4.00	3.56
	1.00 -03	3.21		5.00	3.65
	1.50	4.03		1.00 -02	3.83
	2.00	4.34		2.50	3.93
	2.50	4.47			
	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
204	0.100 -04	0.486 +00
	0.210	0.100 +01
	0.204 -03	0.972
	0.409	0.170 +02
	0.513	0.194
	0.651	0.219
	0.834	0.243
	0.141 -02	0.292
	0.240	0.340
	0.405	0.389
	0.665	0.437
	0.106 -01	0.486
	0.300	0.486
	0.600	0.486
	0.100 +00	0.486

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
				2.00	2.58
205	1.00 -05	5.77 -01		2.50	2.70
	3.58 -04	2.12 +01		3.00	2.81
	3.00 -03	3.12		4.00	2.96
	4.00	3.25		1.00 -02	3.28
	1.00 -02	3.58		3.00	3.59
	1.50	3.70		4.00	3.65
	2.00	3.79		1.00 -01	3.65
	5.00	4.02			
	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	370	1.00 -01	4.74
	2.48 -04	1.73 +01		1.00 -05	6.81 -01
	3.00	1.93		2.69 -04	1.73 +01
	4.00	2.22		3.00	1.81
	5.00	2.42		4.00	2.02
	7.00	2.71		5.00	2.18
	1.00 -03	3.01		7.00	2.37
	1.50	3.36		1.00 -03	2.58
	2.00	3.61		1.50	2.82
	3.00	3.92		2.00	2.98
	4.00	4.14		2.50	3.08
	7.00	4.52		3.00	3.17
	1.00 -02	4.71		6.00	3.32
	1.50	4.96		1.00 -02	3.63
	3.00	5.29		2.00	3.70
	4.00	5.34		1.00 -01	3.72
	1.00 -01	5.34			

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	150	1.50 -04	8.69 +00
	3.25	1.97		2.00	1.16 +01
	4.00	2.07		2.50	1.45
	1.00 -03	2.72		3.00	1.74
	4.00	4.14		3.45	2.00
	5.00	4.41			
	6.00	4.55			
	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	205	1.23 -05	6.89 -01
	1.50	2.42		1.00 -04	5.19 +00
	1.75	2.46		1.35	7.00
	2.00	2.48		2.00	1.03 +01
	3.50	2.61		3.00	1.41
	5.00	2.68		4.00	1.50
	7.50	2.76		6.00	1.61
	1.00 -02	2.82		8.00	1.66
	2.00	2.96		1.00 -03	1.70
	3.71	3.10		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	315	1.00 -05	3.65 -01
	1.00 -02	8.62		7.88 -04	2.91 +01
	1.50	8.83		9.00	3.28
	3.00	9.03		1.00 -03	3.54
	5.00	9.17		1.50	4.58
	1.00 -01	9.17		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	425	1.00 -05	9.10 -01
	1.65	4.52		1.87 -04	1.74 +01
	1.00 -01	4.52		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	540	1.00 -05	8.62 -01
	1.84	4.52		1.62 -04	1.41 +01
	1.00 -01	4.52		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						
	1.00 -03	5.86	205	1.00 -05	9.10 -01	425	1.00 -05	7.58 -01
	2.00	6.81		4.23 -04	4.01 +01		5.00 -04	3.96 +01
	2.50	7.10		7.00	4.50		1.00 -03	4.65
	3.00	7.38		1.00 -03	4.91		2.00	5.35
	5.00	8.00		1.50	5.35		3.00	5.81
	6.00	8.20		2.50	5.89		4.00	6.05
	7.00	8.34		3.00	6.08		6.00	6.46
	8.00	8.41		4.00	6.40		8.00	6.67
	1.00 -02	8.62		6.00	6.78		1.00 -02	6.85
	2.00	8.96		7.00	6.89		1.50	7.10
	2.50	9.10		9.00	7.10		2.00	7.24
	4.00	9.17		1.00 -02	7.17		3.00	7.38
	1.00 -01	9.17		1.50	7.38		1.00 -01	7.38
				2.00	7.58			
95	1.00 -05	9.10 -01		3.00	7.72	480	1.00 -05	6.88 -01
	4.68 -04	4.43 +01		1.00 -01	7.72		5.28 -04	3.90 +01
	6.00	4.67	315	1.00 -05	8.41 -01		1.00 -03	4.56
	9.00	5.14		4.37 -04	3.87 +01		2.00	5.33
	1.00 -03	5.29		5.00	3.96		3.00	5.81
	1.50	5.75		1.00 -03	4.65		4.00	6.05
	2.00	6.07		2.00	5.35		6.00	6.46
	3.00	6.55		3.00	5.81		8.00	6.64
	4.00	6.86		4.00	6.05		1.00 -02	6.85
	5.00	7.10		6.00	6.46		1.50	7.10
	7.00	7.38		8.00	6.67		2.00	7.24
	1.00 -02	7.65		1.00 -02	6.85		3.00	7.38
	1.50	7.93		1.50	7.10		1.00 -01	7.38
	2.50	8.14		2.00	7.24			
	4.00	8.27						

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	425	1.00 -01	8.48
	1.00 -02	9.17		1.00 -05	9.93 -01
	2.00	9.51		4.87 -04	4.98 +01
95	1.00 -01	9.51		1.00 -03	5.75
	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	540	1.00 -05	9.31 -01
	9.00	8.34		4.71 -04	4.50 +01
	2.00 -02	8.69		1.00 -03	5.24
205	1.00 -01	8.83		2.00	5.83
	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	595	1.00 -05	8.83 -01
	5.00	7.65		3.72 -04	3.35 +01
	1.00 -02	8.07		4.00	3.35
315	3.00	8.48		1.00 -01	3.35
	1.00 -01	8.48	650	1.00 -05	8.83 -01
	1.00 -05	1.03 +00		2.50 -04	2.26 +01
	5.00 -04	5.30 +01		1.00 -01	2.26
	1.00 -03	6.09			
	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	315-345	1.00 -05	9.45 -01
	3.00	1.15		3.12 -04	3.01 +01
	4.00	1.23		9.00 -03	5.06
	5.00	1.28		1.50	6.61
	7.00	1.32		2.00	7.45
	1.00 -02	1.35		2.50	8.07
	5.00	1.47		3.00	8.41
	1.00 -01	1.47		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
315	4.00	1.16	650	1.00 -02	8.27
	1.00 -05	9.79 -01		2.00	8.48
	8.20 -04	8.34 +01		6.00	8.69
	1.00 -03	8.55		1.00 -05	8.00 -01
	5.00	9.65		8.39 -04	6.85 +01
425	1.00 -02	1.00 +02	705	1.00 -01	6.85
	3.00	1.03		1.00 -05	7.72 -01
	1.00 -01	1.07		4.93 -04	3.91 +01
	1.00 -05	8.89 -01		1.00 -01	3.91
	8.51 -04	7.86 +01			

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	370	1.00 -05	8.62 -01
	2.50	1.23		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
				1.00 -01	7.31
425	1.00 -05	8.41 -01			

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	870	1.00 -05	0.7
260	1.00 -05	0.9		1.50	1.0
	1.09	1.0		1.93 -04	12.9
	4.34 -04	40.0		7.71	15.9
	7.30	43.8		1.28 -03	17.1
	1.18 -03	47.6		1.97	18.1
	3.46	55.2		4.52	20.5
	1.04 -02	62.2		8.12	22.4
	2.08	66.5		1.49 -02	24.5
	1.00 -01	66.5		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	540	1.00 -05	8.62 -01
	7.32 -04	6.89 +01		6.55 -04	5.81 +01
	1.00 -03	7.17		1.00 -03	6.09
	2.00	7.93		2.00	6.62
	4.00	8.69		4.00	7.10
	6.00	9.10		6.00	7.45
	1.00 -02	9.65		1.00 -02	7.72
	2.00	1.02 +02		2.00	8.07
315	6.00	1.08		6.00	8.48
	1.00 -05	9.24 -01			

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	425 to 540	1.00 -05	8.00 -01
95	1.00 -05	9.58 -01		5.76 -04	4.69 +01
	6.87 -04	6.69 +01		2.00 -03	5.50
	2.00 -03	7.45		6.00	6.18
	6.00	8.20		1.00 -02	6.41
	1.00 -02	8.48		2.00	6.63
	2.00	8.89		3.00	6.75
	5.00	9.10		5.00	6.85
205	1.00 -05	9.03 -01			

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	315	3.00 -04	2.76 +01
	5.00	1.10 +02		4.50	4.14
	1.00 -02	1.24		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	425	4.00 -04	3.45 +01
	5.00	9.65		5.00	4.14
	1.00 -02	1.10 +02		2.00 -03	6.21
	2.50	1.17		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	425	2.50 -04	2.07 +01
	3.00	8.27		5.00	4.14
	1.00 -02	9.65		6.00	5.03
	2.50	1.02 +02		1.20 -03	5.52
95	2.00 -04	1.93 +01		5.00	6.21
	5.00	4.83	650	2.60 -02	6.62
	1.00 -03	6.21		6.00 -04	4.48 +01
	1.80	6.89		2.00 -03	4.83
	7.00	8.27		4.00	4.93
	2.50 -02	8.96		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	315	2.50 -04	2.36 +01
	6.00	1.24		5.00	4.83
	4.00 -02	1.38		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	540	2.70 -04	2.41 +01
	1.50 -02	1.17		7.00	6.21
	4.00	1.24		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 = 2.0×10^5 MPa		Temperature 95°C, E = 1.9×10^5 MPa		Temperature 205°C, E = 1.9×10^5 MPa		Temperature 315°C, E = 1.8×10^5 MPa		Temperature 425°C, E = 1.8×10^5 MPa		Temperature 540°C, E = 1.7×10^5 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 = 2.1×10^5 MPa		Temperature 95°C, E = 2.1×10^5 MPa		Temperature 205°C, E = 2.1×10^5 MPa		Temperature 315°C, E = 2.0×10^5 MPa		Temperature 425°C, E = 2.0×10^5 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
150				1.00 -01	1.45
	2.10 -04	2.07 +01	425 to 650	2.50 -04	2.07 +01
	8.50	8.27		8.00	6.21
	9.50	8.96		1.05 -03	7.58
	1.05 -03	9.65		1.25	8.27
	1.25	1.03 +02		1.35	8.62
	1.42	1.10		1.48	8.96
	1.65	1.17		1.63	9.31
	1.90	1.24		1.80	9.65
	2.30	1.31		2.00	1.00 +02
	3.00	1.38		2.25	1.03
	4.00	1.45		2.80	1.10
	5.20	1.52		3.70	1.17
	1.00 -02	1.59		5.40	1.24
	4.00	1.65		8.30	1.31
	8.00	1.68		1.65 -02	1.38
	1.00 -01	1.68		3.00	1.41
260				1.00 -01	1.41
	2.20 -04	2.07 +01			

Table NFN-18
Tabular Values for Figure NFN-18

Temperature 20°C, E = 2.0×10^5 MPa		Temperature 95°C, E = 2.0×10^5 MPa		Temperature 175°C, E = 1.9×10^5 MPa		Temperature 260°C, E = 1.9×10^5 MPa		Temperature 345°C, E = 1.8×10^5 MPa		Temperature 425°C, E = 1.8×10^5 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 = 2.0×10^5 MPa		Temperature 95°C, E = 2.0×10^5 MPa		Temperature 175°C, E = 1.9×10^5 MPa		Temperature 260°C, E = 1.9×10^5 MPa		Temperature 345°C, E = 1.7×10^5 MPa		Temperature 425°C, E = 1.7×10^5 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	650	0.00025	21
	0.004	122		0.001	83
	0.005	127		0.002	94
	0.007	132		0.003	99
	0.009	135		0.004	100
	0.012	138		0.005	101
	0.1	138		0.1	101
95	0.0002	21	730	0.00025	19
	0.0009	92		0.001	79
	0.002	108		0.002	90
	0.003	117		0.003	94
	0.004	122		0.004	97
	0.005	127		0.1	97
	0.1	127	760	0.00025	19
205	0.0002	19		0.001	78
	0.00095	94		0.1	78
	0.002	108	790	0.00025	19
	0.0025	112		0.001	59
	0.003	114		0.1	59
	0.004	117	815	0.00025	19
	0.1	117		0.001	42
425	0.0002	17		0.1	42
	0.00095	86			
	0.002	97			
	0.003	101			

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	925	1.00 -05	0.686
315	1.00 -05	0.952		1.46 -04	10.0
	1.05 -04	10.0		5.00	34.3
	6.00	57.3		8.14	55.8
	7.05	63.7		1.00 -01	55.8
	9.50	73.1			
	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	315	1.00 -05	0.869
	5.00	151.7		1.15 -04	10.0
	1.10 -02	165.5		9.50	82.7
	2.40	179.3		2.00 -03	96.5
	1.00 -01	179.3		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	425	1.00 -05	0.834
	4.70	137.9		1.20 -04	10.0
	2.10 -02	166.2		9.27	77.6
	1.00 -01	166.2		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	425	1.00 -05	0.883
	1.65 -02	117.2		1.13 -04	10.0
	1.00 -01	120.7		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	595	1.00 -05	0.834
	3.50	96.5		1.20 -04	10.0
	7.60	100.0		4.96	41.4
	2.68 -02	103.4		5.60	44.8
	1.00 -01	105.5		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	315	1.00 -05	4.34 -01
	1.22 -03	6.31 +01		6.92 -04	3.01 +01
	1.50	7.30		8.00	3.23
	2.00	8.27		1.00 -03	3.53
	2.50	9.10		1.50	4.05
	3.00	9.72		2.00	4.46
	4.00	1.09 +02		2.50	4.77
	5.00	1.19		3.00	5.02
	6.00	1.25		4.00	5.34
	7.00	1.29		5.00	5.60
	8.00	1.32		7.00	5.90
	9.00	1.34		9.00	5.90
	1.00 -02	1.37		1.00 -02	5.90
	1.50	1.40		1.50	5.90
	2.00	1.42		1.00 -01	5.90
	2.50	1.43			
	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	315	1.00 -05	4.34 -01
	1.00 -01	1.38		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	315	0.100 -04	0.434 +00
	0.110 -01	0.642		0.159 -03	0.689 +01
	0.200	0.672		0.230	0.100 +02
	0.300	0.688		0.330	0.143
	0.400	0.689		0.100 -02	0.159
	0.500	0.689		0.150	0.165
	0.600	0.689		0.250	0.173
	0.100 +00	0.689		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 NFT-6
Tabular Values for [Figure NFT-6](#)

Temp., °C	A	B, MPa	Temp., °C	A	B, MPa
40	1.00 -05	5.76 -01	205	6.57	2.31
	1.74 -04	1.00 +01		1.17 -02	2.59
	4.67 -03	2.69 +02		2.00	2.76
	7.26	3.17		3.00	2.83
	1.05 -02	3.45		1.00 -01	2.83
	1.83	3.78	315	1.00 -05	5.14 -01
	3.83	3.96		1.94 -04	1.00 +01
	1.00 -01	3.96		3.36 -03	1.72 +02
95	1.00 -05	5.65 -01		4.78	1.92
	1.77 -04	1.00 +01		1.23 -02	2.24
	4.09 -03	2.31 +02		4.50	2.35
	5.97	2.69		1.00 -01	2.35
	1.01 -02	3.10	425	1.00 -05	4.90 -01
	2.44	3.45		2.04 -04	1.00 +01
	4.11	3.54		3.38 -03	1.65 +02
	1.00 -01	3.54		3.88	1.72
205	1.00 -05	5.38 -01		8.82	1.93
	1.85 -04	1.00 +01		5.45 -02	2.07
	3.53 -03	1.90 +02		1.00 -01	2.07

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	260	1.00 -05	3.96 -01
	6.00	8.83		3.83 -04	1.54 +01
	1.00 -02	9.58		1.00 -03	2.14
	1.50	1.00 +02		3.00	2.97
150				9.00	3.78
	1.00 -05	4.54 -01	370	1.00 -05	3.48 -01
	6.72 -04	3.22 +01		2.93 -04	1.05 +01
	1.00 -03	3.85		1.00 -03	1.48
	1.50	4.42		3.00	1.99
	2.00	4.73		9.00	2.59
	4.00	5.32			
	6.00	5.59			
	1.00 -02	5.83			

Table NFZ-2
Tabular Values for Figure NFZ-2

Temperature up to 40°C, E = 1.0×10^5 MPa		Temperature 150°C, E = 8.6×10^4 MPa		Temperature 260°C, E = 7.5×10^4 MPa		Temperature 370°C, E = 6.4×10^4 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 $\Delta \log$ time-to-rupture divided by $\Delta \log$ 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 stainless steels, nickel alloys, copper alloys, and cobalt alloys having an S_Y/S_T ratio less than 0.625. 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) $100 F_{avg} \%$ 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)]	$F_{avg} S_{Ravg}$	$0.8 S_{Rmin}$	$1.0 S_c$
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)]	$(F_{avg} \times 0.85) S_{Ravg}$	$(0.8 \times 0.85) S_{Rmin}$	$0.85 S_c$

NOTE:

(1) Two sets of allowable stress values may be provided for austenitic stainless steels in Table 1A; and nickel alloys, copper alloys, and cobalt alloys in Table 1B; having an S_Y/S_T ratio less than 0.625. The lower values are not specifically identified by a footnote. These lower values do not exceed two-thirds of the 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 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 allowable stress values for nonnuclear materials in Table 3, the Committee is guided by successful experience in service, insofar as evidence of satisfactory experience 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 $\Delta \log$ time-to-rupture divided by $\Delta \log$ 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, nickel alloys, copper alloys, and cobalt alloys having an S_Y/S_T ratio less than 0.625, 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).

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 $1.1 S_T R_T$.

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) $100 F_{avg}$ % 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 IN TABLE 4 FOR USE WITH SECTION VIII, DIVISION 2, PART 5 AND ANNEX 5.F; AND WITH SECTION III, SUBSECTIONS NB AND WB

The allowable stress or design stress intensity value shown at any temperature in Table 4 is the least of the following:

(a) For materials whose strength has not been enhanced by heat treatment or strain hardening,

(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 strain hardening,

(1) one-third of the specified minimum yield strength at room temperature;

(2) one-third 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 $1.1 S_T R_T$.

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 $0.9 S_Y R_Y$ [Note (1)]
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{3} S_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{0.85}{3} S_T$	$\frac{1.1 \times 0.85}{3} S_T R_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{2}{3} \times 0.85 S_Y R_Y$ or $0.9 \times 0.85 S_Y R_Y$ [Note (1)]

NOTE:

(1) For austenitic stainless steels, nickel alloys, copper alloys, and cobalt alloys having an S_Y/S_T ratio less than 0.625, the design stress intensity values in Tables 2A and 2B 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	$\frac{S_T}{4}$	$\frac{2}{3}S_Y$	$\frac{S_T}{4}$	$\frac{1.1}{4} S_T R_T$	$\frac{2}{3}S_Y$	$\frac{2}{3}S_Y R_Y$	$F_{avg} S_{Ravg}$	$0.8S_{Rmin}$	$1.0S_C$
Bolting, with strength enhanced by heat treatment or strain hardening, ferrous and nonferrous [Note (1)]	$\frac{S_T}{5}$	$\frac{S_Y}{4}$	$\frac{1}{5}S_T$	$\frac{1.1}{4} S_T R_T$	$\frac{1}{4}S_Y$	$\frac{2}{3}S_Y R_Y$	$F_{avg} S_{Ravg}$	$0.8S_{Rmin}$	$1.0S_C$

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 Allowable Stress or Design Stress Intensity Values for Table 4

Product/Material	Room Temperature and Below		Above Room Temperature	
	Tensile Strength	Yield Strength	Tensile Strength	Yield Strength
Bolting, with strength not enhanced by heat treatment or strain hardening, ferrous and nonferrous	$\frac{1}{4}S_T$	$\frac{2}{3}S_Y$	$\frac{1}{4}S_T R_T$	$\frac{2}{3} S_Y R_Y$
Bolting, with strength enhanced by heat treatment or strain hardening, ferrous and nonferrous [Note (1)]	NA	$\frac{1}{3}S_Y$	NA	$\frac{1}{3}S_Y R_Y$

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 material whose strength is not enhanced by heat treatment or strain hardening, in which case the values for the material whose strength has not been enhanced by heat treatment or strain hardening shall be used.

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.

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 USE OF CHARTS IN SUBPART 3

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.

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

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 on 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 5, Subsection HB, Subpart B. 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 Section III, Division 5, Subsection HB, Subpart B; 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

Figure 3-500.1
Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under External Pressure

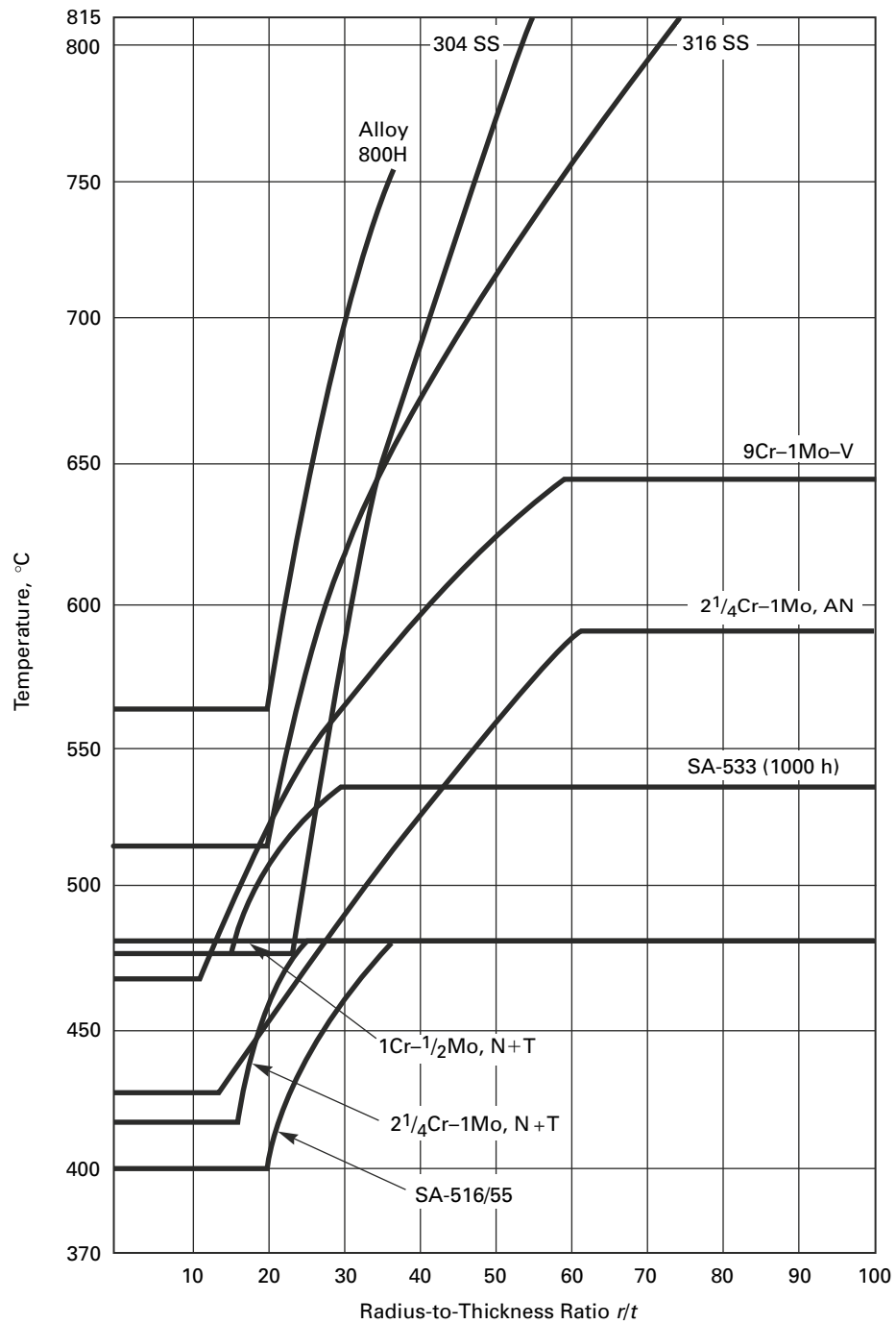
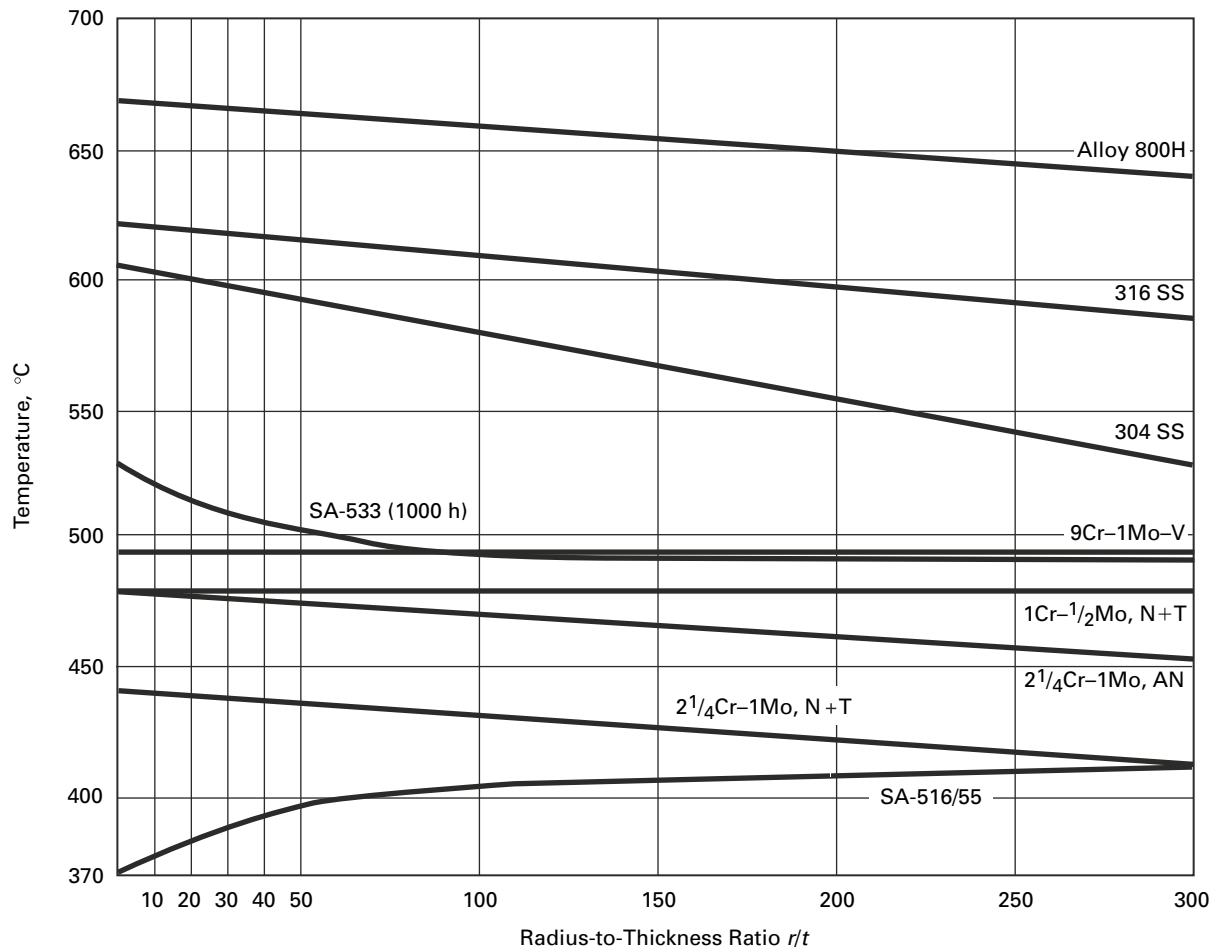


Figure 3-500.2
Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under Axial Compression



(4) 100% of the allowable stress in tension

(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

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.

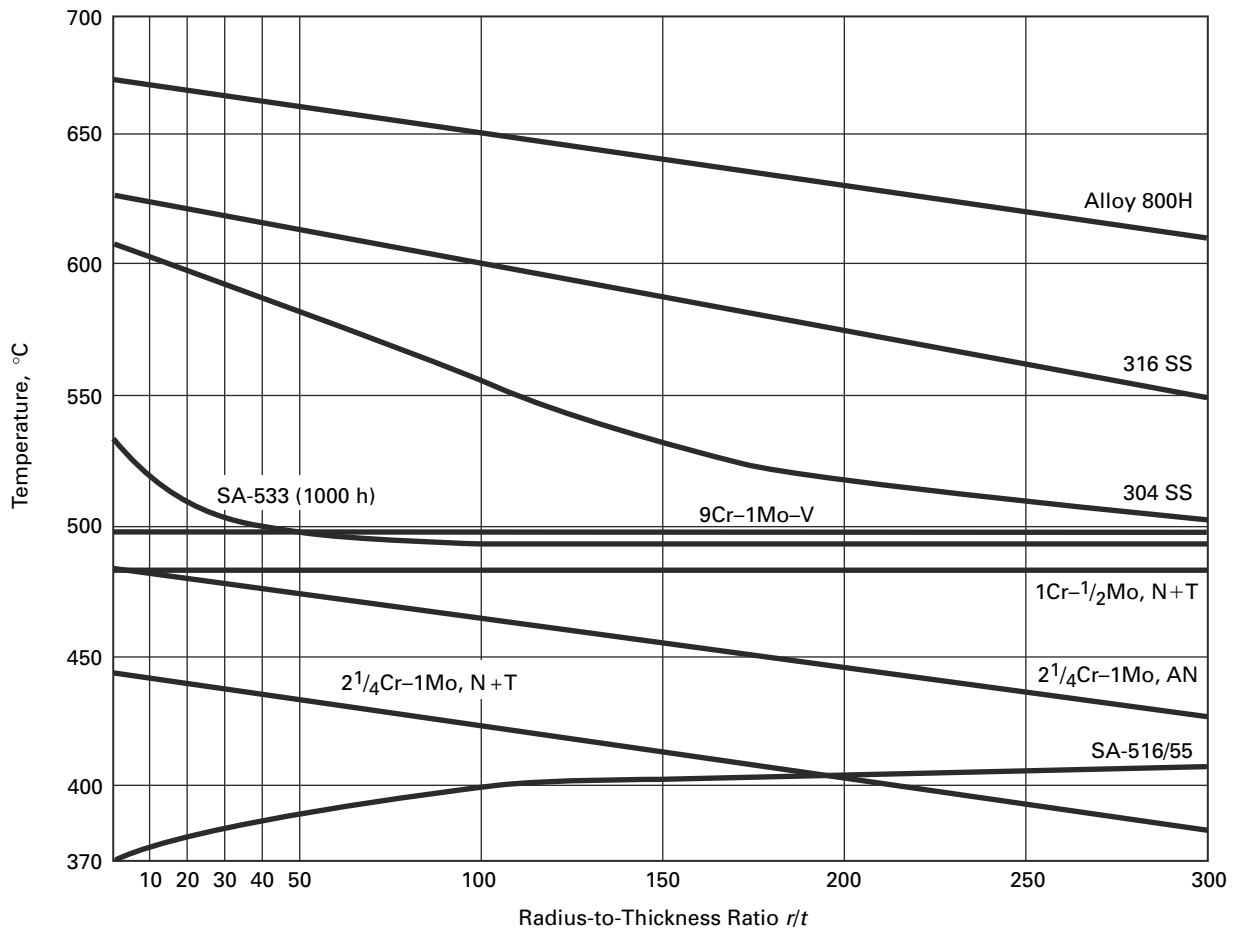
(b) Minimum yield strength, σ_{ymin} , from the Section II, Part D yield strength table, [Table Y-1](#), or approved for inclusion in [Table Y-1](#).

(c) A representative stress-strain, σ - ϵ , curve that covers the range of strain from 0 to 1.0%.

(1) *Procedure.* The procedure for developing the chart parameters, A and B, from the σ - ϵ plots is described in the following:

Step 1. Select a representative σ - ϵ curve. For a new material, σ - ϵ curves are provided in accordance with the requirements of [Mandatory Appendix 5](#). For multiple

Figure 3-500.3
Temperature Limits for Application of Section II External Pressure Charts for Sphere Under External Pressure



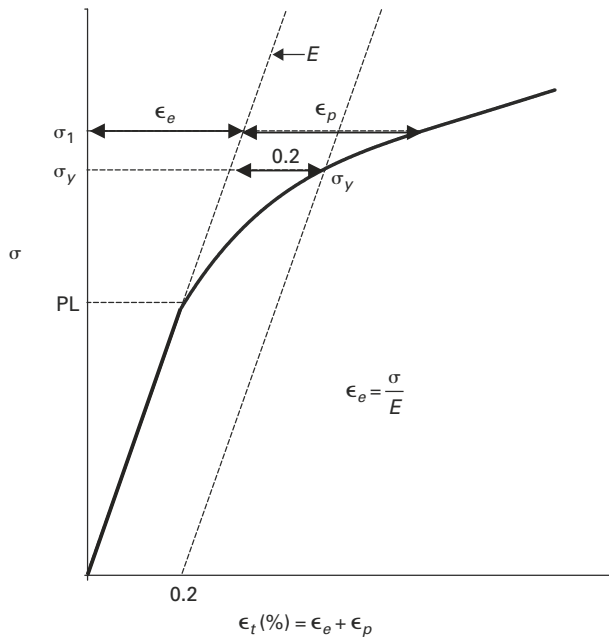
σ - ϵ curves from multiple heats all at a specific temperature, select the curve that shows the largest plastic deformation at lower stresses, usually the one with the lowest ratio of proportional limit to yield stress. The shape of the curve is more important than the absolute value of stress, because the curve is going to be normalized to σ_{ymin} . A σ - ϵ 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 σ - ϵ curve for each temperature to the specified E and σ_{ymin} at that temperature. First, determine the yield stress, σ_y , on the representative σ - ϵ curve in the usual manner, i.e., the stress at 0.2% plastic strain [see [Figure 3-700.1](#), illustration (a)]. If the σ - ϵ curve has no clearly defined elastic portion, then it is necessary to obtain E by constructing a line tangent to the σ - ϵ 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

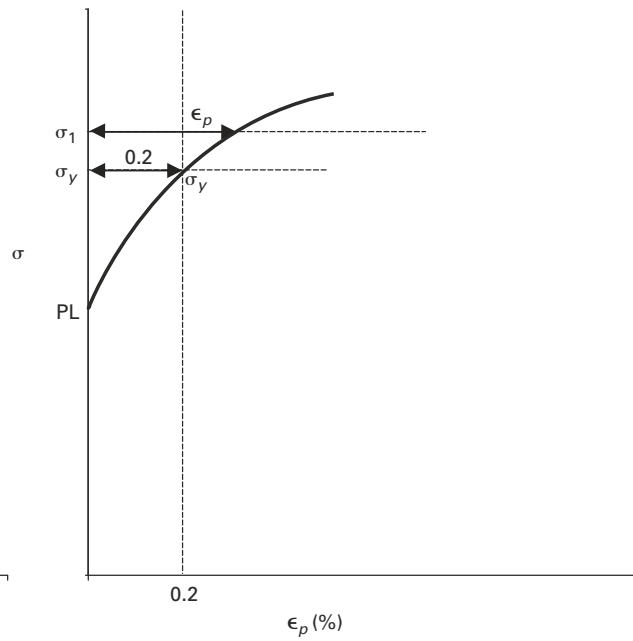
elastic strain measured by a tensile test is unreliable, so it is necessary to subtract it out from the total strain [see [Figure 3-700.1](#), illustration (b)]. The σ - ϵ curve is then normalized to σ_{ymin} by multiplying the stress at each value of plastic strain by the ratio σ_{ymin}/σ_y [see [Figure 3-700.1](#), illustration (c)]. The normalized σ - ϵ 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 σ - ϵ plot as a function of stress. This can be done graphically by calculating the tangent (i.e., the slope of a straight line tangent to the curve) at a number of points along the σ - ϵ curve and plotting the tangent against the stress at the associated points. Alternatively, if the σ - ϵ curve is approximated in algebraic terms and represented in

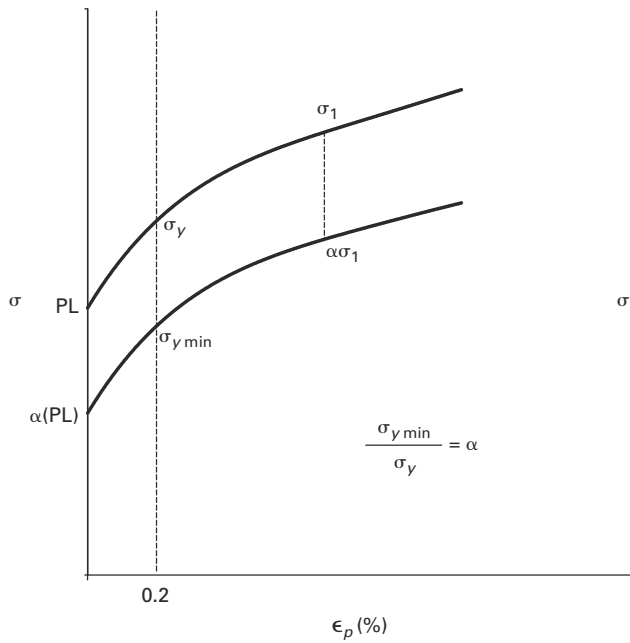
Figure 3-700.1
Normalization of Test σ - ϵ to σ_{ymin} and E_{code}



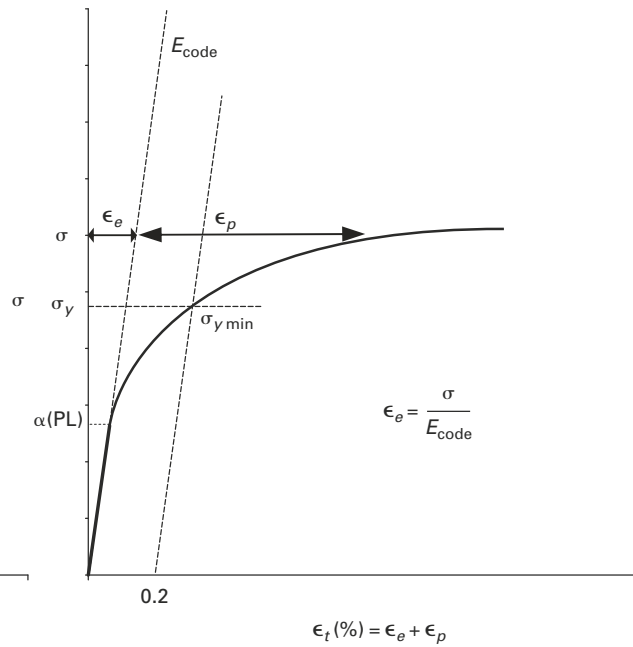
(a) From Test



(b) Subtract Out Elastic



(c) Normalize to σ_{ymin}



(d) Add in Code E

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 σ_{ymin} . 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 σ - ε 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 σ - ε 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 $1/2 \sigma_{ymin}$ 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 $B = 1/2 \sigma_{ymin}$. In summary,

(a) Segment 1: $B = 1/2 AE$ up to the proportional limit (PL)

(b) Segment 2: $B = 1/2 AE_t$ from PL to $1/2 \sigma_{ymin}$, where $E_t = d\sigma/d\varepsilon$

(c) Segment 3: $B = 1/2 \sigma_{ymin}$

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

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

- [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

MANDATORY APPENDIX 5

GUIDELINES ON THE APPROVAL OF NEW MATERIALS UNDER THE ASME BOILER AND PRESSURE VESSEL CODE

(25) 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 issued by other than national or international standards-developing organizations will not be considered for approval. Examples for such material specifications are those issued by organizations performing conformity assessment activities and those issued by material producers or suppliers or by equipment manufacturers. 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 wrought, cast, or hot isostatically pressed powder 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 or, provided all of the requirements of [Table 5-100](#) of this Appendix are met, the inclusion of hot isostatically pressed (HIP) powder metallurgy components of this grade. 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. If the new material is not made to a recognized national or international specification, a Code Case can be issued only when a request is submitted to a recognized standardization body to include the material in their specification.

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

Table 5-100
Hot Isostatically Pressed Component Requirements for Austenitic Stainless Steels,
Austenitic–Ferritic (Duplex) Stainless Steels, Martensitic Stainless Steels, Ferritic Steels, and Nickel
Alloys

Category	Requirement
Chemistry	The chemistry requirements of the hot isostatically pressed components shall be identical to those of the corresponding wrought product form.
Mechanical properties	The room-temperature mechanical properties of hot isostatically pressed components shall be identical to those that apply to the corresponding wrought product form.
Heat treatment	The heat-treatment requirements that apply to the hot isostatically pressed components shall be identical to those that apply to the corresponding wrought product form.
Grain size	The grain size requirements that apply to the hot isostatically pressed components shall be identical to those that apply to the corresponding wrought product form.
Control of powder prior to hot isostatic pressing	The maximum allowable powder size shall be 5 mm and the powder shall be produced by the gas atomization process. Immediately following atomization, the powder shall remain shielded by an inert gas until the powder is below a temperature of 40°C, to ensure that the detrimental absorption of oxygen and other deleterious contaminants is no longer possible. For austenitic stainless steels, duplex stainless steels, martensitic stainless steels, and nickel alloys, powder should be protected during storage to prevent the detrimental pickup of oxygen and other contaminants. For ferritic steels, following atomization, powders shall be stored under a positive nitrogen or argon atmosphere or vacuum to minimize potential oxidation or contamination.
Mandatory testing of hot isostatically pressed components	The chemical composition of a sample from one part from each lot of parts shall be determined by the manufacturer. The composition of the sample shall conform to the chemistry requirements of the defined wrought product form. The microstructure shall be examined at 20–50X, 100–200X, and 1,000–2,000X. The microstructure shall be reasonably uniform and shall be free of voids, laps, cracks, and porosity. One sample from each production lot shall be examined. The sample shall be taken from the component, stem, protrusion, or test part made from a single powder blend consolidated in the same hot isostatic press, using the same pressure, temperature, and time parameters, and heat treated in the same final heat-treatment charge at the option of the producer, after hot isostatic pressing or after final heat treatment. Samples for mechanical testing shall be from the component, stem, protrusion, or test part made from a single powder blend consolidated in the same hot isostatic press, using the same pressure, temperature, and time parameters, and heat-treated in the same final heat-treatment charge.
Material certification requirements	A manufacturer's certification shall be furnished to the purchaser stating that material has been manufactured, tested, and inspected in accordance with the applicable specification, and that the test results on representative samples meet specification requirements. A report of the test results shall be furnished.

GENERAL NOTES:

- (a) When a grade does exist in a defined wrought product form for alloys other than those cited, an inquirer may request the inclusion of hot isostatically pressed (HIP) components of this grade. However, the Committee may have additional requirements placed on the grade to accept this request.
- (b) If the material is to be used at temperatures where the time-dependent performance will determine the allowable stress values, the requirements of Mandatory Appendix 5 relative to the provision of data for new materials shall apply.

- (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.

(25) 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. All elements required by the specification shall be reported. Elements within the specified compositional range that are known to influence strength, ductility, toughness, weldability, and behavior under service conditions shall also be reported. The method used for chemical analysis shall be sufficiently precise to provide an accurate measurement of the elements at the level at which they should be reported. Furthermore, note the following:

- (a) It is not required that all elements be analyzed by the same technique.
- (b) The existence of interferences between elements during analysis shall be considered.
- (c) If standards traceable to national standards laboratories are not available or not used, the applicant should describe the method or methods used and how precision and detection limits were determined.

After review of the submitted data, the Committee reserves the right to request additional data (see 5-1700) or 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.

(25) 5-400 METALLURGICAL STRUCTURE AND HEAT TREATMENT

When applicable for the proposed material, the inquirer shall indicate the intended metallurgical structures, including the desired grain size range, to be achieved in order to comply with the mechanical properties requirements and, where applicable, fully describe the heat treatment (including cooling methods) to be applied to achieve these structures, the mechanical properties, and the expected behavior under service conditions. The inquirer shall report the melting and forming practices used to produce the evaluated product forms. The heat treatment temperatures shall be representative of the proposed range.

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.

hot isostatically pressed component lot: a number of parts made from a single powder blend consolidated in the same hot isostatic press using the same pressure, temperature, and time parameters, and heat treated in the same final heat-treatment charge.

powder blend: a homogeneous mixture of powder from one or more heats of the same grade. The term "powder blend" shall be substituted for the term "heat" for hot isostatically pressed powder material in 5-300, 5-700, 5-900, 5-1200, 5-1400, and 5-1800.

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.

(25) 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 nominal composition. Testing shall include the characterization of the metallurgical structure, including determination of grain size.

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.

If the hot isostatically pressed powder material meets all of the requirements of Table 5-100, it shall be considered the same material as that of the approved wrought material for temperatures approximately 25°C below the temperature where time-dependent properties, as defined by the Time-Dependent Properties Notes (T-Notes) in the applicable allowable stress table for the approved wrought material, govern.

If the hot isostatically pressed material is to be used at temperatures where the time-dependent properties, as defined by the Time-Dependent Properties Notes (T-Notes) in the applicable allowable stress table for the approved wrought material, govern, the requirements of this Appendix relative to the provision of data for new materials shall apply.

If the hot isostatically pressed powder material does not meet all of the requirements of Table 5-100, it shall be considered as a separate material to that of the approved wrought material. In this case, the requirements of this Appendix relative to the provision of data for new materials shall apply.

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, reduction of area (when specified in the material specification), and elongation. For steels, nickel alloys, cobalt alloys, and aluminum alloys, data shall be provided at room temperature and 50°C intervals, beginning at 100°C to 50°C above the maximum intended use temperature, unless the maximum intended use temperature does not exceed 40°C. For copper alloys, titanium alloys, and zirconium alloys, data shall be provided at room temperature, 65°C, and 100°C, and then at 50°C intervals, to 50°C above the maximum intended use temperature, unless the maximum intended use temperature does not exceed 40°C. The test methods shall be as given in ASTM A370, ASTM A1058, ASTM E8, ASTM E21, or other equivalent national or international test standards. 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. Data provided shall be expressed in the units and to the number of significant figures shown in Table 5-800. When either the material specification or the applicable construction code (e.g., Section XII) permits or requires that yield strength be determined by other than the 0.2% offset method, those other yield strength values shall also be reported.

5-900 TIME-DEPENDENT PROPERTIES**(25)**

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.

The creep-rupture test method shall be in accordance with ASTM E139 or other equivalent national or international test standard. 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 intervals of 50°C 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.

Data provided shall be expressed in the units and to the number of significant figures shown in Table 5-800. 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

Table 5-800
ASTM Test Methods and Units for Reporting

ASTM Designation	Title	Property	Metric Units	Metric Significant Figures
A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products	Tensile strength and yield strength	...	...
A1058	Standard Test Methods for Mechanical Testing of Steel Products—Metric	Tensile strength and yield strength	MPa	3
D2766	Standard Test Method for Specific Heat of Liquids and Solids	Specific heat [Note (1)]	J/kg-K	3
E8	Standard Test Methods for Tension Testing of Metallic Materials	Tensile strength and yield strength	MPa	3
		Density	kg/m ³	4
E21	Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials	Tensile strength and yield strength	MPa	3
E132	Standard Test Method for Poisson's Ratio at Room Temperature	Poisson's ratio	...	2
E139	Standard Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials	Rupture time	h	5
E228	Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer	Instantaneous coefficient	(mm/mm/°C) × 10 ⁻⁶	3, except 2 for x < 10
		Mean linear coefficient	(mm/mm/°C) × 10 ⁻⁶	
		Linear coefficient	mm/m	
E289	Standard Test Method for Linear Thermal Expansion of Rigid Solids With Interferometry	Instantaneous coefficient	(mm/mm/°C) × 10 ⁻⁶	3
		Mean coefficient	(mm/mm/°C) × 10 ⁻⁶	
		Linear coefficient	mm/m	
E831	Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis	Instantaneous coefficient	(mm/mm/°C) × 10 ⁻⁶	3, except 2 for x < 10
		Mean linear coefficient	(mm/mm/°C) × 10 ⁻⁶	
		Linear coefficient	mm/m	
E1225	Standard Test Method for Thermal Conductivity of Solids Using the Guarded-Comparative-Longitudinal Heat Flow Technique	Thermal conductivity	W/m × °C	4, except 3 for x < 100
E1461	Standard Test Method for Thermal Diffusivity by the Flash Method	Thermal diffusivity	m ² /s	3
		Thermal conductivity	W/m × °C	4, except 3 for x < 10
E1875	Standard Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio by Sonic Resonance	Modulus of elasticity	MPa × 10 ³	3

NOTE:

(1) Specific heat is not published but may be used to calculate thermal diffusivity from thermal conductivity.

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 elongation. Reduction of area shall also be reported, if feasible.

Post-test metallographic evaluation shall be performed on at least three test specimens including the longest-duration test samples at the time of submission of test samples. The assessment should be done on actual test specimens that were tested at temperatures within the range between the minimum time-dependent temperature and the maximum intended use temperature. The assessment shall include macro-images to document the overall appearance (oxidation, necking, intergranular fracture, etc.), as well as micro-images to document the extent of cavitation damage and grain size.

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). For precipitation-strengthened alloys, the shortest test duration considered in the allowable stress analysis values is 1 000 h.

At successive temperatures, two or more tests should be conducted at nearly the same stress value.

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 precipitation-strengthened materials, an emphasis shall be placed on relevant test conditions suitably below the yield strength.

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, creep-rupture data with duration of more than 30 000 h is required at $\pm 25^\circ\text{C}$ of the maximum intended use temperature. This long-term data can be supplemented with relevant or equivalent service experience. 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 three test stresses at each test temperature, including at least one stress for each material resulting in MCR values

below $3 \times 10^{-4} \text{ \%}/\text{h}$. Creep rate data may be obtained from instrumented stress-rupture tests or may be obtained on additional test 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

Stress-strain data (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. 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, modulus of elasticity, 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 heat meeting the requirements of the material specification, the inquirer shall furnish to the Boiler and Pressure Vessel Committee on Materials adequate data necessary to establish values for coefficient of thermal expansion, coefficients of thermal conductivity and diffusivity, modulus of elasticity, Poisson's ratio, and density. Test methods shall be as follows:

(a) ASTM E228, ASTM E289, or ASTM E831 for thermal expansion coefficients

(b) ASTM E1225 or ASTM E1461 and ASTM D2776 for thermal conductivity and thermal diffusivity

(c) ASTM E1875 for modulus of elasticity

(d) ASTM E1875 or ASTM E132 for Poisson's ratio

Data from other equivalent national or international test standards shall be acceptable in lieu of those listed above. Instantaneous, mean, and linear coefficients of thermal expansion shall be reported. Data for all physical properties shall be provided at least 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. Data provided shall be expressed in the units and to the number of significant figures shown in [Table 5-800](#).

(25) 5-1500 DATA REQUIREMENTS FOR WELDS, WELDMENTS, AND WELDABILITY

The following welding information is required for a new base metal for use in welded construction in an ASME BPV Construction Code: data on weldability, data on strength and toughness in the time-independent regime, data on strength in the time-dependent regime, and post-test examination.

The data requirements for weldability and for strength in the time-independent regime are the responsibility of the BPV IX Standards Committee and are to be found in Section II, Part C, Guideline on the Approval of New Welding and Brazing Material Classifications Under the ASME Boiler and Pressure Vessel Code; and in Section IX, Mandatory Appendix J, Guideline for Requesting P-Number Assignments for Base Metals Not Listed in Table QW/QB-422. The requirements for weld metal and weldment toughness data vary with the class of materials and their application, and are to be found in the Construction Codes that have toughness rules — Sections III, VIII, and XII.

Data for welds and weldments for a new base material for use in the time-dependent regime are the responsibility of the BPV II and BPV IX Standards Committees, and particularly of their joint Subgroup on Strength of Weldments. The following welding information shall be

provided by the Inquirer, to support the request for a Code Case for, or incorporation of, a new base material for use in elevated temperature service:

(a) When there is one or more AWS, ASME, or equivalent consumable specification and classification suitable for use with the new base material, and when such consumable/process combinations can produce welds and weldments that have both good weldability and as high or higher strengths as the base metal over the range of expected service temperatures, no time-dependent test data is required. Rather, the inquirer shall submit a tabular or graphical comparison of time-dependent allowable stresses for base metals nominally matching the compositions of such welding consumables against the allowable stresses proposed for the new base metal. (Note that since neither ASME nor any other organization publishes allowable stresses for all-weld metal or for weldments, it is necessary to use, in this comparison, the allowable stresses for the base metals equivalent to the welding consumables as a reasonable first approximation.) An example of such a comparison appears in [Table 5-1500](#).

(b) When there is no such suitable consumable having an AWS, ASME, or equivalent specification and classification, or when it is necessary or desirable to use a new, perhaps nominally matching in composition to the base metal, welding consumable, the following information shall be provided to the Committee:

(1) the chemistry ranges for each element specified for the consumable to be used. If the chemistry ranges vary for the consumables to be used for different processes, then the chemistry ranges of the consumables appropriate for each process shall be provided.

(2) creep-rupture data for weldments made with one lot of consumables for each process intended to be used with the new base material

(-a) at temperature intervals not greater than 100°C. Where there is a possibility of degradation of strength related to metallurgical instability, test temperatures shall be at intervals of 50°C or less.

(-b) over a temperature range from the first rational temperature above the temperature at which time-dependent properties control the allowable stresses of the new base material to about 50°C above the maximum intended service temperature for which allowable stresses for the base material are requested.

(-c) at a minimum of four stresses calculated to produce rupture times at least 1 000 h and with one test exceeding 10 000 h.

(-d) the test temperature; stress; rupture time; specimen size and configuration, including weld location; and failure location (base metal, weld metal, or heat affected zone), for all test samples.

(-e) the creep-rupture data shall be compared to the scatter bands of data for the base metal. For the evaluation of creep strength enhanced ferritic (CSEF) steels, a preference shall be placed on cross-weld test specimens

Table 5-1500
Example of a Comparison of Allowable Stresses of Base Metals With Compositions Similar to Those of Selected Welding Consumables and the Proposed New Base Metal

Comparison of Nominal Chemical Compositions, %, and Specified Mechanical Properties of Ni-Base Alloys in Section II, Part B

Grade	Ni	Cr	Fe	Mn	Mo	Co	Al	C	Cu	B	Si	Ti	W	Cb + Ta	Ultimate Tensile Strength, MPa	Yield Strength, MPa
N06230	Bal. ≈ 53	22	3	0.65	2	5	0.5	0.1	...	...	0.5	...	14	...	760	310
N06600	72 min.	15.5	8	0.5	...	...	...	0.1	0.25	...	0.25	...	...	...	550	240
N06617	44	22	1.5	0.5	9	12	1.2	0.1	0.25	0.005	0.5	0.4	...	...	665	240
N06625	58 min.	21.5	5	0.5	9	1	0.4	0.1	0.4	...	0.5	0.4	...	3.65	827	414
N06696	Bal. ≈ 60	30	4	0.2	2	...	...	0.07	2	...	1.5	0.2	...	...	586	240

Comparison of Allowable Stresses of Ni-Base Alloys in Section II, Part B (MPa at Temperature, °C, Estimated for N06696)

Grade	P-No.	500	550	600	650	700	750	800	850	900	950	1 000
N06230	43	194	194	151	102	75.5	50.4	32.9	18.4	10.2	5.2	2.4
N06600	43	79.7	40.1	19.0	13.8	...	...	...	...	...	...	...
N06617	43	108	106	106	105	81.0	50.4	31.3	19.4	12.3	7.5	...
N06625	43	184	182	178	136	84.3	50.2	30.3	16.5	...	...	...
N06696	TBD	139	87.0	55.6	35.5	22.8	13.9	9.0	4.9	3.2	2.1	1.4

GENERAL NOTE: In this example, the proposed new base metal is N06696.

with large cross-sectional area or vessel tests or other feature-type tests. The extent of testing described in 5-1500 may be reduced in lieu of feature-type tests.

(c) Post-test metallographic evaluation shall be performed on at least three actual test specimens including the longest-duration test samples at the time of submission. The assessment shall be limited to a test temperature not higher than the maximum intended use temperature and not lower than the temperature transition to time-dependent behavior. The assessment shall include macro-images to document the overall appearance (oxidation, necking, intergranular fracture, etc.), as well as micro-images to document the nature and extent of cavitation damage.

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

(a) the text of the EN standard shall remain unaltered and shall be included as adopted by CEN

(b) national forewords and/or annexes may be added to cover specific national practices, but shall not be in contradiction with the EN standard

(c) 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)

(d) 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 6

BASIS FOR ESTABLISHING STRESS VALUES IN TABLES 6A, 6B, 6C, AND 6D

6-100 DERIVATION OF ALLOWABLE STRESS VALUES

The values in Tables 6A, 6B, 6C, and 6D 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.

The factors employed to determine the allowable stress values are provided in [Tables 6-100\(a\)](#), [6-100\(b\)](#), and [6-100\(c\)](#). Nomenclature for these tables is as follows:

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 yield 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

The maximum allowable stress shall be the lowest value obtained from the criteria in [Tables 6-100\(a\)](#), [6-100\(b\)](#), and [6-100\(c\)](#). The maximum use temperature for materials is limited to below the time-dependent regime. Allowable stresses are listed for temperatures up to 275°C. If a material reaches the time-dependent regime below 275°C, no allowable stress values are listed for that material above the cross-over temperature. The mechanical properties considered and the factors applied to establish the maximum allowable stresses are given below.

6-110 RULES FOR ESTABLISHING STRESS VALUES IN TABLES 6A AND 6B

(a) At any temperature below the creep range, the allowable stresses are established at no higher than the lowest of the following:

(1) one-fifth of the specified minimum tensile strength at room temperature

(2) one-fifth 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 bolting materials, the basis for setting stresses is the same as for all other materials with the exception that (1) and (2) above are replaced by

(1) one-fourth of the specified minimum tensile strength at room temperature

(2) one-fourth of the tensile strength at temperature

The following limitation also applies to bolting materials: At temperatures below the creep range, the stresses for materials whose strength has been enhanced by heat treatment or by strain hardening shall not exceed the lesser of 20% of the specified minimum tensile strength at room temperature or 25% of the specified minimum yield strength at room temperature unless these values are lower than the annealed values, in which case the annealed values shall be used.

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 $1.1 S_T R_T$.

6-120 RULES FOR ESTABLISHING STRESS VALUES IN TABLES 6C AND 6D

At any temperature below the creep range, the allowable stresses are established at no higher than the lowest of the following:

(a) one-fourth of the specified minimum tensile strength at room temperature

(b) one-fourth 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

Two sets of allowable stress values are provided in Table 6D for austenitic stainless steels. The higher values should be used only where slightly greater deformation is not in itself objectionable. The higher alternative allowable stresses are identified by a Note. These stresses

exceed two-thirds for austenitic stainless steel materials but do not exceed 90% of the minimum yield strength at temperature. These higher stresses are not recommended for the design of flanges and other strain-sensitive applications.

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 $1.1 S_T R_T$.

Table 6-100(a)
Criteria for Establishing Allowable Stress Values for Tables 6A and 6B

Product/Material	Room Temperature and Below		Above Room Temperature			
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength	
Wrought or cast, ferrous and nonferrous	$\frac{S_T}{5}$	$\frac{2}{3} S_Y$	$\frac{S_T}{5}$	$\frac{1.1}{5} S_T R_T$	$\frac{2}{3} S_Y$	$\frac{2}{3} S_Y R_Y$
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{5} S_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{0.85}{5} S_T$	$\frac{1.1 \times 0.85}{5} S_T R_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{2}{3} \times 0.85 S_Y R_Y$
Bolting, wrought ferrous	$\frac{S_T}{4}$	$\frac{2}{3} S_Y$	$\frac{S_T}{4}$	$\frac{1.1}{4} S_T R_T$	$\frac{2}{3} S_Y$	$\frac{2}{3} S_Y R_Y$

Table 6-100(b)
Criteria for Establishing Allowable Stress Values for Table 6C

Product/Material	Room Temperature and Below		Above Room Temperature			
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength	
Wrought or cast, ferrous and nonferrous	$\frac{S_T}{4}$	$\frac{2}{3} S_Y$	$\frac{S_T}{4}$	$\frac{1.1}{4} S_T R_T$	$\frac{2}{3} S_Y$	$\frac{2}{3} S_Y R_Y$
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{4} S_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{0.85}{4} S_T$	$\frac{1.1 \times 0.85}{4} S_T R_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{2}{3} \times 0.85 S_Y R_Y$

Table 6-100(c)
Criteria for Establishing Allowable Stress Values for Table 6D

Product/Material	Room Temperature and Below		Above Room Temperature			
	Tensile Strength	Yield Strength	Tensile Strength		Yield Strength	
Wrought or cast, ferrous and nonferrous	$\frac{S_T}{4}$	$\frac{2}{3} S_Y$	$\frac{S_T}{4}$	$\frac{1.1}{4} S_T R_T$	$\frac{2}{3} S_Y$	$0.9 S_Y R_Y$ [Note (1)]
Welded pipe or tube, ferrous and nonferrous	$\frac{0.85}{4} S_T$	$\frac{2}{3} \times 0.85 S_Y$	$\frac{0.85}{4} S_T$	$\frac{1.1 \times 0.85}{4} S_T R_T$	$\frac{2}{3} \times 0.85 S_Y$	$0.9 \times 0.85 S_Y R_Y$ [Note (1)]

NOTE:

- (1) Two sets of allowable stress values may be provided in Table 6D for austenitic materials. The lower values are not specifically identified by a Note; these lower values do not exceed two-thirds of the yield strength at temperature. The higher alternate allowable stresses are identified by a Note; these higher stresses may exceed two-thirds but do not exceed 90% of the yield strength at temperature. The higher stress values should only be used 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 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 $5 \times (C + N)$ 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 (ksi√in.)	MPa square root meters (MPa√m)
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

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, nickel alloys, copper alloys, and cobalt alloys

(4) for austenitic stainless steels, nickel alloys, copper alloys, and cobalt alloys having an S_y/S_T ratio less than 0.625, 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 $66\frac{2}{3}\%$, 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 $R_y S_y$.

(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.

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](#).

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, nickel alloy, copper alloy, and cobalt alloy product forms having an S_y/S_T ratio less than 0.625	$\frac{S_T}{2.4}$	$\frac{S_y}{1.5}$	$\frac{S_T}{2.4}$	$\frac{R_y S_y}{1.5}$	$\text{Min.} \left(F_{\text{avg}} S_{R\text{avg}}, 0.8 S_{R\text{min}} \right)$	$1.0 S_{\text{cavg}}$
All wrought or cast austenitic stainless steel, nickel alloy, copper alloy, and cobalt alloy product forms except bolting, having an S_y/S_T ratio less than 0.625 [Note (1)]	$\frac{S_T}{2.4}$	$\frac{S_y}{1.5}$	$\frac{S_T}{2.4}$	$\text{Min.} \left(\frac{S_y}{1.5}, \frac{0.9 S_y R_y}{1.0} \right)$	$\text{Min.} \left(F_{\text{avg}} S_{R\text{avg}}, 0.8 S_{R\text{min}} \right)$	$1.0 S_{\text{cavg}}$

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) 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.

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-Mn 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, 2¹/₄Cr-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:

$$\begin{aligned} J \text{ factor (base metal)} &= (\text{Si} + \text{Mn}) \times (\text{P} + \text{Sn}) \times 10,000 \\ &\leq 150 \text{ (elements calculated in wt. \%)} \end{aligned}$$

$$\begin{aligned} X \text{ factor (weld metal)} &= (10\text{P} + 5\text{Sb} + 4\text{Sn} + \text{As})/100 \\ &\leq 15 \text{ (elements calculated in ppm)} \end{aligned}$$

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 2¹/₄Cr-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 air-borne 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 Non-mandatory 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 unre-moved 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 ENVIRONMENTALLY 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-702.1.6 Hydrogen Environment Embrittlement of Cold-Worked Stainless Steels at Low Temperatures

Cold-worked austenitic stainless steels may be susceptible to hydrogen environment embrittlement when exposed to hydrogen charging conditions in the temperature range of -130°C to 95°C . The susceptibility to embrittlement may be worsened by the development of strain-induced martensite resulting from cold-forming operations, especially cold spinning. A full solution anneal after completion of cold-forming operations will reduce potential embrittlement and subsequent loss of ductility and toughness.

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 m³ 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.

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.^{4, 5}

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 Section 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 nomenclatures associated with the equations. 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, %
$\frac{1}{32}$	0.8	-0.8
$\frac{3}{64}$	1.2	-0.8
$\frac{1}{16}$	1.5	5.5
$\frac{3}{32}$	2.5	-5.0
$\frac{1}{8}$	3	5.5
$\frac{5}{32}$	4	-0.8
$\frac{3}{16}$	5	-5.0
$\frac{7}{32}$	5.5	1.0
$\frac{1}{4}$	6	5.5
$\frac{5}{16}$	8	-0.8
$\frac{3}{8}$	10	-5.0
$\frac{7}{16}$	11	1.0
$\frac{1}{2}$	13	-2.4
$\frac{9}{16}$	14	2.0
$\frac{5}{8}$	16	-0.8
$1\frac{1}{16}$	17	2.6
$\frac{3}{4}$	19	0.3
$\frac{7}{8}$	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
$1\frac{1}{8}$	29
$1\frac{1}{4}$	32
$1\frac{1}{2}$	38
2	50
$2\frac{1}{4}$	57
$2\frac{1}{2}$	64
3	75
$3\frac{1}{2}$	89
4	100
$4\frac{1}{2}$	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 $\frac{1}{8}$	DN 6	NPS 20	DN 500
NPS $\frac{1}{4}$	DN 8	NPS 22	DN 550
NPS $\frac{3}{8}$	DN 10	NPS 24	DN 600
NPS $\frac{1}{2}$	DN 15	NPS 26	DN 650
NPS $\frac{3}{4}$	DN 20	NPS 28	DN 700
NPS 1	DN 25	NPS 30	DN 750
NPS $1\frac{1}{4}$	DN 32	NPS 32	DN 800
NPS $1\frac{1}{2}$	DN 40	NPS 34	DN 850
NPS 2	DN 50	NPS 36	DN 900
NPS $2\frac{1}{2}$	DN 65	NPS 38	DN 950
NPS 3	DN 80	NPS 40	DN 1000
NPS $3\frac{1}{2}$	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 millimeters (mm²), and areas in square feet (ft²) were converted to square meters (m²). 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 millimeters (mm³), and volumes in cubic feet (ft³) were converted to cubic meters (m³). 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

(1) 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	Use exclusively in equations
psi	kPa	6.894757	Use 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√in.	MPa√m	1.0988434	...
Btu/hr	W	0.2930711	Use for boiler rating and heat transfer
lb/ft ³	kg/m ³	16.018463	...

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, 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.

It should be recognized that following the “one material: one trend curve” rule will result in certain inconsistencies with the criteria established by Section II, Part D, [Mandatory Appendices 1, 2, and 10](#). 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 $(205 \times 2)/3 = 136.67 = 137$ MPa. Instead, 138 MPa is obtained from $(30 \text{ ksi} \times 6.894757 \times 2)/3 = 137.89514 = 138$ 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, TENSILE STRENGTH, AND YIELD STRENGTH TABLES IN SECTION II, PART D AND IN CODE CASES

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. When listing tensile strength and yield strength values in ksi, the last step in the analysis is to round the calculated values to four significant figures for values of 100.0 ksi and greater, to three significant figures for values less than 100.0 ksi down to and including 10.0 ksi, and to two significant figures for values less than 10.0 ksi.

D-320 METRIC TABLES

When listing allowable stress, tensile strength, and yield strength 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, 1 022 rounds to 1 020, while 1 023 rounds to 1 025 MPa.

NONMANDATORY APPENDIX E

MATERIAL DATA FOR STRESS ANALYSIS IN THE TIME-DEPENDENT REGIME

E-100 INTRODUCTION

Tables E-100.1-1 through Table E-100.23-1 and Figures E-100.2-1 through E-100.22-11 were drawn from the 2015 Edition of Section III, Subsection NH. They are intended to be used in the time-dependent stress analysis

for nonnuclear applications using the strain method. A cross-reference between the table and figure numbers in this Appendix and those in the 2015 Edition of Section III, Subsection NH is provided in Table E-100.24-1.

Table E-100.1-1
Tensile Strength Values, S_u

For Metal Temperature Not Exceeding, °C	See Table U for Values up to 538°C				
	304 SS	316 SS	Ni-Fe-Cr UNS N08810	2 $\frac{1}{4}$ Cr-1Mo	9Cr-1Mo-V
550	388	435	402	358	379
575	373	417	391	327	341
600	355	396	378	290	303
625	335	373	362	248	265
650	314	347	345	202	228
675	289	318	326	...	...
700	264	288	305	...	...
725	238	255	282	...	...
750	211	221	258	...	...
775	185	185	233	...	...
800	159	149	208	...	...
825	...	...	182	...	...
850	...	...	157	...	...
875	...	...	132	...	...
900	...	...	109	...	...

GENERAL NOTES:

- (a) 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. 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. Neither the tensile strength nor the yield strength values correspond exactly to either *average* or *minimum* as these terms are applied to a statistical treatment of a homogeneous set of data.
- (b) Neither the ASME Material Specifications nor the rules of Sections I, IV, VIII, or XII require elevated temperature testing for tensile or 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 tensile and 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.

Table E-100.1-2
Tensile and Yield Strength Reduction Factor Due to Long Time Prior Elevated Temperature Service

Material	Service Temp., °C	YS Reduction Factor	TS Reduction Factor
304 SS	≥480	1.00	0.80
316 SS	≥480	1.00	0.80
800H	≥730	0.90	0.90
2 $\frac{1}{4}$ Cr-1Mo	≥425	[Note (1)]	[Note (1)]
9Cr-1Mo-V	≥480	1.0	[Note (2)]

GENERAL NOTE: No reduction factor required for service below the indicated temperature.

NOTES:

- (1) Tables E-100.1-3 and E-100.1-4 are selected to correspond to the maximum wall-averaged temperature achieved during any Level A, B, or C Service Loading.
- (2) See Table E-100.1-5.

Table E-100.1-3
Yield Strength Reduction Factors for 2 $\frac{1}{4}$ Cr-1Mo

Temp., °C	Time, h										
	1	10	30	10 ²	3 × 10 ²	10 ³	3 × 10 ³	10 ⁴	3 × 10 ⁴	10 ⁵	3 × 10 ⁵
375	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
425	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.88
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.94	0.89	0.82
525	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.88	0.82	0.77
550	1.00	1.00	1.00	1.00	1.00	0.98	0.95	0.88	0.82	0.76	0.71
575	1.00	1.00	1.00	1.00	1.00	0.94	0.88	0.82	0.76	0.71	0.66
600	1.00	1.00	1.00	1.00	0.99	0.90	...	...	...	...	...
625	1.00	1.00	1.00	0.99	0.93	0.85	...	...	...	...	...
650	1.00	1.00	1.00	0.96	0.89	0.82	...	...	...	...	...

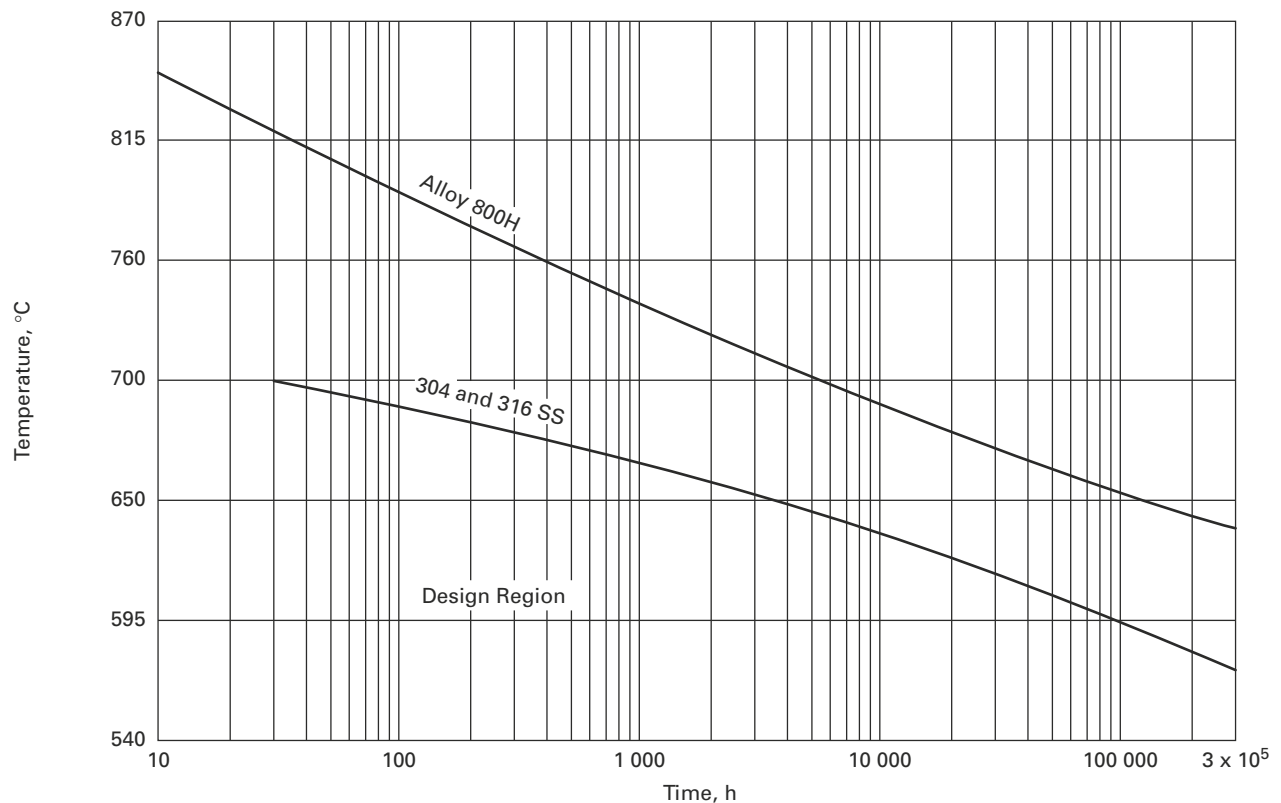
Table E-100.1-4
Tensile Strength Reduction Factors for 2 $\frac{1}{4}$ Cr-1Mo

Temp., °C	Time, h										
	1	10	30	10 ²	3 × 10 ²	10 ³	3 × 10 ³	10 ⁴	3 × 10 ⁴	10 ⁵	3 × 10 ⁵
375	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
425	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.89
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.94	0.88	0.84
500	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.93	0.88	0.83	0.79
525	1.00	1.00	1.00	1.00	1.00	0.98	0.94	0.88	0.84	0.79	0.74
550	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.84	0.80	0.74	0.70
575	1.00	1.00	1.00	1.00	0.98	0.91	0.86	0.80	0.75	0.70	0.65
600	1.00	1.00	1.00	1.00	0.93	0.87	...	...	...	...	...
625	1.00	1.00	1.00	0.94	0.88	0.82	...	...	...	...	...
650	1.00	1.00	1.00	0.90	0.84	0.78	...	...	...	...	...

Table E-100.1-5
Tensile Strength Reduction Factors for 9Cr-1Mo-V

Temp., °C	Time, h										
	1	10	30	10 ²	3 × 10 ²	10 ³	3 × 10 ³	10 ⁴	3 × 10 ⁴	10 ⁵	3 × 10 ⁵
375	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
425	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97
525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.91
550	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.92	0.89
575	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.92	0.88	0.83
600	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.92	0.89	0.85	0.84
625	1.00	1.00	1.00	1.00	1.00	0.97	0.94	0.90	0.87	0.83	0.81
650	1.00	1.00	1.00	1.00	0.98	0.94	0.91	0.87	0.84	0.81	0.78

Figure E-100.2-1
Permissible Time/Temperature Conditions for Material That Has Been Cold Worked >5% and <20% and Subjected to Short-Time High Temperature Transients



GENERAL NOTE: The sum of time at every temperature shall determine a point within the design region of the figure for the specific material. For multiple temperature/time combinations, the linear summation of life fraction shall not exceed 1.0, the material limit.

Table E-100.3-1
Permissible Base Materials for Structures Other Than Bolting

Base Material	Spec. No.	Product Form	Types, Grades, or Classes
Types 304 SS and 316 SS [Note (1)], [Note (2)]	SA-182	Fittings & forgings	F304, F304H, F316, F316H
	SA-213	Smls. tube	TP304, TP304H, TP316, TP316H
	SA-240	Plate	304, 316, 304H, 316H
	SA-249	Welded tube	TP304, TP304H, TP316, TP316H
	SA-312	Welded & smls. pipe	TP304, TP304H, TP316, TP316H
	SA-358	Welded pipe	304, 316, 304H, 316H
	SA-376	Smls. pipe	TP304, TP304H, TP316, TP316H
	SA-403	Fittings	WP304, WP304H, WP316, WP316H, WP304W, WP304HW, WP316W, WP316HW
	SA-479	Bar	304, 304H, 316, 316H
	SA-965	Forgings	F304, F304H, F316, F316H
	SA-430	Forged & bored pipe	FP304, FP304H, FP316, FP316H
Ni-Fe-Cr (Alloy 800H) [Note (3)]	SB-163	Smls. tube	UNS N08810
	SB-407	Smls. pipe & tube	UNS N08810
	SB-408	Rod & bar	UNS N08810
	SB-409	Plate, sheet & strip	UNS N08810
	SB-564	Forgings	UNS N08810
2 ¹ / ₄ Cr-1Mo [Note (4)]	SA-182	Forgings	F22, Class 1
	SA-213	Smls. tube	T22
	SA-234	Piping fittings	WP22, WP22W [Note (5)]
	SA-335	Forged pipe	P22
	SA-336	Fittings, forgings	F22a
	SA-369	Forged pipe	FP22
	SA-387	Plate	Grade 22, Class 1
	SA-691	Welded pipe	Pipe 2 ¹ / ₄ CR (SA-387, Grade 22, Class 1)
9Cr-1Mo-V	SA-182	Forgings	F91
	SA-213	Smls. tube	T91
	SA-335	Smls. pipe	P91
	SA-387	Plate	91

NOTES:

- (1) These materials shall have a minimum specified room temperature yield strength of 207 MPa and a minimum specified carbon content of 0.04%.
- (2) For use at temperatures above 540°C, these materials may be used only if the material is heat treated by heating to a minimum temperature of 1 040°C and quenching in water or rapidly cooling by other means.
- (3) These materials shall have a total aluminum-plus-titanium content of at least 0.50% and shall have been heat treated at a temperature of 1 120°C or higher.
- (4) This material shall have a minimum specified room temperature yield strength of 207 MPa, a minimum specified room temperature ultimate strength of 414 MPa, a maximum specified room temperature ultimate strength of 586 MPa, and a minimum specified carbon content of 0.07%.
- (5) The material allowed under SA-234 shall correspond to one of the following:
 - (a) SA-335, Grade P22
 - (b) SA-387, Grade 22, Class 1
 - (c) SA-182, Grade F22, Class 1 in compliance with Note (3).

Table E-100.3-2
Permissible Weld Materials

Base Material	Spec. No.	Class
Types 304 SS and 316 SS	SFA-5.4	E308, E308L, E316, E316L, E16-8-2
	SFA-5.9	ER308, ER308L, ER316, ER316L, ER16-8-2
	SFA-5.22	E308, E308T, E308LT, E316T, E316LT-1, EXXXT-G (16-8-2 chemistry)
Ni-Fe-Cr (Alloy 800H)	SFA-5.11	ENiCrFe-2
	SFA-5.14	ERNiCr-3
2 $\frac{1}{4}$ Cr-1Mo	SFA-5.5	E90XX-B3 (>0.05% carbon)
	SFA-5.23	EB3, ECB3
	SFA-5.28	E90C-B3 (>0.05% carbon), ER90S-B3
	SFA-5.29	E90T-B3 (>0.05% carbon)
9Cr-1Mo-V	SFA-5.5	E90XX-B9
	SFA-5.23	EB9
	SFA-5.28	ER90S-B9

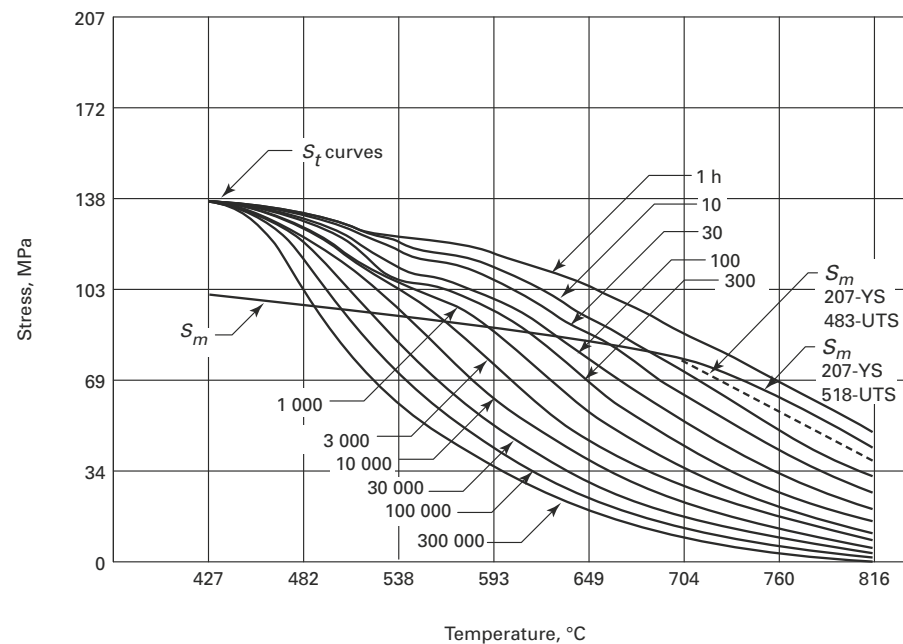
Table E-100.3-3
 S_o — Maximum Allowable Stress Intensity, MPa, for Design Condition Calculations

For Metal Temperature Not Exceeding, °C	304 SS	316 SS	Ni-Fe-Cr (Solution Annealed) UNS N08810	2 $\frac{1}{4}$ Cr-1Mo	9Cr-1Mo-V
375	...	...	...	123	184
400	...	...	...	123	178
425	105	110	105	116	172
450	102	108	104	116	165
475	101	108	103	99	154
500	99	107	101	81	133
525	86	101	99	64	117
550	74	88	89	48	102
575	69	77	74	35	81
600	65	76	68	26 [Note (1)]	62
625	51	62	62	...	46
650	42	51	51	...	29
675	34	39	41	...	...
700	27	30	34	...	...
725	21	23	28	...	...
750	17	18	23 [Note (2)]	...	...
775	14	13	...	...	...
800	11 [Note (3)]	11 [Note (4)]	...	...	...

NOTES:

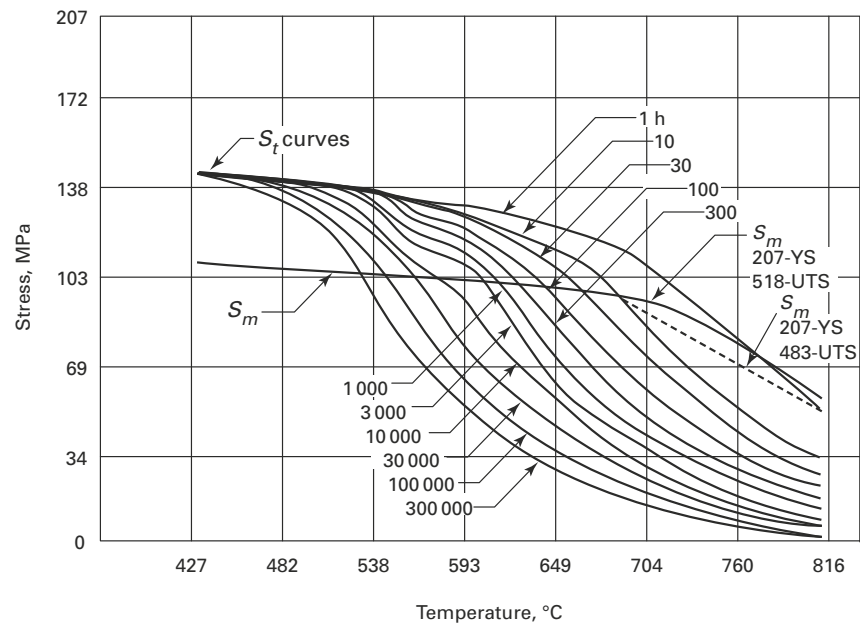
(1) This is the value of S_o for 2 $\frac{1}{4}$ Cr-1Mo at 593°C.(2) At 760°C the value of S_o for UNS N08810 is 21 MPa.(3) At 816°C the value of S_o for 304 SS is 9.7 MPa.(4) At 816°C the value of S_o for 316 SS is 9.0 MPa.

Figure E-100.4-1
 S_{mt} — Allowable Stress Intensity Values, MPa, Type 304 SS — 207-YS, 518-UTS (207-YS, 483-UTS)



Temp., °C	1 h	10 h	30 h	10^2 h	3×10^2 h	10^3 h	3×10^3 h	10^4 h	3×10^4 h	10^5 h	3×10^5 h
425	105	105	105	105	105	105	105	105	105	105	105
450	102	102	102	102	102	102	102	102	102	102	102
475	101	101	101	101	101	101	101	101	101	101	101
500	99	99	99	99	99	99	99	99	99	99	93
525	98	98	98	98	98	98	98	98	98	87	73
550	96	96	96	96	96	96	96	94	82	70	58
575	93	93	93	93	93	93	91	78	66	56	46
600	91	91	91	91	91	89	75	63	54	44	37
625	89	89	89	89	87	74	62	51	43	36	29
650	88	88	88	84	73	61	51	42	35	28	23
675	85	85	83	77	61	51	42	35	28	22	19
700	82 (81)	80	69	61	50	42	34	28	23	18	15
725	77 (74)	70	61	52	43	35	29	22	18	15	12
750	69 (66)	60	52	44	36	29	23	18	15	12	9
775	61 (57)	51	44	36	29	24	19	15	12	9	7
800	53 (49)	43	37	29	23	18	15	11	9	7	5

Figure E-100.4-2
 S_{mt} — Allowable Stress Intensity Values, MPa, Type 316 SS — 207-YS, 518-UTS (207-YS, 483-UTS)



Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	110	110	110	110	110	110	110	110	110	110	110
450	108	108	108	108	108	108	108	108	108	108	108
475	107	107	107	107	107	107	107	107	107	107	107
500	106	106	106	106	106	106	106	106	106	106	106
525	105	105	105	105	105	105	105	105	105	105	105
550	104	104	104	104	104	104	104	104	104	101	87
575	104	104	104	104	104	104	104	104	95	79	67
600	102	102	102	102	102	102	102	91	75	62	51
625	101	101	101	101	101	94	86	72	59	48	40
650	101	101	101	98	84	72	64	57	48	38	31
675	98	98	98	80	69	58	51	44	38	30	24
700	95 (92)	91	78	65	54	46	41	34	28	22	18
725	90 (85)	75	63	52	44	36	31	25	21	16	13
750	82 (76)	62	51	41	35	29	24	19	16	11	9
775	70 (65)	50	40	32	27	23	18	14	12	8	7
800	61 (58)	40	32	25	21	17	13	10	8	5	4

Figure E-100.4-3

S_{mt} — Allowable Stress Intensity Values, MPa, Ni-Fe-Cr (Alloy 800H)

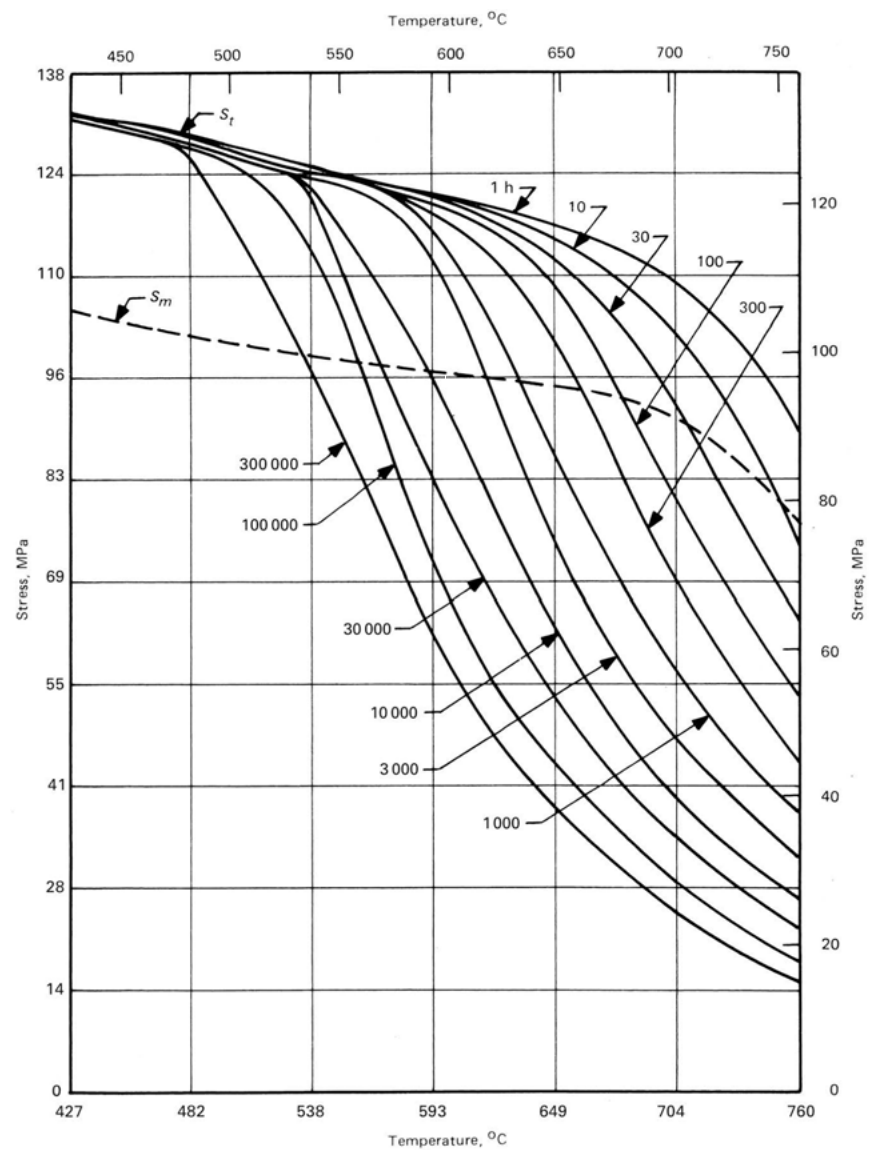
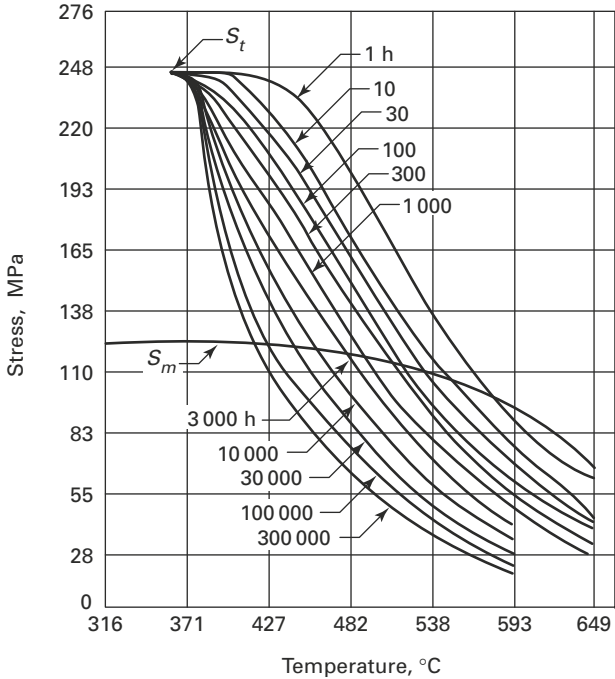


Figure E-100.4-3
 S_{mt} — Allowable Stress Intensity Values, MPa, Ni-Fe-Cr (Alloy 800H) (Cont'd)

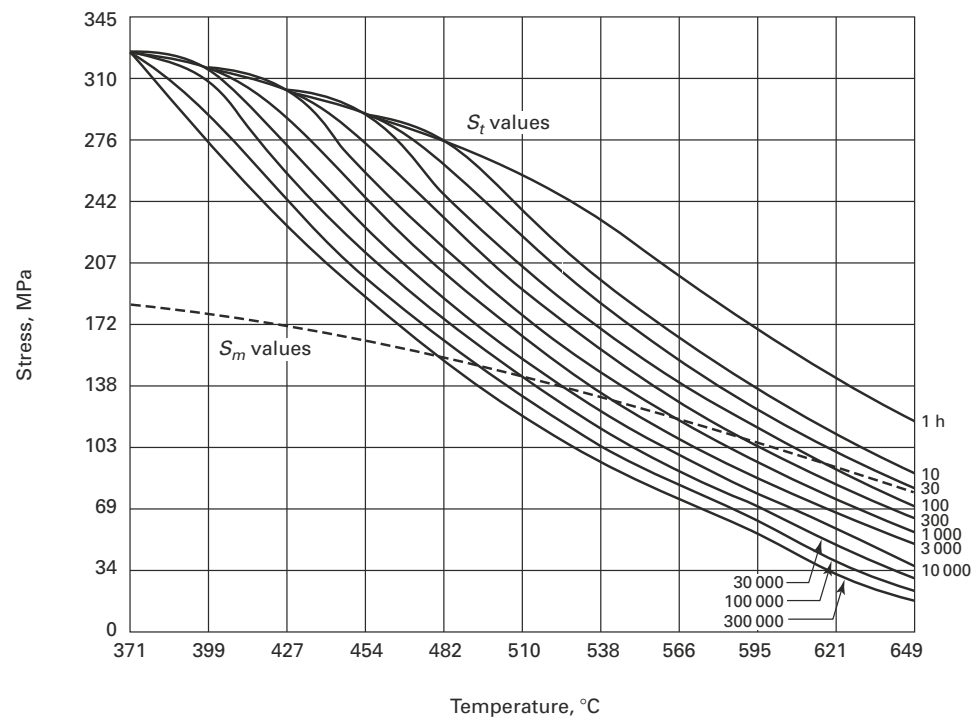
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	105	105	105	105	105	105	105	105	105	105	105
450	104	104	104	104	104	104	104	104	104	104	104
475	103	103	103	103	103	103	103	103	103	103	103
500	101	101	101	101	101	101	101	101	101	101	101
525	100	100	100	100	100	100	100	100	100	100	98
550	99	99	99	99	99	99	99	99	99	94	88
575	98	98	98	98	98	98	98	98	94	82	72
600	97	97	97	97	97	97	96	91	79	67	58
625	96	96	96	96	96	96	92	80	68	59	50
650	95	95	95	95	95	84	73	62	53	45	39
675	93	93	93	93	84	71	60	51	44	37	31
700	91	91	91	82	70	59	50	41	35	29	25
725	85	85	81	69	58	49	41	34	30	24	20
750	78	77	69	58	49	40	34	28	24	20	16

Figure E-100.4-4
 S_{mt} — Allowable Stress Intensity Values, MPa, $2\frac{1}{4}\text{Cr-1Mo}$



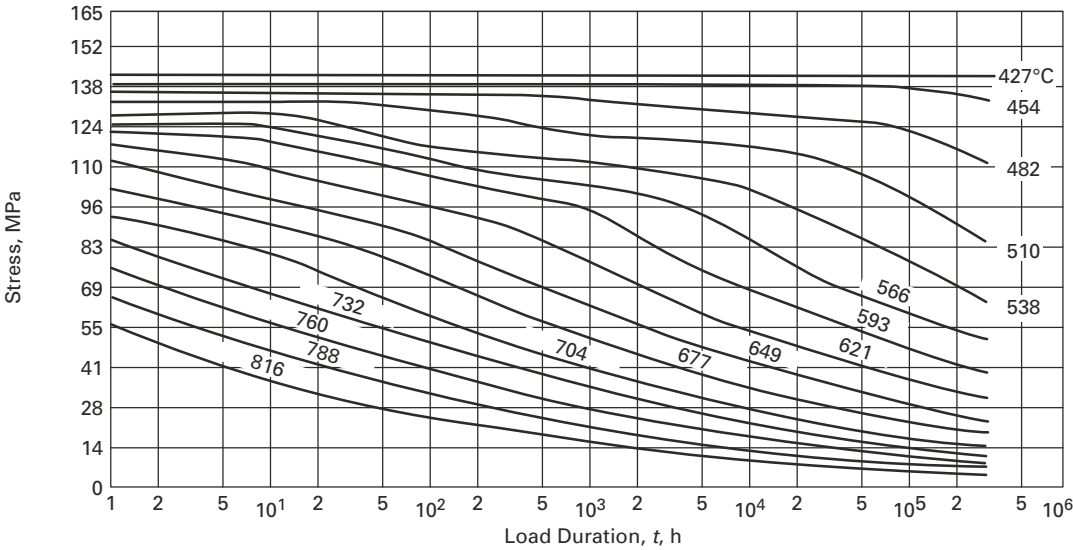
Temp., °C	1 h	10 h	30 h	10^2 h	3×10^2 h	10^3 h	3×10^3 h	10^4 h	3×10^4 h	10^5 h	3×10^5 h
375	...	123	123	123	123	123	123	123	123	123	123
400	123	123	123	123	123	123	123	123	123	123	123
425	123	123	123	123	123	123	123	123	123	123	112
450	122	122	122	122	122	122	122	122	116	101	89
475	119	119	119	119	119	119	114	106	92	80	71
500	116	116	116	116	116	111	99	85	74	64	56
525	112	112	112	106	97	89	78	66	57	48	41
550	107	107	98	89	81	74	64	54	46	38	33
575	100	89	80	72	66	59	50	42	35	29	25
600	89	72	66	59	53	47	...	...	...	...	...
625	72	58	53	49	42	36	...	...	...	...	...
650	62	43	42	41	35	28	...	...	...	...	...

Figure E-100.4-5
 S_{mt} — Allowable Stress Intensity Values, MPa, 9Cr-1Mo-V



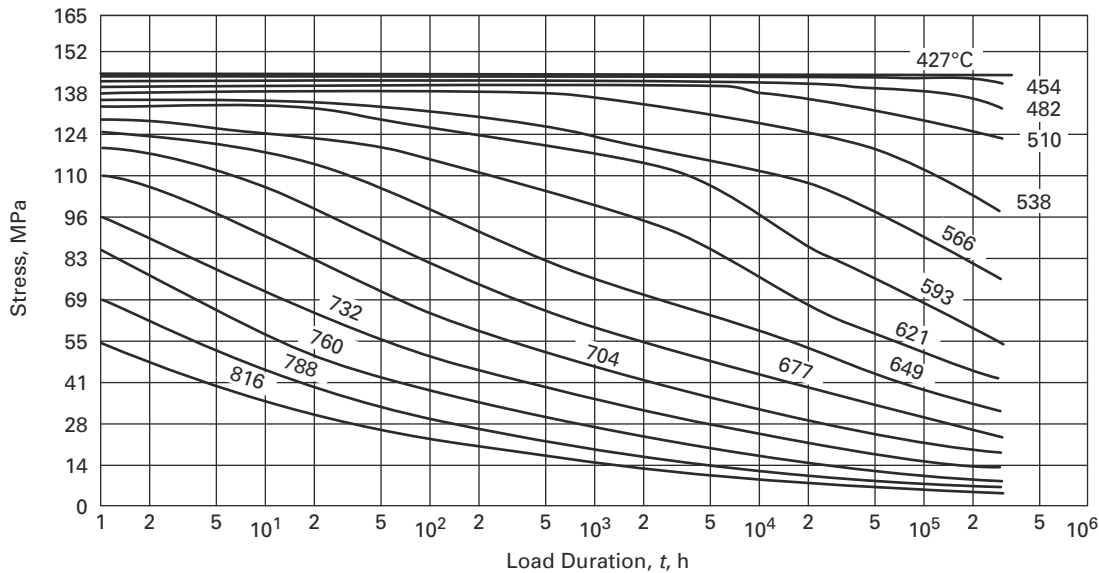
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
375	183	183	183	183	183	183	183	183	183	183	183
400	179	179	179	179	179	179	179	179	179	179	179
425	172	172	172	172	172	172	172	172	172	172	172
450	165	165	165	165	165	165	165	165	165	165	165
475	156	156	156	156	156	156	156	156	156	156	154
500	147	147	147	147	147	147	147	147	147	138	131
525	136	136	136	136	136	136	136	132	126	115	106
550	125	125	125	125	125	125	121	111	102	93	85
575	114	114	114	114	114	108	99	90	81	73	66
600	101	101	101	101	97	86	80	71	63	54	48
625	88	88	88	86	78	70	63	54	44	36	30
650	76	76	76	69	62	54	44	36	29	22	17

Figure E-100.5-1
 S_t — Allowable Stress Intensity Values, MPa, Type 304 SS



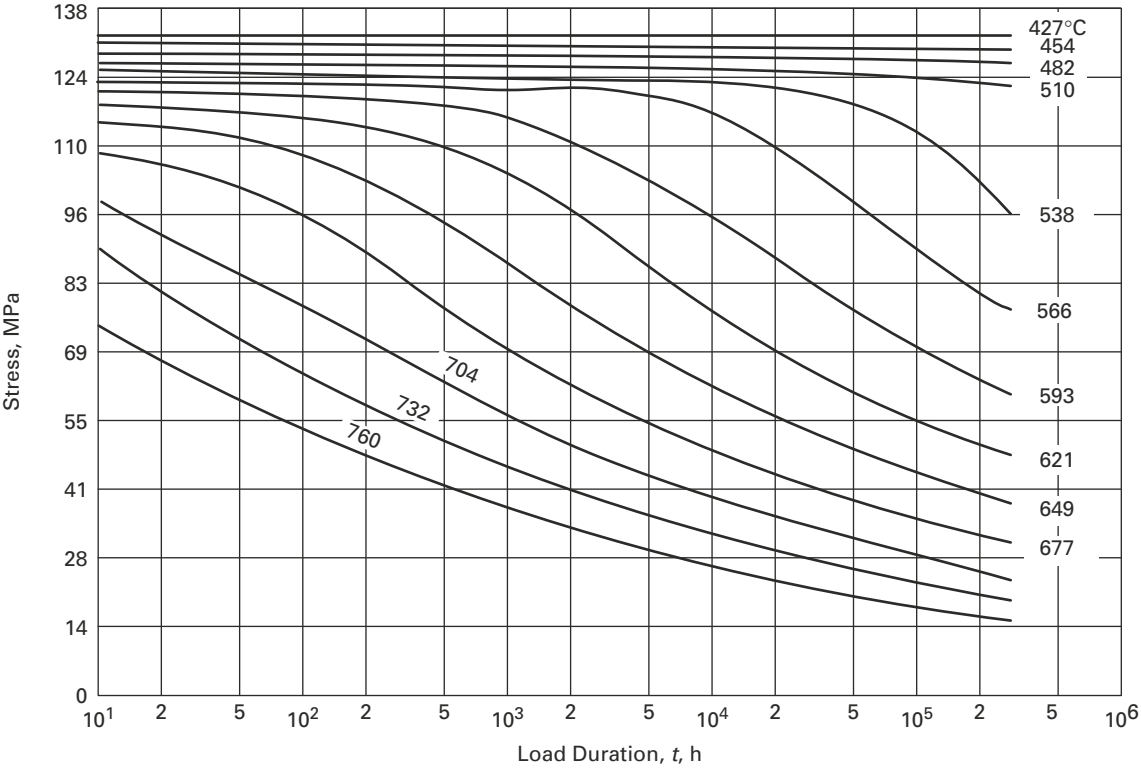
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	141	141	141	141	141	141	141	141	141	141	141
450	138	138	138	138	138	138	138	138	138	137	134
475	136	136	135	135	135	134	132	130	129	126	116
500	133	133	132	131	128	125	123	121	117	107	93
525	130	129	127	122	118	115	113	108	100	87	73
550	126	125	121	115	110	107	103	94	82	70	58
575	123	121	116	110	105	100	91	78	66	56	46
600	120	115	109	102	97	88	75	63	54	44	37
625	116	107	101	93	87	74	62	51	43	36	29
650	110	98	92	84	73	61	51	42	35	28	23
675	102	90	83	72	61	51	42	35	28	22	19
700	93	80	71	61	50	42	34	28	23	18	15
725	86	70	61	52	43	35	29	22	18	15	12
750	78	60	52	44	36	29	23	18	15	12	9
775	69	51	44	36	29	24	19	15	12	9	7
800	60	43	37	29	23	18	15	11	9	7	5

Figure E-100.5-2
 S_t — Allowable Stress Intensity Values, MPa, Type 316 SS



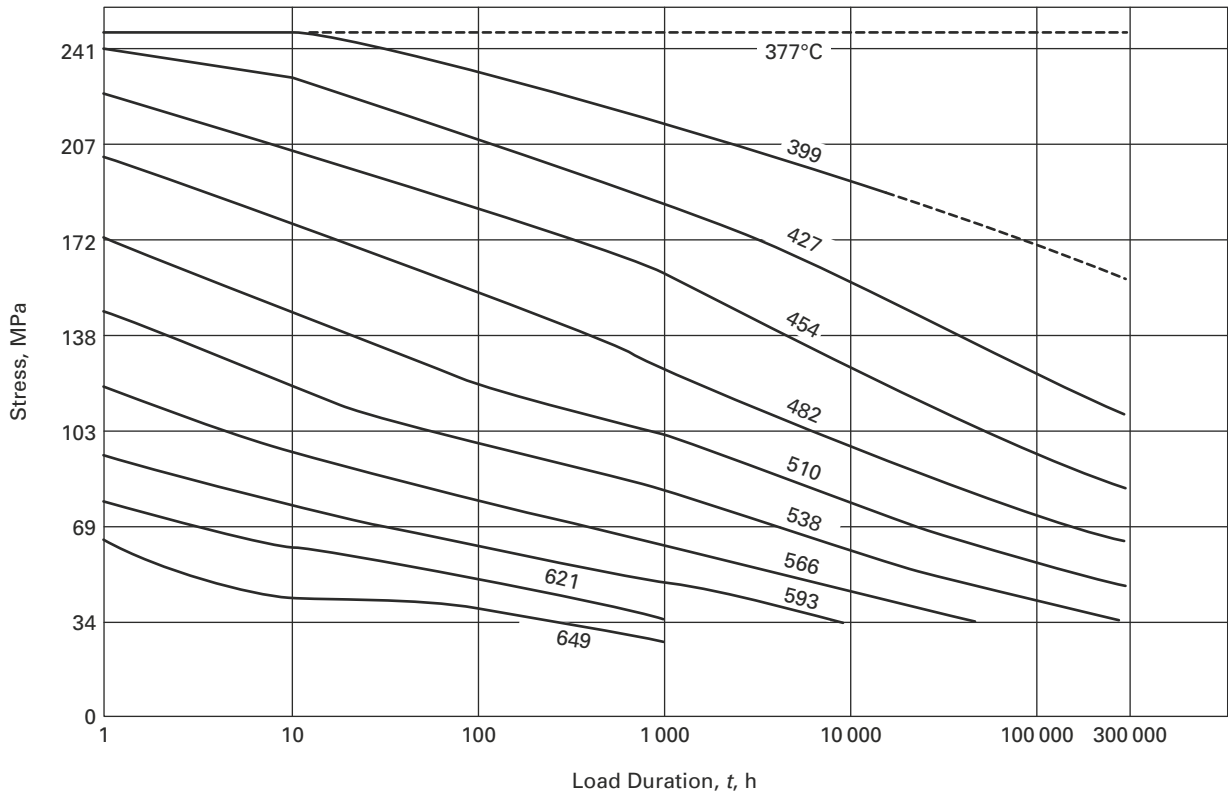
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	143	143	143	143	143	143	143	143	143	143	143
450	142	142	142	142	142	142	142	142	142	142	140
475	141	141	141	141	141	141	141	141	140	138	135
500	140	140	140	140	140	139	139	138	134	131	125
525	138	138	138	138	138	136	134	130	126	118	108
550	136	136	135	134	132	128	125	119	113	101	87
575	133	133	131	127	124	119	114	105	95	79	67
600	131	129	126	121	116	110	105	91	75	62	51
625	127	121	118	111	103	94	86	72	59	48	40
650	123	116	108	97	84	72	64	57	48	38	31
675	118	106	94	80	69	58	51	44	38	30	24
700	112	91	78	65	54	46	41	34	28	22	18
725	101	75	63	52	44	36	31	25	21	16	13
750	88	62	51	41	35	29	24	19	16	11	9
775	74	50	40	32	27	23	18	14	12	8	7
800	61	40	32	25	21	17	13	10	8	5	4

Figure E-100.5-3
 S_t — Allowable Stress Intensity Values, MPa, Ni-Fe-Cr (Alloy 800H)



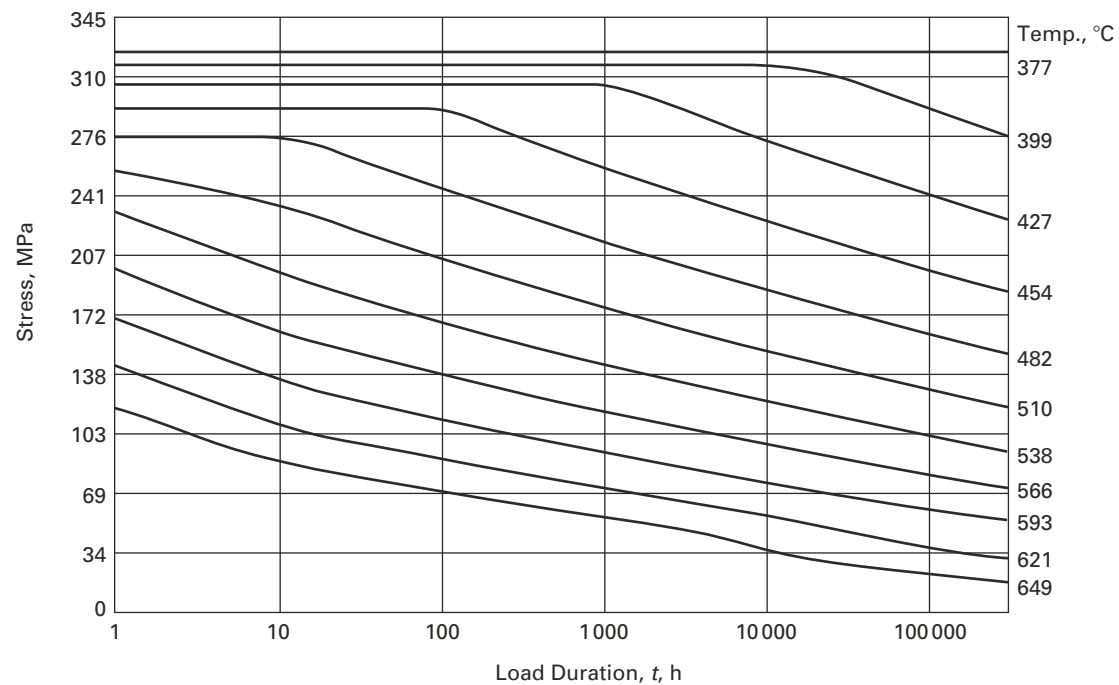
Temp., °C	1 h	10 h	30 h	10^2 h	3×10^2 h	10^3 h	3×10^3 h	10^4 h	3×10^4 h	10^5 h	3×10^5 h
425	132	132	132	132	132	132	132	132	132	132	132
450	130	130	130	130	130	130	130	130	130	130	130
475	129	129	129	129	129	129	128	128	128	127	126
500	128	128	128	128	128	128	127	126	126	125	124
525	126	126	126	126	126	125	124	124	122	119	109
550	124	124	124	124	124	123	122	121	113	103	88
575	123	123	123	122	121	120	117	111	96	83	72
600	121	121	120	119	117	114	107	91	79	67	58
625	119	118	116	115	109	102	89	75	64	55	47
650	117	115	112	109	101	85	74	62	53	45	39
675	114	109	105	98	85	72	61	52	44	37	31
700	110	100	94	82	70	59	50	41	35	29	25
725	99	88	82	70	58	49	41	34	29	24	20
750	94	80	69	58	49	40	34	28	24	20	16

Figure E-100.5-4
 S_t — Allowable Stress Intensity Values, MPa, $2\frac{1}{4}\text{Cr-1Mo}$



Temp., °C	1 h	10 h	30 h	10^2 h	3×10^2 h	10^3 h	3×10^3 h	10^4 h	3×10^4 h	10^5 h	3×10^5 h
375	...	245	245	245	245	245	245	245	245	245	245
400	243	243	239	231	224	216	205	196	183	172	161
425	241	230	220	211	200	186	173	160	142	125	112
450	226	207	197	186	176	164	149	130	116	101	89
475	206	183	170	159	147	136	122	106	92	80	71
500	182	156	144	132	122	111	99	85	74	64	56
525	153	127	116	106	97	89	78	66	57	48	41
550	131	108	98	89	81	74	64	54	46	38	33
575	109	89	80	72	66	59	50	42	35	29	25
600	89	72	66	59	53	47	...	...	...	...	...
625	72	58	53	49	42	36	...	...	...	...	...
650	62	43	42	41	35	28	...	...	...	...	...

Figure E-100.5-5
 S_t — Allowable Stress Intensity Values, MPa, 9Cr-1Mo-V



Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
375	325	325	325	325	325	325	325	325	325	325	325
400	317	317	317	317	317	317	316	316	307	290	275
425	307	307	307	307	307	307	292	276	262	246	232
450	294	294	294	294	279	264	249	234	220	206	193
475	275	275	271	256	241	225	211	197	184	171	160
500	262	249	235	219	205	191	178	165	153	141	131
525	242	214	200	185	172	163	148	136	126	115	106
550	217	182	170	156	144	132	119	111	102	93	85
575	189	154	142	130	119	108	99	90	81	73	66
600	164	126	115	107	97	86	79	71	63	54	48
625	139	106	96	86	78	70	62	54	44	36	30
650	117	87	78	69	62	54	47	36	29	22	17

Table E-100.6-1
Yield Strength Values, S_y , Versus Temperature

Temp., °C	Stresses, MPa					Ni-Cr-Fe-Mo-Cb UNS N07718
	304 SS	316 SS	Ni-Fe-Cr UNS N08810	2 $\frac{1}{4}$ Cr-1Mo	9Cr-1Mo-V	
RT						1 034
50						1 016
100						989
150						970
200						955
250						945
300						937
350	See Table Y-1 for values up to 538°C					929
375						925
400						922
425						918
450						914
475						909
500						902
525						896
550	106	116	108	160	269	888
575	104	115	108	151	243	883 [Note (1)]
600	102	114	108	139	218	...
625	100	112	108	126	193	...
650	97	110	107	110	165	...
675	94	107	105	...	...	...
700	91	103	102	...	...	...
725	87	99	99.1	...	...	...
750	82	94	95.6	...	...	...
775	76	88	91.5	...	...	...
800	69 [Note (2)]	81 [Note (3)]	86.9	...	...	...
825	...	...	81.8	...	...	...
850	...	...	76.3	...	...	...
875	...	...	70.3	...	...	...
900	...	...	64.0	...	...	...

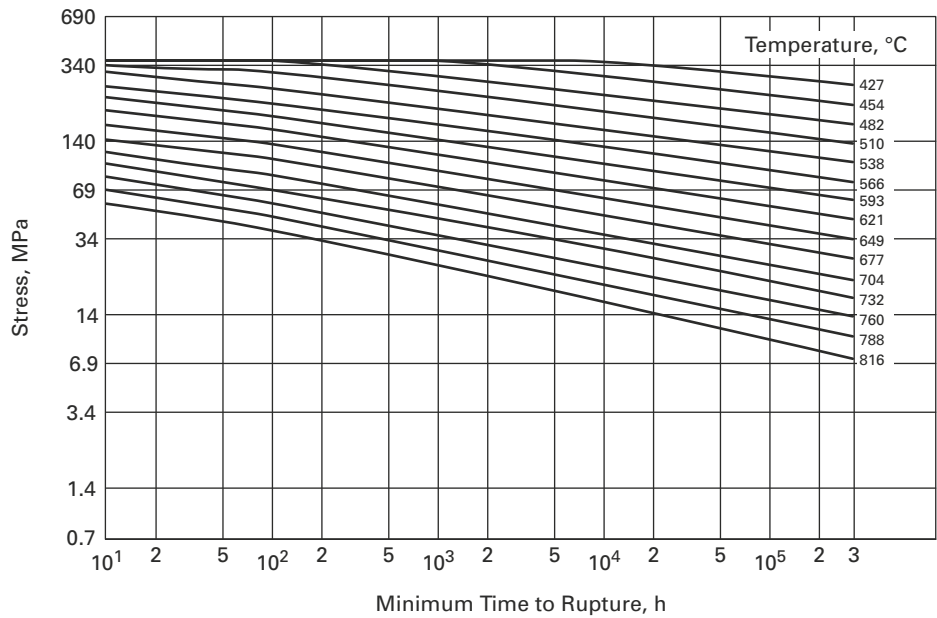
GENERAL NOTES:

- (a) 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 either *average* or *minimum* as these terms are applied to a statistical treatment of a homogeneous set of data.
- (b) Neither the ASME Materials Specifications nor the rules of Sections I, IV, VIII, or XII 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 retests or other means should be considered.

NOTES:

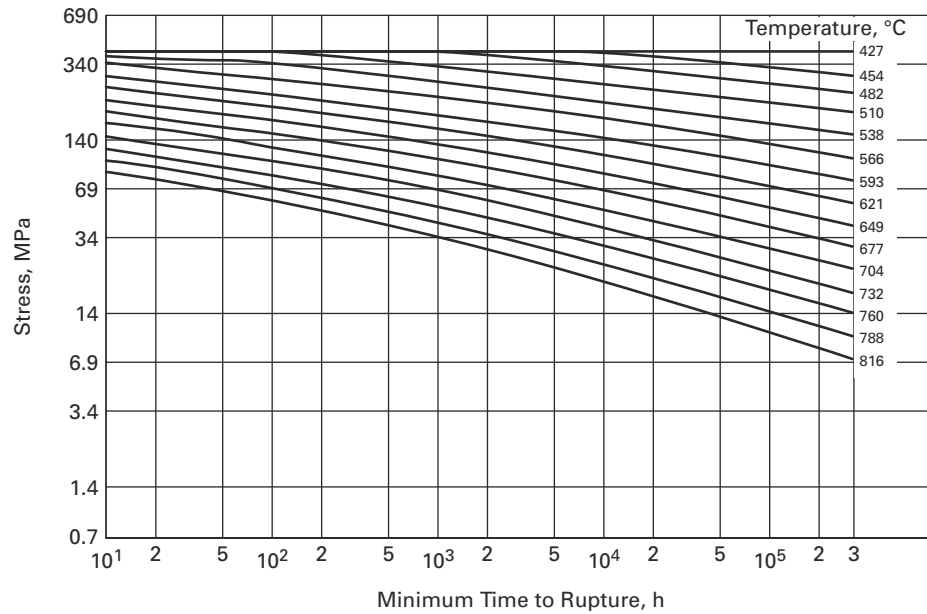
- (1) At 566°C the yield strength, S_y , is 883 MPa for UNS N07718.
- (2) At 816°C the yield strength, S_y , is 64 MPa for 304 SS.
- (3) At 816°C the yield strength, S_y , is 75 MPa for 316 SS.

Figure E-100.7-1
Expected Minimum Stress-to-Rupture Values, MPa, Type 304 SS



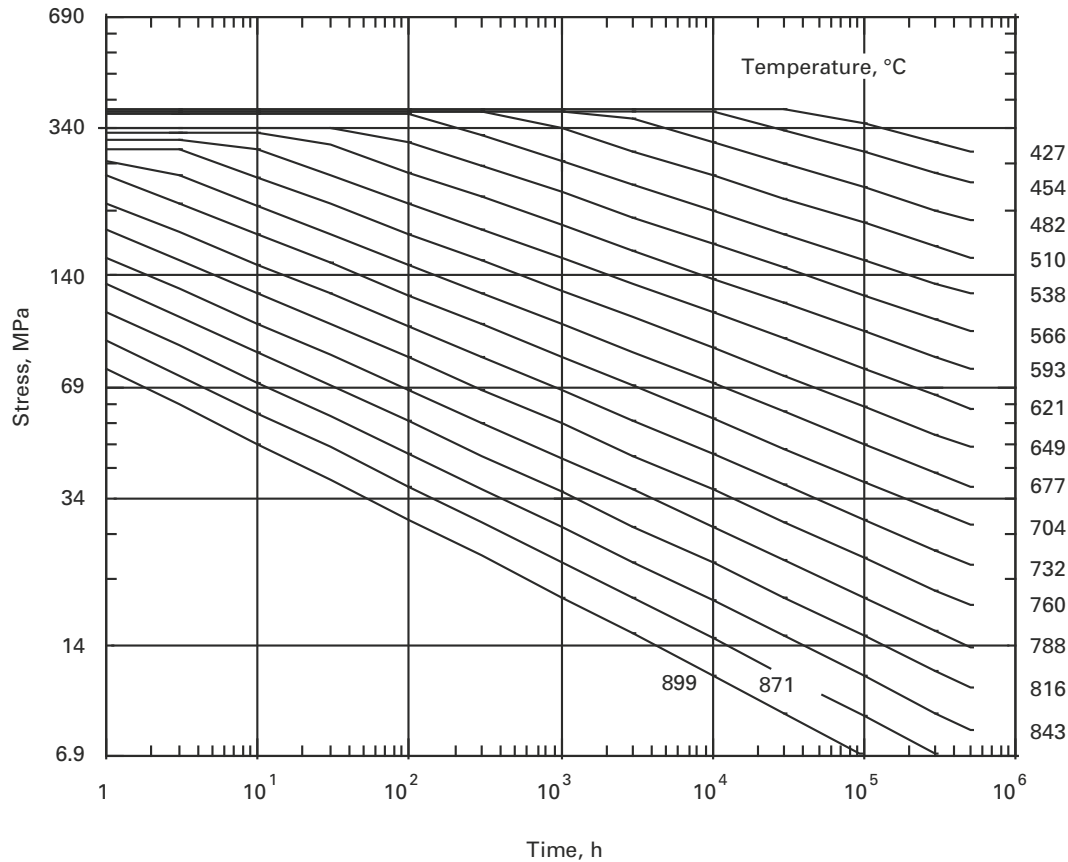
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	393	393	393	393	393	393	393	393	354	308	272
450	390	390	390	390	390	390	353	325	287	249	219
475	385	385	385	385	364	340	300	265	232	201	176
500	377	377	363	350	317	284	250	217	188	161	140
525	368	358	328	301	267	236	205	177	153	129	114
550	355	321	285	254	223	195	168	144	124	104	91
575	333	274	241	214	188	161	139	113	100	83	59
600	298	233	205	180	157	134	113	95	80	66	56
625	256	198	175	151	130	111	93	78	64	53	44
650	220	169	147	127	110	92	77	63	52	43	34
675	189	145	125	108	91	75	62	51	42	35	28
700	162	123	106	91	75	63	52	41	34	27	22
725	140	106	91	77	64	53	43	34	28	22	18
750	121	89	77	67	54	44	35	28	23	18	14
775	105	76	66	55	45	36	29	23	18	14	11
800	91	65	56	46	37	29	24	19	14	10	9

Figure E-100.7-2
Expected Minimum Stress-to-Rupture Values, MPa, Type 316 SS



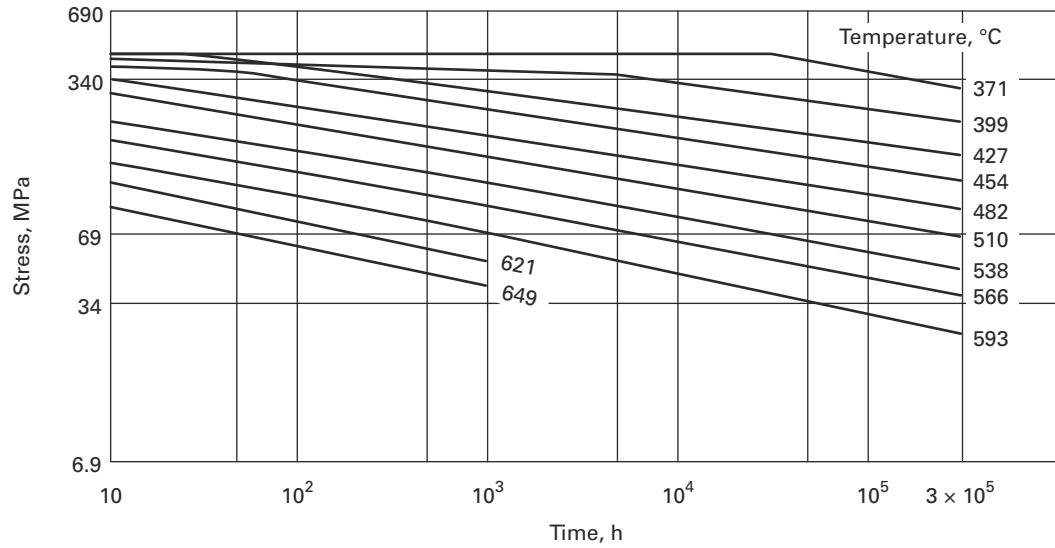
Temp., °C	1 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	445	445	445	445	445	445	445	445	445	445	445
450	437	437	437	437	437	437	437	437	419	395	372
475	431	431	431	431	430	429	409	389	352	317	286
500	419	419	419	419	401	381	349	322	285	248	219
525	406	406	388	371	340	307	275	248	226	183	158
550	393	381	350	323	289	268	230	203	173	147	125
575	380	347	311	283	249	223	194	169	142	120	100
600	357	300	266	241	212	185	159	136	112	94	79
625	315	259	229	205	179	155	130	110	89	72	59
650	275	224	199	176	151	129	107	88	70	57	46
675	244	194	170	150	127	108	89	71	57	44	35
700	212	167	147	128	106	89	72	57	45	34	27
725	186	144	127	108	92	76	60	47	36	27	21
750	163	125	109	91	76	63	50	38	29	21	16
775	144	109	94	78	64	52	41	30	23	16	12
800	124	92	79	65	54	42	32	24	18	12	9

Figure E-100.7-3
Expected Minimum Stress-to-Rupture Values, MPa, Ni-Fe-Cr (Alloy 800H)



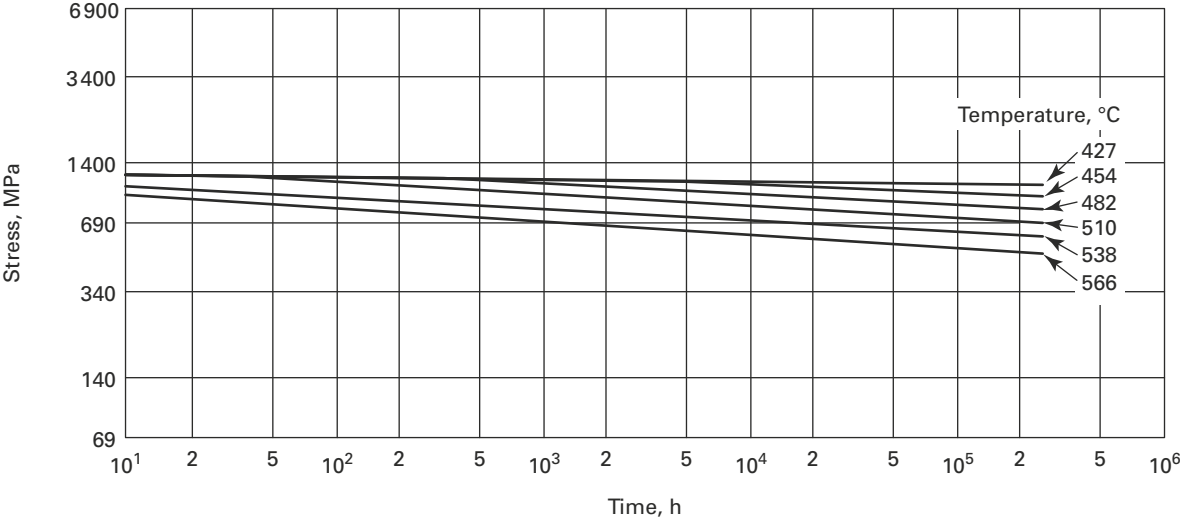
Temp., °C	1 h	3 h	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h	5 × 10 ⁵ h
425	387	387	387	387	387	387	387	387	387	387	374	330	312
450	385	385	385	385	385	385	385	385	385	354	307	270	254
475	384	384	384	384	384	384	384	384	333	292	252	220	207
500	382	382	382	382	382	382	369	321	276	241	207	180	168
525	379	379	379	379	379	361	309	268	229	198	169	146	137
550	352	352	352	352	351	303	258	223	189	163	138	119	111
575	342	342	342	342	297	255	216	185	156	134	113	96	90
600	331	331	331	297	250	214	180	154	129	110	92	78	72
625	317	317	296	252	211	180	150	127	106	90	75	63	58
650	302	302	252	214	178	150	125	105	87	73	61	51	47
675	285	259	215	181	150	126	104	87	72	60	49	41	38
700	264	221	183	153	126	105	86	72	59	49	40	33	30
725	227	189	155	129	106	88	71	59	48	40	32	26	24
750	195	162	132	109	89	73	59	49	39	32	26	21	19
775	167	138	112	92	74	61	49	40	32	26	21	17	15
800	143	118	95	77	62	51	40	33	26	21	17	13	12
825	123	100	80	65	52	42	33	27	21	17	13	11	9.7
850	105	85	68	55	43	35	27	22	17	14	11	8.5	7.6
875	90	72	57	46	36	29	23	18	14	11	8.5	6.7	6.0
900	77	61	48	38	30	24	18	15	11	8.9	6.8	5.3	4.7

Figure E-100.7-4
Expected Minimum Stress-to-Rupture Values, MPa, 2½Cr-1Mo



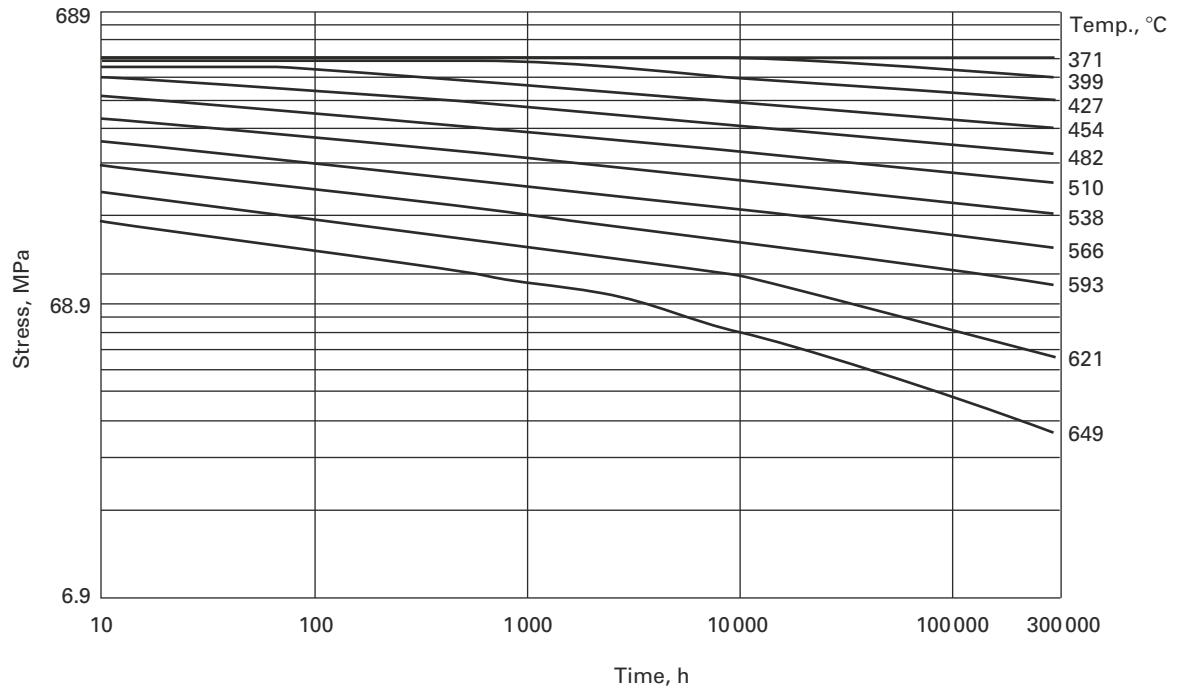
Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
375	406	405	404	403	401	399	396	392	356	323
400	400	393	386	375	363	350	328	296	256	233
425	387	384	373	337	301	266	245	216	191	170
450	363	353	325	287	249	221	197	172	151	133
475	328	299	265	236	205	183	159	140	121	105
500	291	256	222	194	167	148	128	112	96	83
525	244	214	184	161	137	118	103	88	71	70
550	196	175	150	132	112	96	81	68	58	48
575	168	145	122	106	89	76	63	52	43	36
600	138	117	98	85	69	...	...	...	...	...
625	114	94	77	65	52	...	...	...	...	...
650	92	76	62	51	43	...	...	...	...	...

Figure E-100.7-5
Expected Minimum Stress-to-Rupture Values, MPa, Ni-Cr-Fe-Mo-Cb (Alloy 718)



Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	1 160	1 160	1 160	1 160	1 160	1 160	1 160	1 160	1 100	1 060
450	1 180	1 180	1 180	1 180	1 180	1 150	1 110	1 060	1 020	985
475	1 180	1 180	1 180	1 150	1 110	1 070	1 020	974	924	883
500	1 170	1 150	1 120	1 070	1 030	975	926	881	825	775
525	1 123	1 060	1 020	962	920	865	812	759	704	649
550	1 050	987	938	891	833	778	723	672	609	558

Figure E-100.7-6
Expected Minimum Stress-to-Rupture Values, MPa, 9Cr-1Mo-V



Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
375	487	487	487	487	487	487	487	487	487	487
400	475	475	475	475	475	475	475	461	435	412
425	459	459	459	459	459	436	412	390	366	345
450	440	440	440	418	396	374	350	329	308	289
475	419	404	385	361	338	317	295	276	257	240
500	374	353	329	307	285	266	247	229	212	196
525	322	301	278	259	239	222	204	189	173	159
550	274	251	234	216	198	178	166	153	139	127
575	231	213	194	179	163	149	135	122	110	99
600	192	176	160	146	132	118	106	94	82	72
625	159	145	130	117	105	94	81	67	53	42
650	130	117	104	93	81	72	54	44	33	25

Table E-100.8-1
Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E308T and E308LT, SFA-5.4 E308 and E308L, and SFA-5.9 ER308 and ER308L

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.97
475	1.00	0.99	0.98	0.97	0.97	0.97	0.97	0.97	0.96	0.95
500	1.00	0.98	0.97	0.96	0.96	0.96	0.96	0.96	0.94	0.92
525	1.00	0.98	0.96	0.95	0.94	0.94	0.94	0.94	0.92	0.89
550	1.00	0.99	0.97	0.96	0.95	0.95	0.95	0.94	0.91	0.87
575	1.00	0.99	0.98	0.98	0.98	0.98	0.98	0.95	0.90	0.84
600	1.00	0.99	0.98	1.00	1.00	1.00	0.98	0.94	0.87	0.80
625	1.00	1.00	1.00	1.00	1.00	0.98	0.94	0.89	0.80	0.70
650	1.00	1.00	1.00	1.00	0.98	0.95	0.88	0.81	0.71	0.60
675	1.00	1.00	0.97	0.97	0.92	0.88	0.79	0.70	0.58	0.47

Table E-100.8-2
Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 EXXXT-G (16-8-2 Chemistry), SFA-5.4 E16-8-2, and SFA-5.9 ER16-8-2

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
550	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
575	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
600	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
625	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
650	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table E-100.8-3
Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E316T and E316LT-1, -2, and -3; SFA-5.4 E316 and E316L; and SFA-5.9 ER316 and ER316L

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.95
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.91
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.93	0.87
525	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.90	0.84
550	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.96	0.89	0.81
575	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.89	0.79
600	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.87	0.77
625	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.84	0.75
650	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.79	0.68
675	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.86	0.73	0.62
700	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.79	0.66	0.55
725	1.00	1.00	1.00	1.00	1.00	0.94	0.83	0.72	0.61	0.50
750	1.00	1.00	1.00	1.00	0.95	0.87	0.76	0.65	0.54	0.46

Table E-100.9-1
Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E308T and E308LT, SFA-5.4 E308 and E308L, and SFA-5.9 ER308 and ER308L

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	0.98	0.96	0.96	0.96	0.95	0.93	0.93	0.93	0.93
475	1.00	0.95	0.90	0.90	0.90	0.89	0.86	0.86	0.85	0.85
500	1.00	0.91	0.83	0.83	0.83	0.83	0.79	0.79	0.76	0.76
525	1.00	0.88	0.78	0.78	0.77	0.76	0.73	0.72	0.68	0.67
550	1.00	0.88	0.76	0.76	0.75	0.74	0.72	0.70	0.65	0.61
575	1.00	0.89	0.79	0.79	0.78	0.77	0.75	0.72	0.68	0.61
600	0.98	0.90	0.82	0.81	0.79	0.79	0.76	0.72	0.68	0.62
625	0.91	0.88	0.85	0.82	0.79	0.77	0.74	0.70	0.65	0.58
650	0.81	0.80	0.79	0.79	0.76	0.75	0.70	0.64	0.57	0.49
675	0.79	0.78	0.76	0.74	0.73	0.69	0.64	0.57	0.49	0.40
700	0.75	0.74	0.71	0.69	0.64	0.60	0.54	0.47	0.39	0.31

Table E-100.9-2
Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 EXXXT-G (16-8-2 Chemistry), SFA-5.4 E16-8-2, and SFA-5.9 ER16-8-2

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	0.97	0.92	0.92	0.92	0.91	0.91	0.90	0.89	0.88
475	1.00	0.95	0.89	0.84	0.84	0.83	0.80	0.79	0.77	0.76
500	1.00	0.93	0.87	0.85	0.84	0.82	0.81	0.79	0.77	0.76
525	1.00	0.93	0.88	0.88	0.88	0.86	0.85	0.84	0.83	0.82
550	0.97	0.93	0.91	0.91	0.91	0.90	0.89	0.90	0.87	0.85
575	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.94	0.92	0.89
600	0.91	0.91	0.93	0.94	0.94	0.96	0.96	0.97	0.97	0.97
625	0.91	0.91	0.93	0.95	0.95	0.96	0.98	0.99	0.99	1.00
650	0.89	0.89	0.90	0.92	0.93	0.97	0.99	1.00	1.00	1.00

Table E-100.9-3
Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E316T and E316LT-1 and -2, SFA-5.4 E316 and E316L, and SFA-5.9 ER316 and ER316L

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450	1.00	1.00	0.99	0.98	0.97	0.97	0.96	0.95	0.93	0.90
475	1.00	1.00	0.98	0.96	0.93	0.91	0.90	0.88	0.85	0.81
500	1.00	1.00	0.96	0.91	0.88	0.86	0.83	0.81	0.76	0.72
525	1.00	1.00	0.91	0.88	0.85	0.81	0.77	0.74	0.67	0.63
550	1.00	1.00	0.90	0.87	0.85	0.81	0.76	0.72	0.64	0.57
575	1.00	1.00	0.93	0.92	0.88	0.84	0.79	0.74	0.67	0.57
600	1.00	1.00	0.97	0.95	0.90	0.87	0.81	0.75	0.68	0.61
625	1.00	1.00	1.00	0.96	0.91	0.87	0.81	0.75	0.65	0.58
650	1.00	1.00	0.96	0.95	0.90	0.87	0.81	0.72	0.64	0.55
675	1.00	1.00	0.96	0.93	0.89	0.84	0.77	0.69	0.60	0.51
700	1.00	0.98	0.93	0.90	0.84	0.80	0.73	0.66	0.57	0.48
725	0.99	0.96	0.90	0.85	0.79	0.74	0.67	0.61	0.53	0.46
750	0.96	0.92	0.84	0.79	0.73	0.69	0.62	0.56	0.49	0.43

Table E-100.10-1
Stress Rupture Factors for Alloy 800H Welded With SFA-5.11 ENiCrFe-2 (INCO A)

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450–475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
500	1.00	1.00	1.00	1.00	0.99	0.97	0.95	0.94	0.91	0.89
525	1.00	1.00	1.00	1.00	0.98	0.94	0.91	0.88	0.84	0.80
550	1.00	1.00	1.00	1.00	0.98	0.94	0.90	0.86	0.82	0.77
575	1.00	1.00	1.00	1.00	0.98	0.94	0.89	0.85	0.80	0.76
600	1.00	1.00	1.00	1.00	0.98	0.94	0.89	0.84	0.79	0.74
625	1.00	1.00	1.00	1.00	0.98	0.93	0.88	0.83	0.77	0.72
650	1.00	1.00	1.00	1.00	0.98	0.93	0.87	0.81	0.75	0.70
675	1.00	1.00	1.00	1.00	0.98	0.92	0.85	0.80	0.73	0.68
700	1.00	1.00	1.00	1.00	0.97	0.91	0.84	0.77	0.71	0.65
725	1.00	1.00	1.00	1.00	0.96	0.90	0.83	0.76	0.69	0.63
750	1.00	1.00	1.00	1.00	0.95	0.88	0.81	0.74	0.66	0.60

Table E-100.10-2
Stress Rupture Factors for Alloy 800H Welded With SFA-5.14 ERNiCr-3 (INCO 82)

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
450–475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
500	0.93	0.94	0.94	0.94	0.93	0.93	0.92	0.92	0.91	0.91
525	0.87	0.88	0.88	0.88	0.87	0.87	0.86	0.85	0.84	0.83
550	0.86	0.87	0.87	0.87	0.86	0.85	0.84	0.84	0.82	0.81
575	0.89	0.89	0.89	0.89	0.88	0.88	0.86	0.84	0.83	0.81
600	0.92	0.92	0.92	0.91	0.89	0.88	0.87	0.85	0.83	0.81
625	0.94	0.93	0.93	0.92	0.90	0.89	0.87	0.85	0.83	0.81
650	0.96	0.96	0.95	0.93	0.92	0.90	0.88	0.86	0.83	0.81
675	0.99	0.98	0.96	0.95	0.93	0.91	0.88	0.85	0.82	0.80
700	1.00	1.00	0.98	0.96	0.93	0.91	0.88	0.85	0.82	0.78
725	1.00	1.00	0.99	0.96	0.94	0.91	0.87	0.84	0.78	0.71
750	1.00	1.00	1.00	0.97	0.94	0.90	0.82	0.76	0.67	0.59

Table E-100.11-1
Stress Rupture Factors for 2½Cr-1Mo (415/205) Welded With SFA-5.28 E90C-B3, SFA-5.28 ER90S-B3, SFA-5.5 E90XX-B3 (>0.05C), SFA-5.23 EB3, SFA-5.23 ECB3 (>0.05C), and SFA-5.29 E90T1-B3 (>0.05C)

Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
400–450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
475	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97
525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.94
550	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.94	0.90
575	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.93	0.89	0.85
600	1.00	1.00	1.00	1.00	0.99	0.97	0.93	0.89	0.84	0.79
625	1.00	1.00	1.00	1.00	0.98	0.94	0.90	0.86	0.80	0.75
650	1.00	1.00	1.00	0.98	0.93	0.89	0.83	0.78	0.71	0.66

Table E-100.12-1
Stress Rupture Factors for 9Cr-1Mo-V Welded With SFA-5.28 ER90S-B9, SFA-5.5 E90XX-B9, and SFA-5.23 EB9

Temp., °C	Ratio
425	1.0
450	0.95
475	0.93
500	0.92
525	0.91
550	0.89
575	0.87
600	0.84
625	0.80
650	0.76

Table E-100.13-1
Permissible Materials for Bolting

Material	Spec. No.	Grades
Type 304 SS	SA-193	B8, Class 1 and B8A, Class 1A [Note (1)]
Type 316 SS	SA-193	B8M, Class 1 and B8MA, Class 1A [Note (1)]
Ni-Cr-Fe-Mo-Cb Alloy 718 [Note (2)], [Note (3)], [Note (4)]	SB-637	N07718

GENERAL NOTE: If bolting temperatures do not exceed those given in Table 4 for the bolting material, the S_m values in Table 4 shall apply. For elevated temperatures, the list of materials shown above can be used in bolting applications.

NOTES:

- (1) For use at temperatures above 540°C, these materials may be used only if the material is heat treated by heating to a minimum temperature of 1 040°C and quenching in water or rapidly cooling by other means.
- (2) Maximum forging diameter shall be limited to 150 mm.
- (3) Welding is not permitted.
- (4) Precautionary Note: In use of Alloy 718, consideration shall be given to a reduction in toughness caused by long-term exposure at a temperature of 540°C or greater.

Table E-100.14-1
 S_o — Maximum Allowable Stress Intensity, MPa, for Design Condition Calculations of Bolting Materials

For Metal Temperature Not Exceeding, °C	304 SS	316 SS	Alloy 718
425	38	40	230
450	38	40	228
475	37	39	227
500	37	39	226
525	36	39	224
550	35	39	222
575	35	39	...
600	34	38	...
625	33	37	...
650	32	37	...
675	32	37	...
700	27	29	...

Figure E-100.15-1
 S_{mt} — Allowable Stress Intensity, Type 304 SS, Bolting

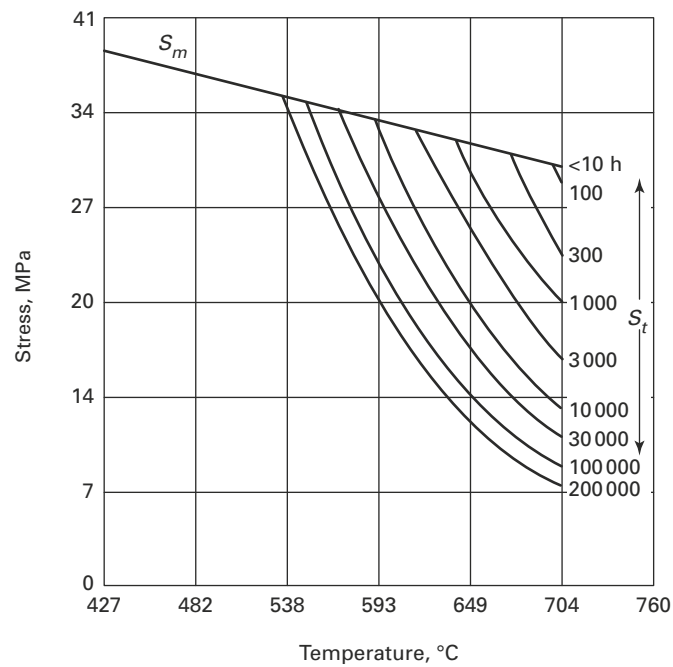


Figure E-100.15-2
 S_{mt} — Allowable Stress Intensity, Type 316 SS, Bolting

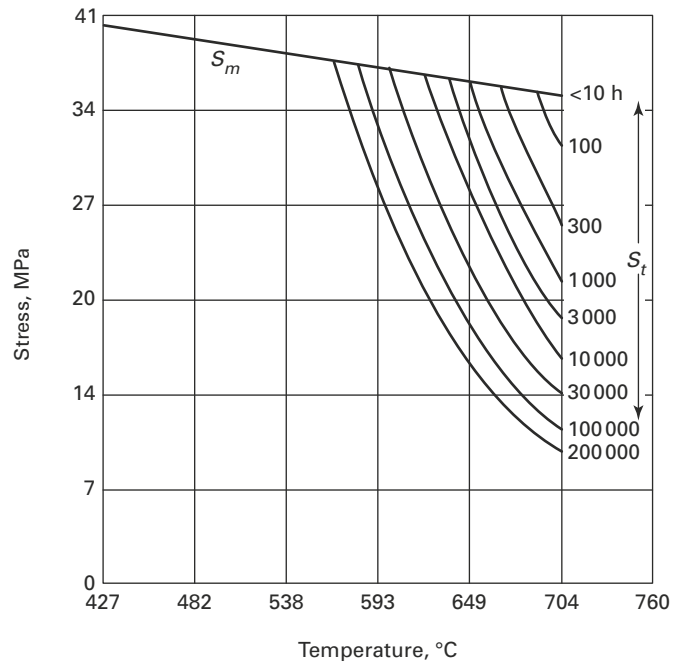
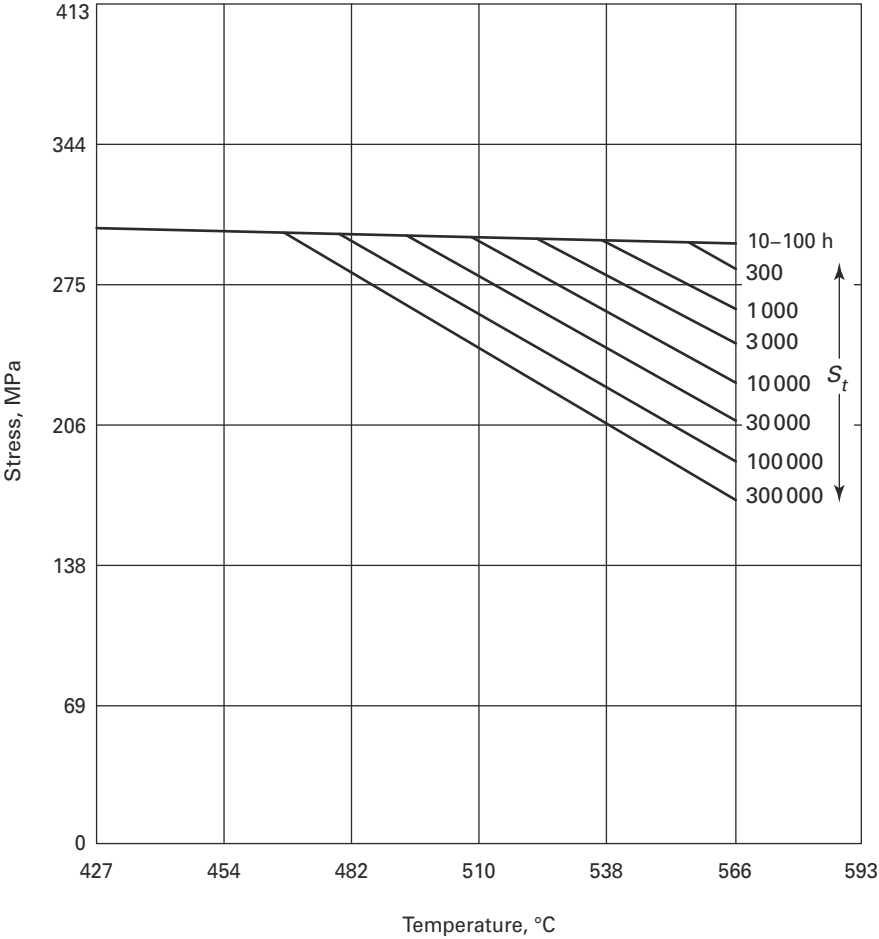
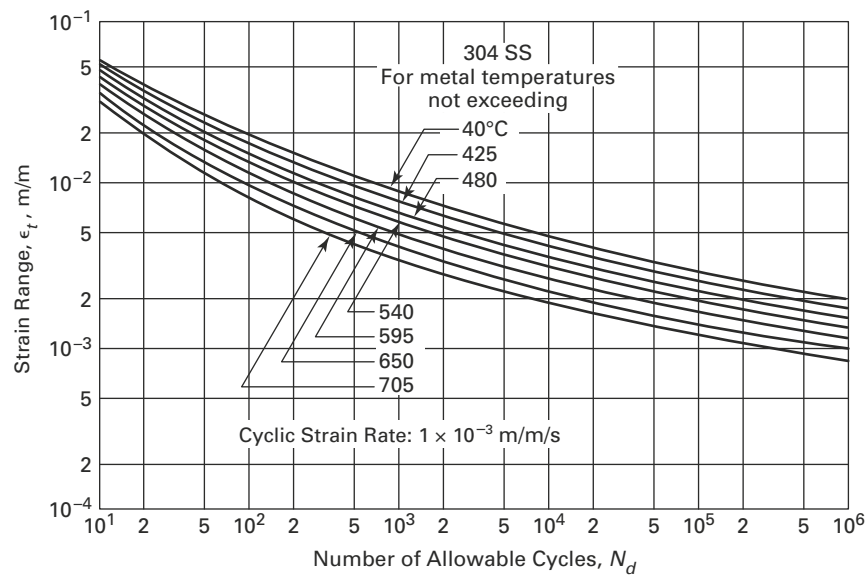


Figure E-100.15-3
 S_{mt} — Allowable Stress Values, MPa, Alloy 718, Bolting



Temp., °C	10 h	30 h	10 ² h	3 × 10 ² h	10 ³ h	3 × 10 ³ h	10 ⁴ h	3 × 10 ⁴ h	10 ⁵ h	3 × 10 ⁵ h
425	306	306	306	306	306	306	306	306	306	306
450	304	304	304	304	304	304	304	304	304	304
475	303	303	303	303	303	303	303	303	300	300
500	301	301	301	301	301	301	298	288	275	263
525	298	298	298	298	298	290	282	261	242	224
550	296	296	296	292	282	265	250	228	208	191

Figure E-100.16-1
Design Fatigue Strain Range, ϵ_t , for 304 SS

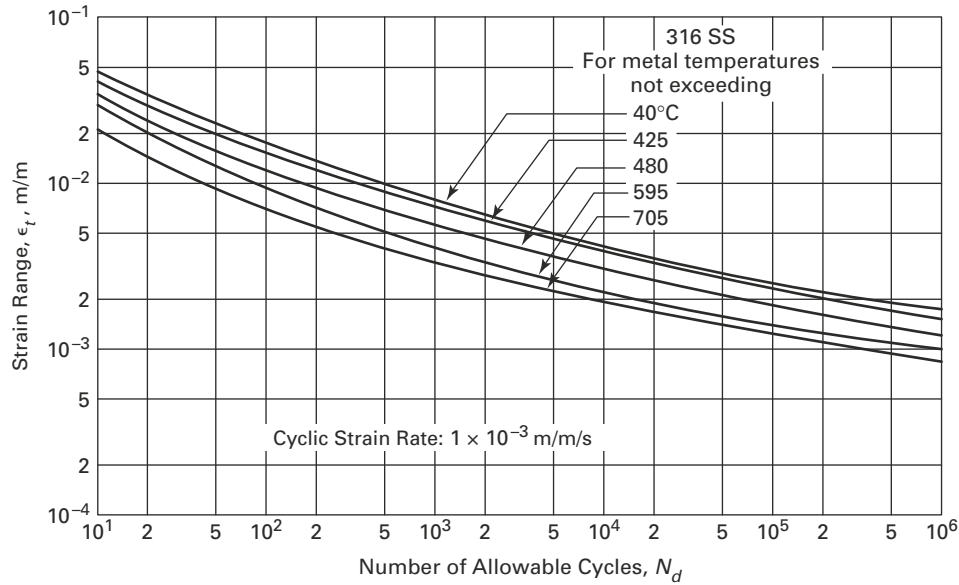


Number of Cycles, N_d [Note (1)]	Strain Range, ϵ_t (m/m), at Temperature						
	40°C	425°C	480°C	540°C	595°C	650°C	705°C
10	0.051	0.050	0.0465	0.0425	0.0382	0.0335	0.0297
20	0.036	0.0345	0.0315	0.0284	0.025	0.0217	0.0186
40	0.0263	0.0246	0.0222	0.0197	0.017	0.0146	0.0123
10^2	0.018	0.0164	0.0146	0.0128	0.011	0.0093	0.0077
2×10^2	0.0142	0.0125	0.011	0.0096	0.0082	0.0069	0.0057
4×10^2	0.0113	0.00965	0.00845	0.00735	0.0063	0.00525	0.00443
10^3	0.00845	0.00725	0.0063	0.0055	0.0047	0.00385	0.00333
2×10^3	0.0067	0.0059	0.0051	0.0045	0.0038	0.00315	0.00276
4×10^3	0.00545	0.00485	0.0042	0.00373	0.0032	0.00263	0.0023
10^4	0.0043	0.00385	0.00335	0.00298	0.0026	0.00215	0.00185
2×10^4	0.0037	0.0033	0.0029	0.00256	0.00226	0.00187	0.00158
4×10^4	0.0032	0.00287	0.00254	0.00224	0.00197	0.00162	0.00138
10^5	0.00272	0.00242	0.00213	0.00188	0.00164	0.0014	0.00117
2×10^5	0.0024	0.00215	0.0019	0.00167	0.00145	0.00123	0.00105
4×10^5	0.00215	0.00192	0.0017	0.0015	0.0013	0.0011	0.00094
10^6	0.0019	0.00169	0.00149	0.0013	0.00112	0.00098	0.00084

NOTE:

(1) Cyclic strain rate: 1×10^{-3} m/m/s.

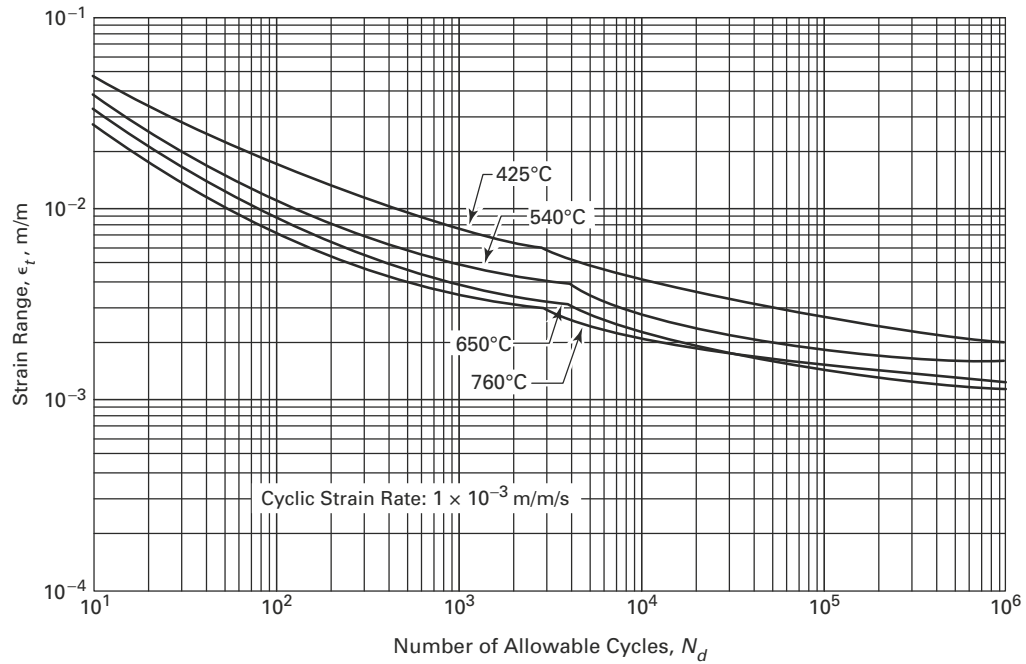
Figure E-100.16-2
Design Fatigue Strain Range, ϵ_t , for 316 SS



Number of Cycles, N_d [Note (1)]	Strain Range, ϵ_t (m/m), at Temperature				
	40°C	425°C	480°C	540°C to 650°C	705°C
10^1	0.0507	0.0438	0.0378	0.0318	0.0214
2×10^1	0.0357	0.0318	0.0251	0.0208	0.0149
4×10^1	0.026	0.0233	0.0181	0.0148	0.0105
10^2	0.0177	0.0159	0.0123	0.00974	0.00711
2×10^2	0.0139	0.0125	0.00961	0.00744	0.00551
4×10^2	0.0110	0.00956	0.00761	0.00574	0.00431
10^3	0.00818	0.00716	0.00571	0.00424	0.00328
2×10^3	0.00643	0.00581	0.00466	0.00339	0.00268
4×10^3	0.00518	0.00476	0.00381	0.00279	0.00226
10^4	0.00403	0.00376	0.00301	0.00221	0.00186
2×10^4	0.00343	0.00316	0.00256	0.00186	0.00162
4×10^4	0.00293	0.00273	0.00221	0.00161	0.00144
10^5	0.00245	0.00226	0.00182	0.00136	0.00121
2×10^5	0.00213	0.00196	0.00159	0.00121	0.00108
4×10^5	0.00188	0.00173	0.00139	0.00109	0.000954
10^6	0.00163	0.00151	0.00118	0.000963	0.000834

NOTE:
(1) Cyclic strain rate: 1×10^{-3} m/m/s.

Figure E-100.16-3
Design Fatigue Strain Range, ϵ_t , for Ni-Fe-Cr Alloy 800H

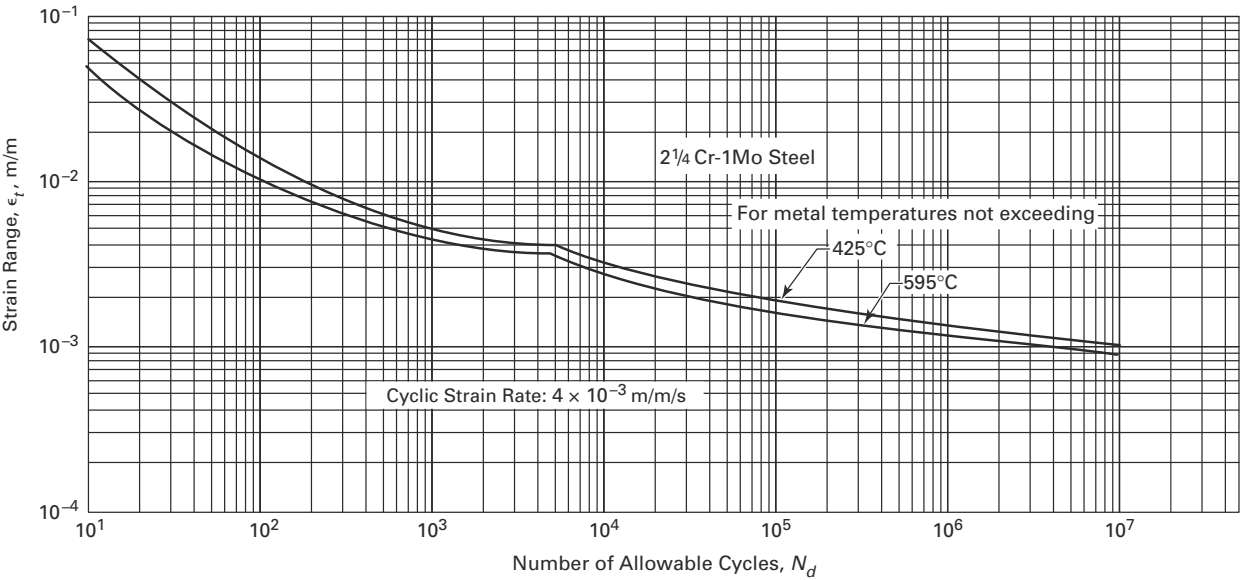


Number of Cycles, N_d [Note (1)]	Strain Range, ϵ_t (m/m), at Temperature			
	425°C	540°C	650°C	760°C
10^1	0.0500	0.0424	0.03414	0.02841
2×10^1	0.0362	0.02735	0.02199	0.01829
4×10^1	0.0027	0.01849	0.01483	0.01233
10^2	0.0184	0.01164	0.00932	0.00774
2×10^2	0.0142	0.00849	0.00678	0.00562
4×10^2	0.0113	0.00660	0.00533	0.00469
10^3	0.00841	0.00515	0.00417	0.00388
2×10^3	0.00685	0.00454	0.00366	0.00349
3×10^3	0.00644	0.00433	0.00347	0.00309
4×10^3	0.00572	0.00409	0.00327	0.00270
10^4	0.00452	0.00293	0.00234	0.00212
2×10^4	0.00392	0.00243	0.00197	0.00183
4×10^4	0.00343	0.00212	0.00175	0.00164
10^5	0.00288	0.00194	0.00155	0.00149
2×10^5	0.00254	0.00186	0.00147	0.00140
4×10^5	0.00229	0.00178	0.00140	0.00132
10^6	0.00200	0.00169	0.00131	0.00122

NOTE:

(1) Cyclic strain rate: 1×10^{-3} m/m/s.

Figure E-100.16-4
Design Fatigue Strain Range, ϵ_t , for 2 $\frac{1}{4}$ Cr-1Mo Steel

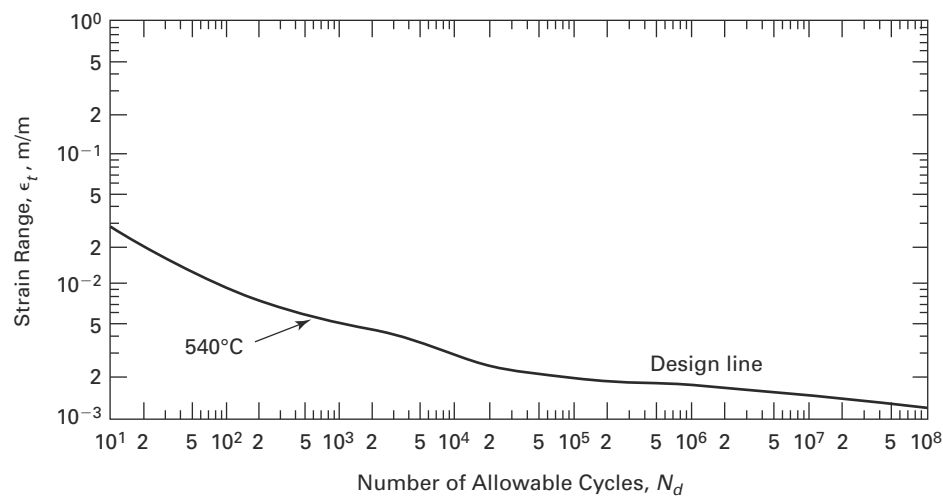


Number of Cycles, N_d [Note (1)]	Strain Range, ϵ_t (m/m), at Temperature	
	425°C	480°C to 595°C
10^1	0.056	0.040
4×10^1	0.023	0.0163
10^2	0.013	0.0097
2×10^2	0.0094	0.0070
4×10^2	0.0070	0.0056
10^3	0.0052	0.0042
2×10^3	0.0044	0.0039
4×10^3	0.0040	0.0035
10^4	0.0032	0.00265
2×10^4	0.0026	0.00215
4×10^4	0.0023	0.00182
10^5	0.00195	0.00158
2×10^5	0.00173	0.00142
4×10^5	0.00155	0.00130
10^6	0.00137	0.00118

NOTE:

(1) Cyclic strain rate: 4×10^{-3} m/m/s.

Figure E-100.16-5
Design Fatigue Strain Range, ϵ_t , for 9Cr-1Mo-V Steel



Number of Cycles, N_d	Strain Range, ϵ_t (m/m), at 540°C Temperature
[Note (1)]	
10	0.028
20	0.019
40	0.0138
10^2	0.0095
2×10^2	0.0075
4×10^2	0.0062
10^3	0.0050
2×10^3	0.0044
4×10^3	0.0039
10^4	0.0029
2×10^4	0.0024
4×10^4	0.0021
10^5	0.0019
2×10^5	0.00176
4×10^5	0.0017
10^6	0.00163
2×10^6	0.00155
4×10^6	0.00148
10^7	0.00140
2×10^7	0.00132
4×10^7	0.00125
10^8	0.00120

NOTE:
(1) Cyclic strain rate: 4×10^{-3} m/m/s.

Figure E-100.17-1
Time–Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under Axial Compression

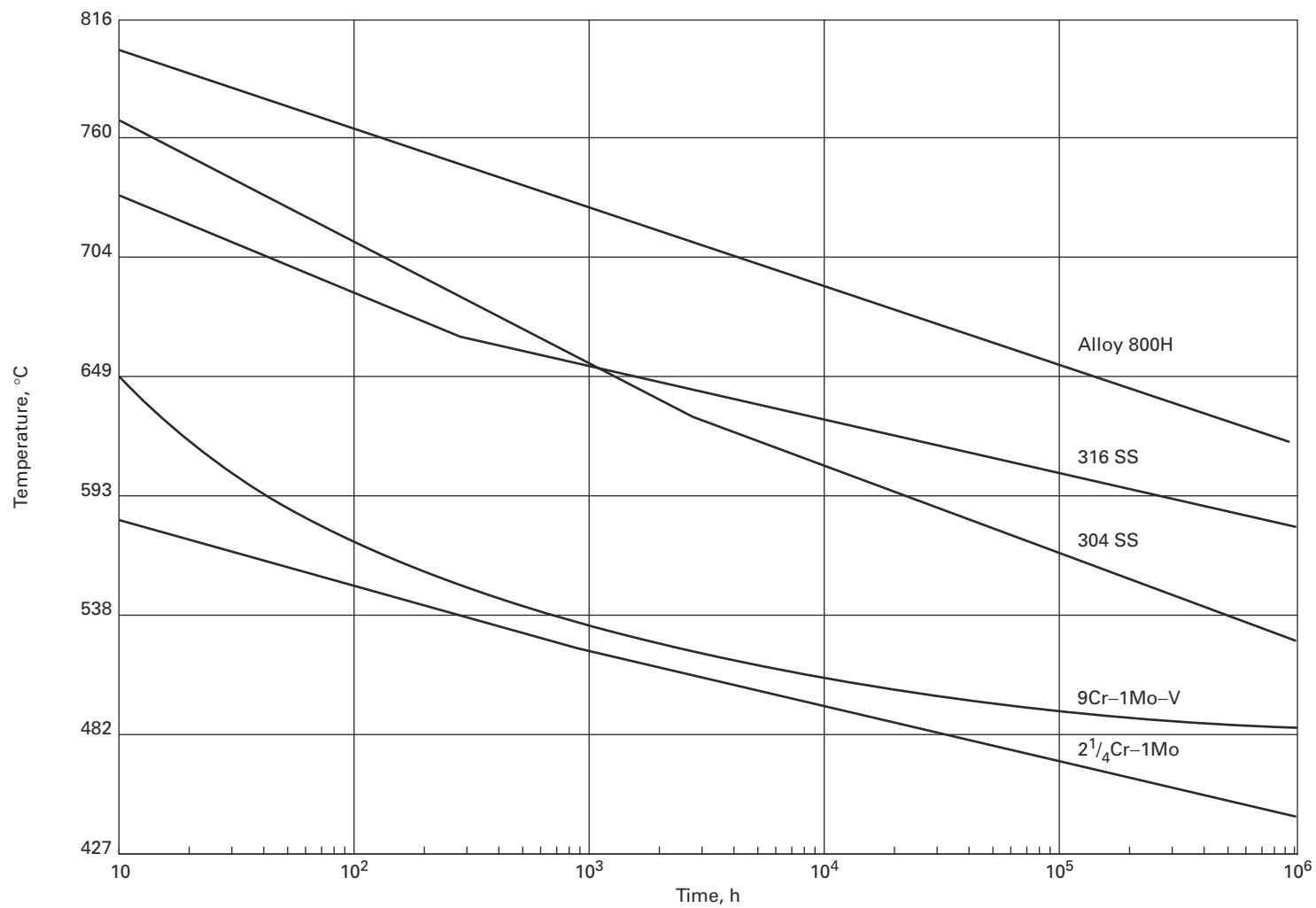


Figure E-100.17-2

Time-Temperature Limits for Application of Section II External Pressure Charts for Sphere Under External Pressure

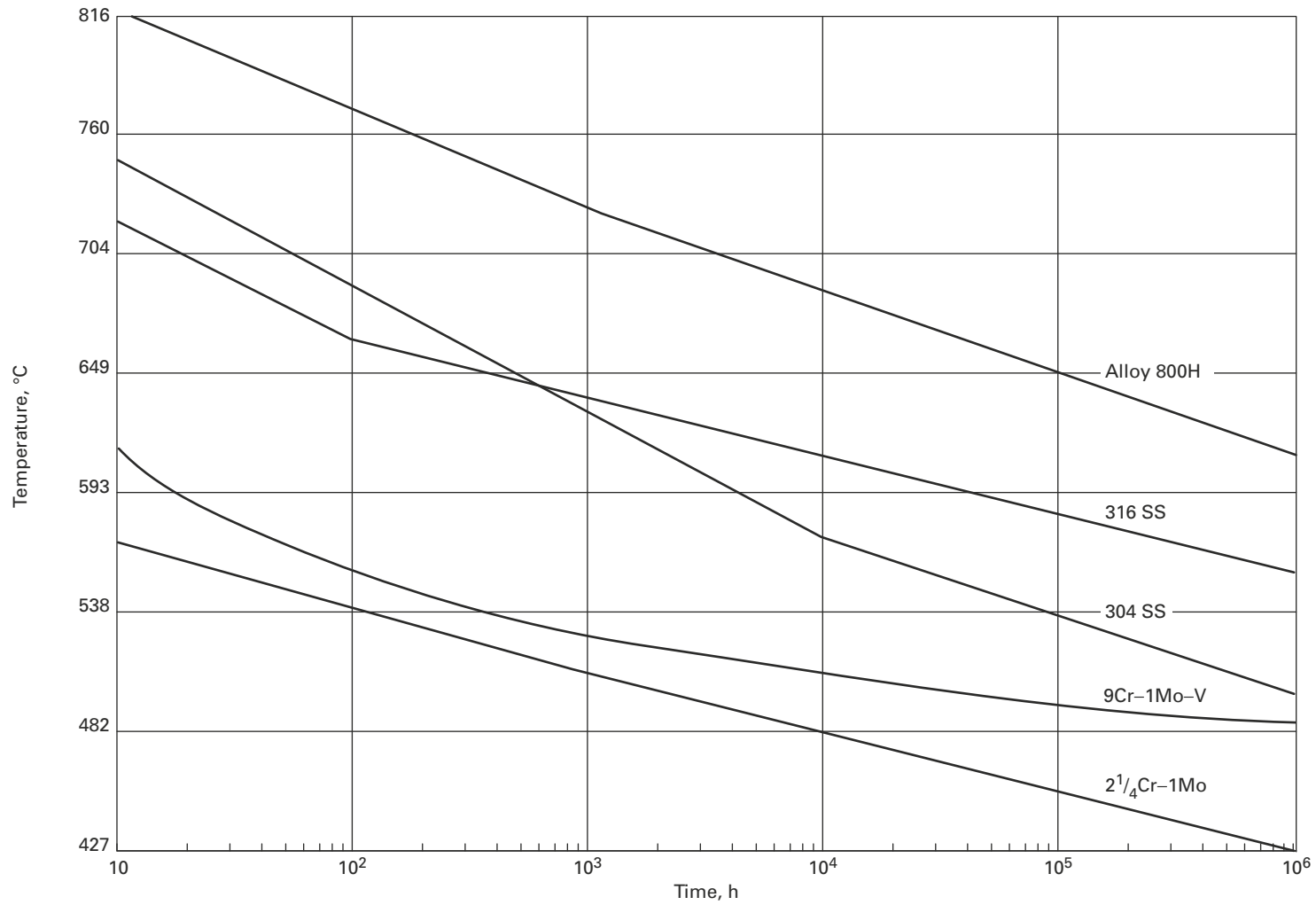


Figure E-100.17-3
Temperature Limits for Application of Section II External Pressure Charts for Cylinder Under External Pressure

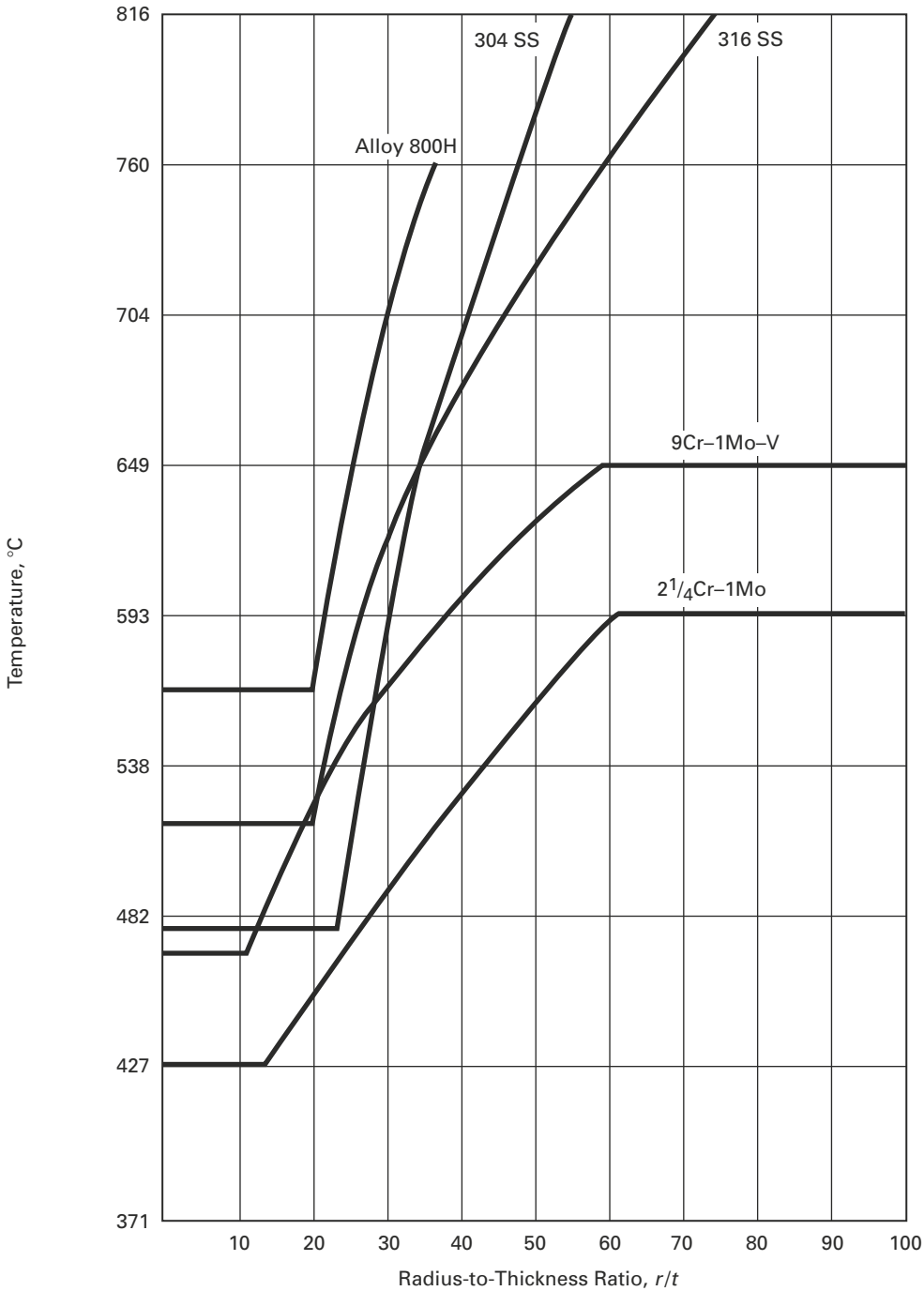


Figure E-100.18-1
Average Isochronous Stress-Strain Curves for Type 304 SS at 427°C

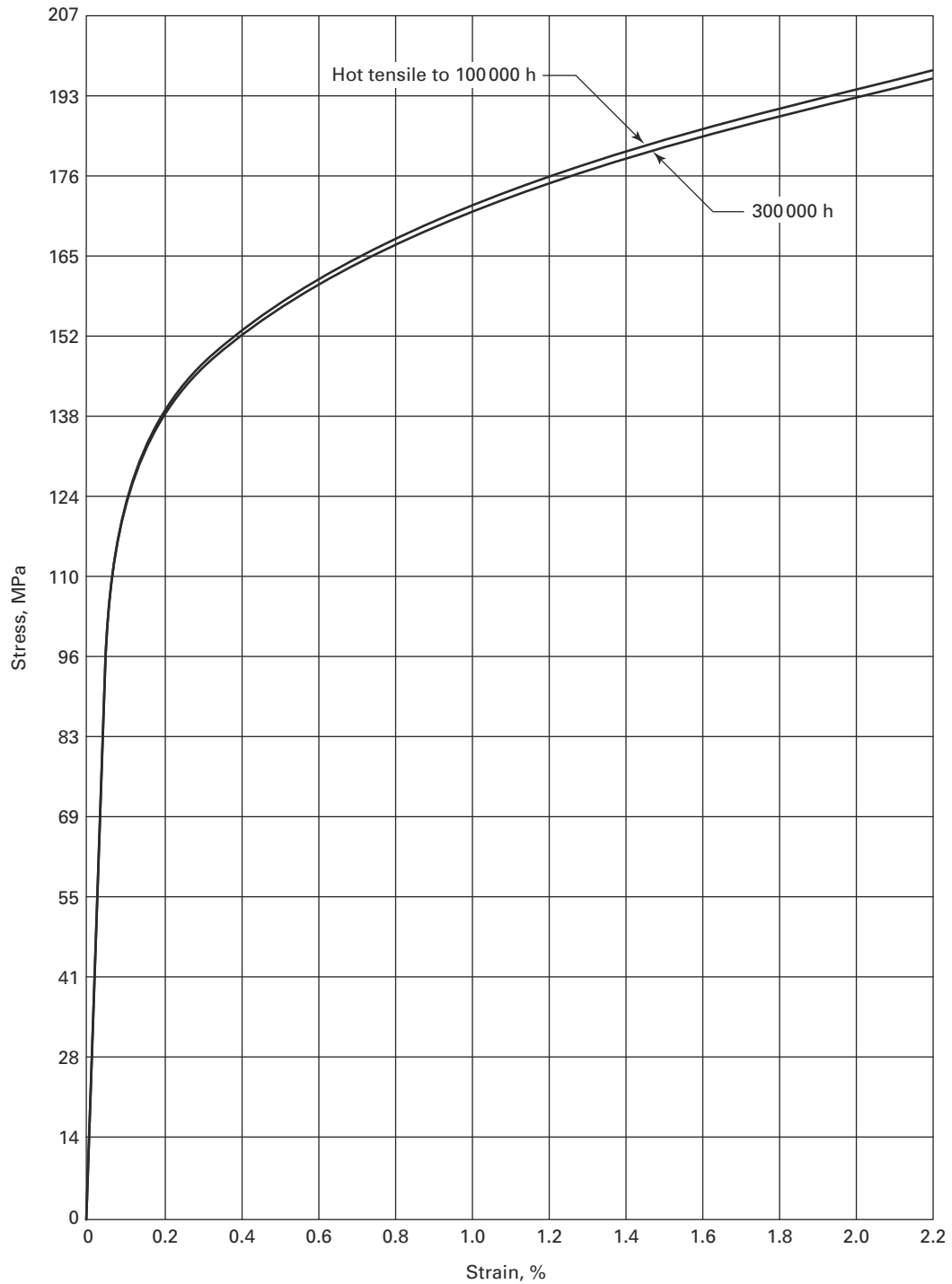


Figure E-100.18-2
Average Isochronous Stress-Strain Curves for Type 304 SS at 454°C

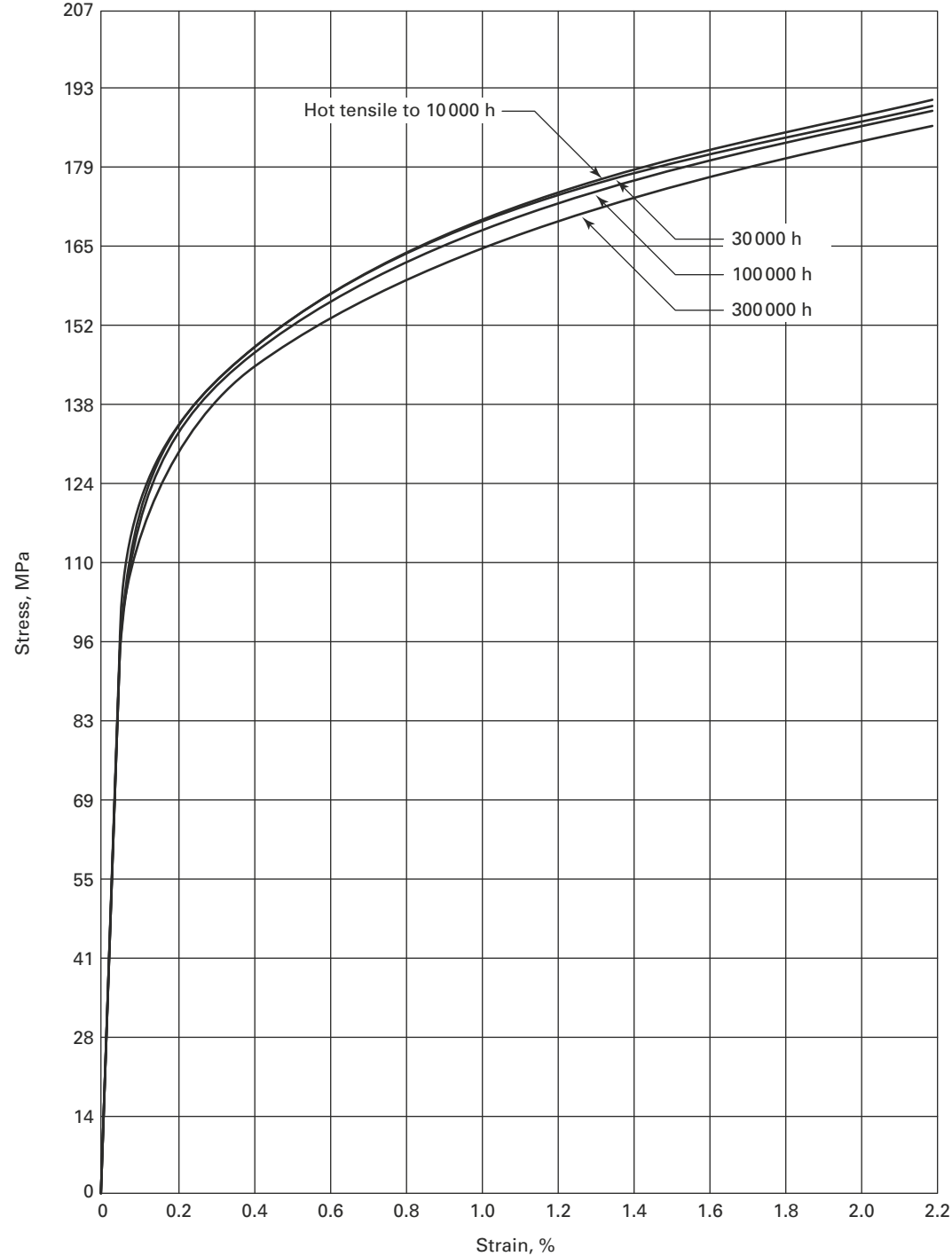


Figure E-100.18-3
Average Isochronous Stress-Strain Curves for Type 304 SS at 482°C

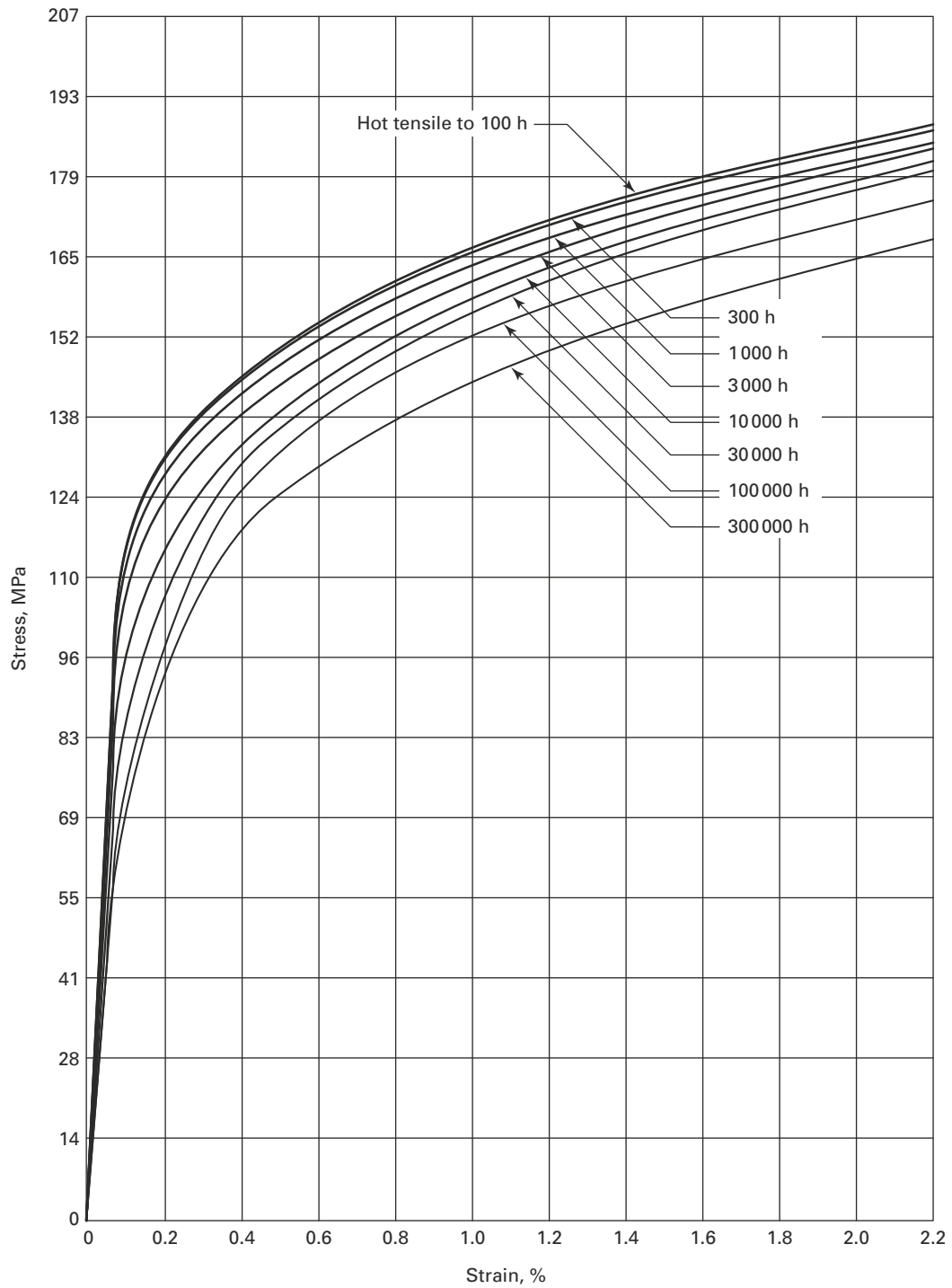


Figure E-100.18-4
Average Isochronous Stress-Strain Curves for Type 304 SS at 510°C

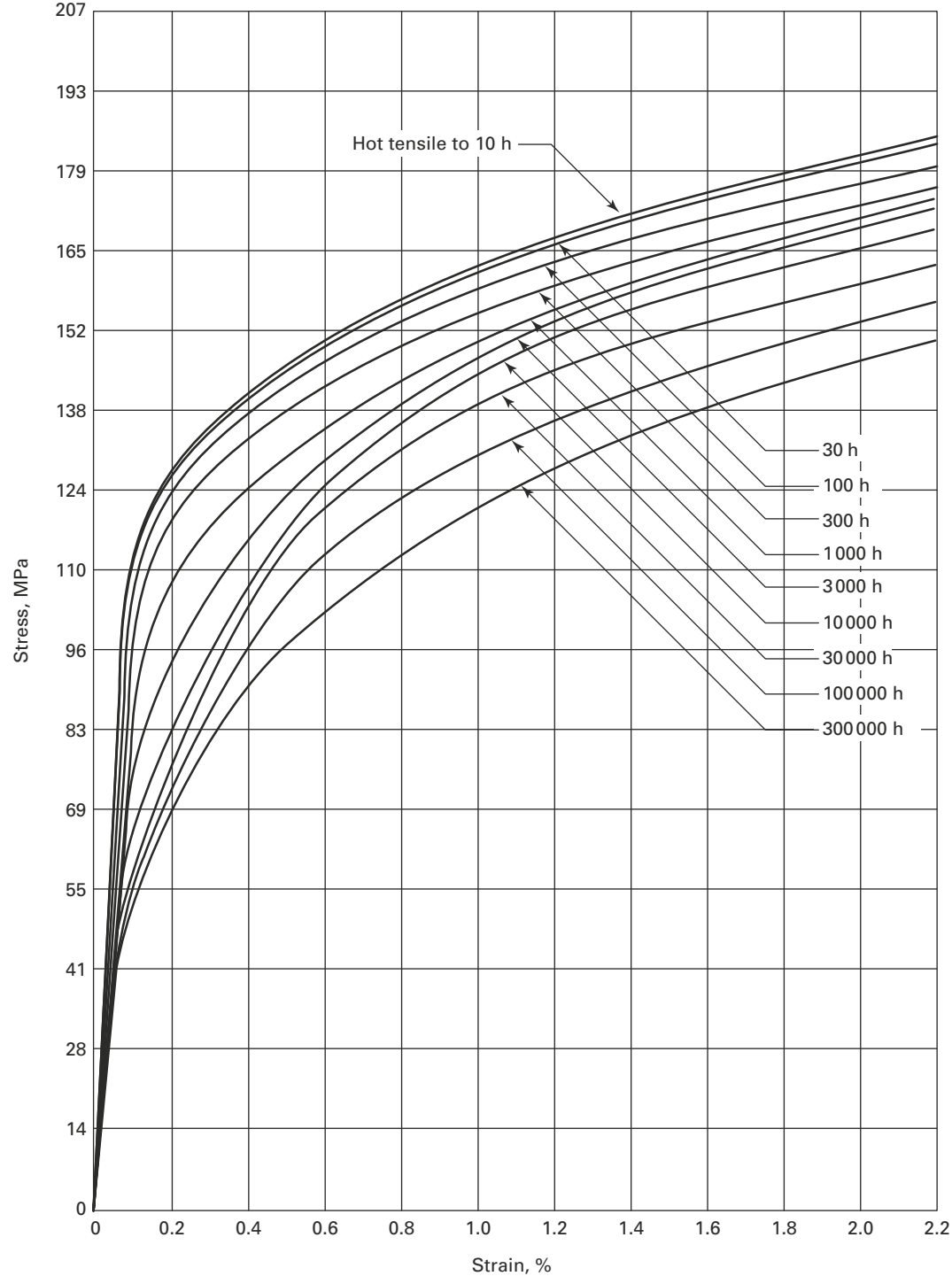


Figure E-100.18-5
Average Isochronous Stress-Strain Curves for Type 304 SS at 538°C

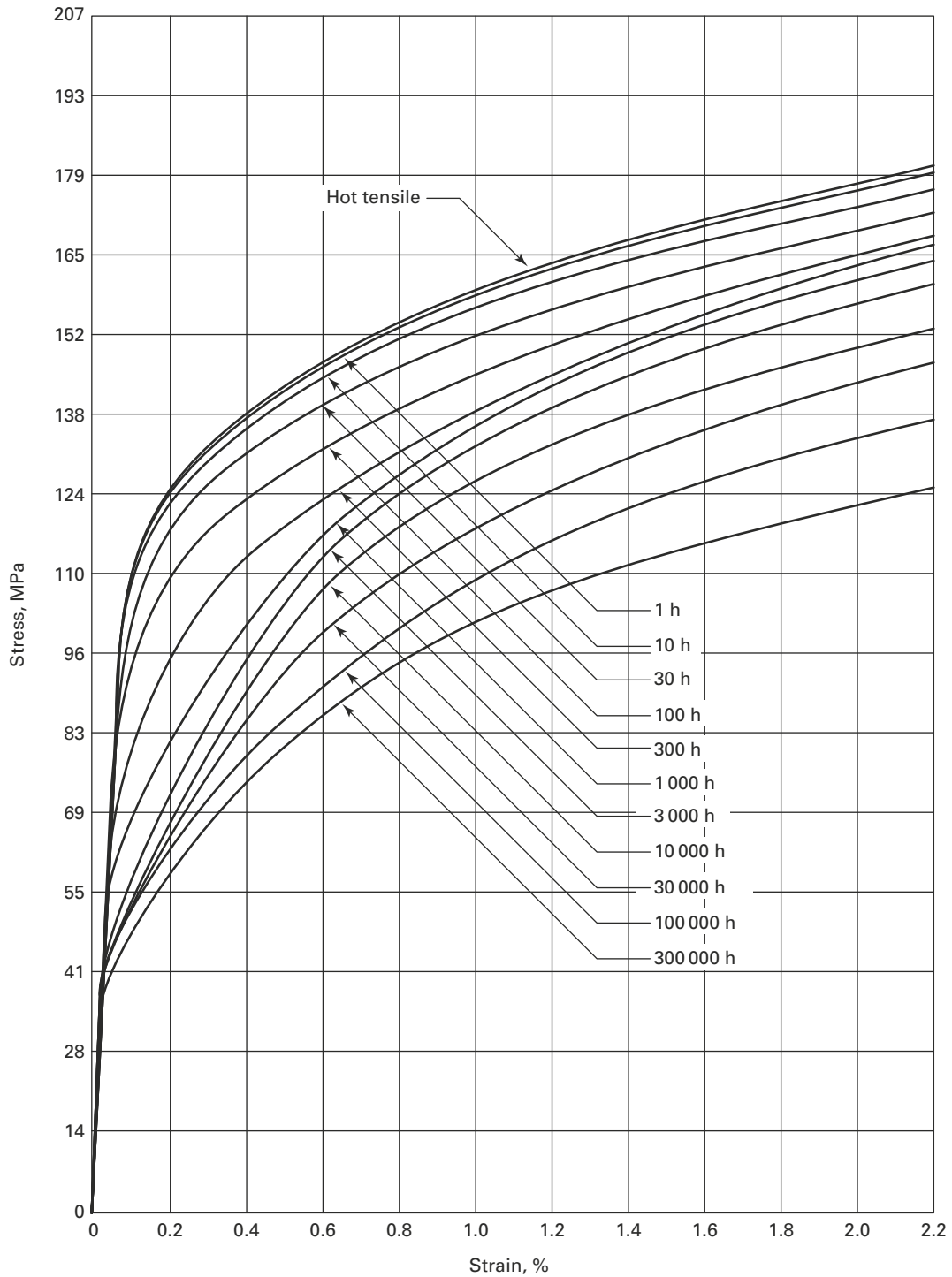


Figure E-100.18-6
Average Isochronous Stress-Strain Curves for Type 304 SS at 566°C

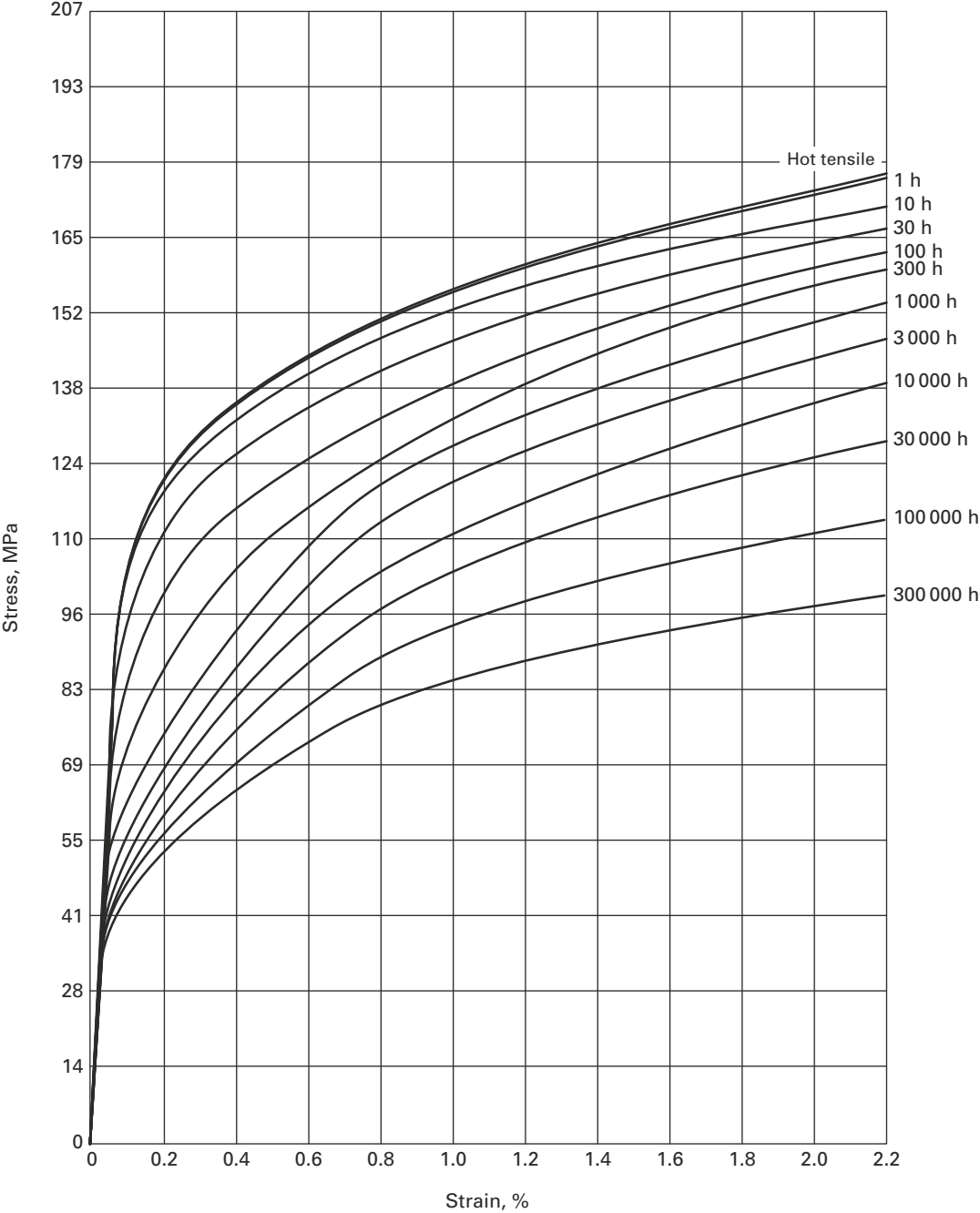


Figure E-100.18-7
Average Isochronous Stress-Strain Curves for Type 304 SS at 593°C

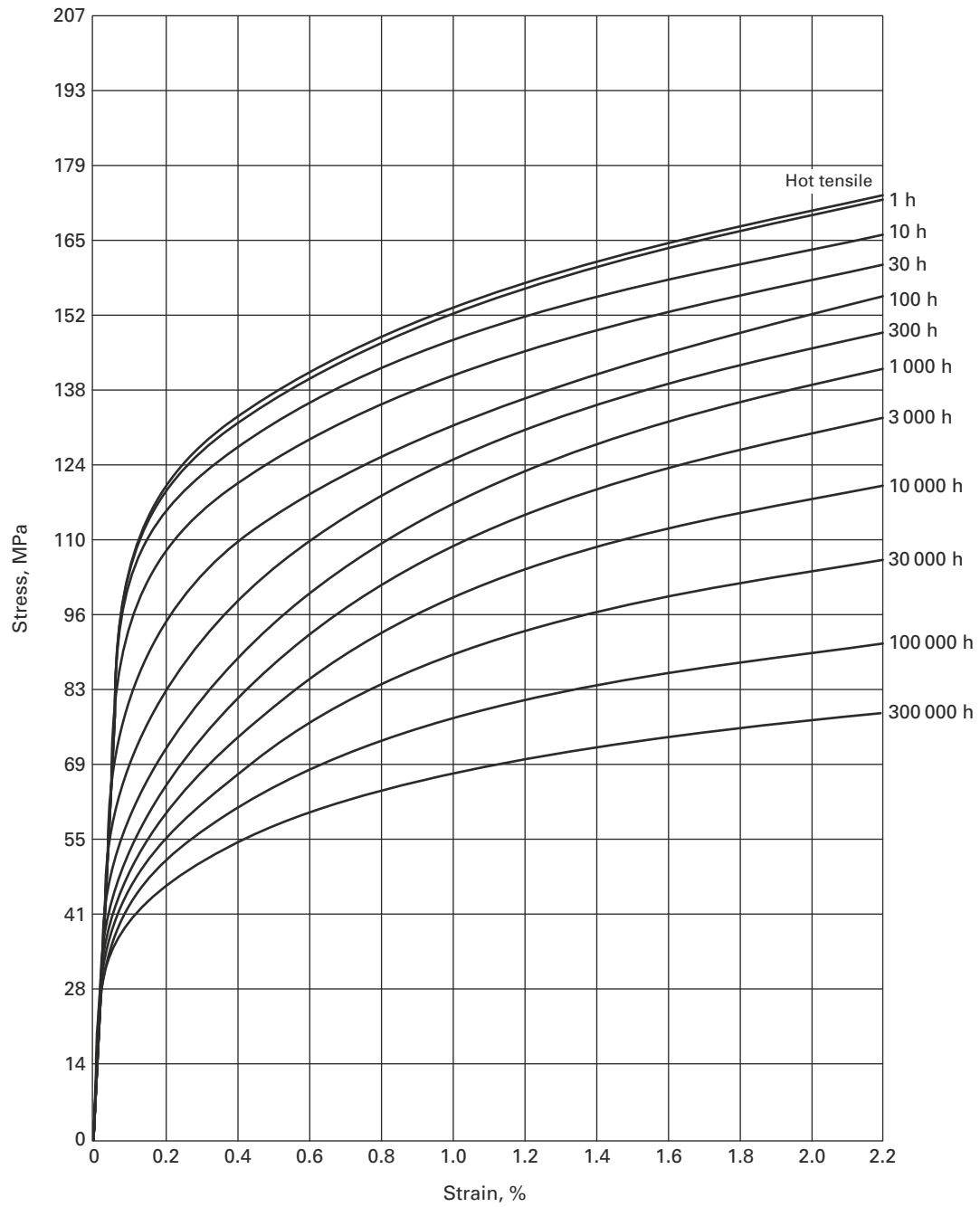


Figure E-100.18-8
Average Isochronous Stress-Strain Curves for Type 304 SS at 621°C

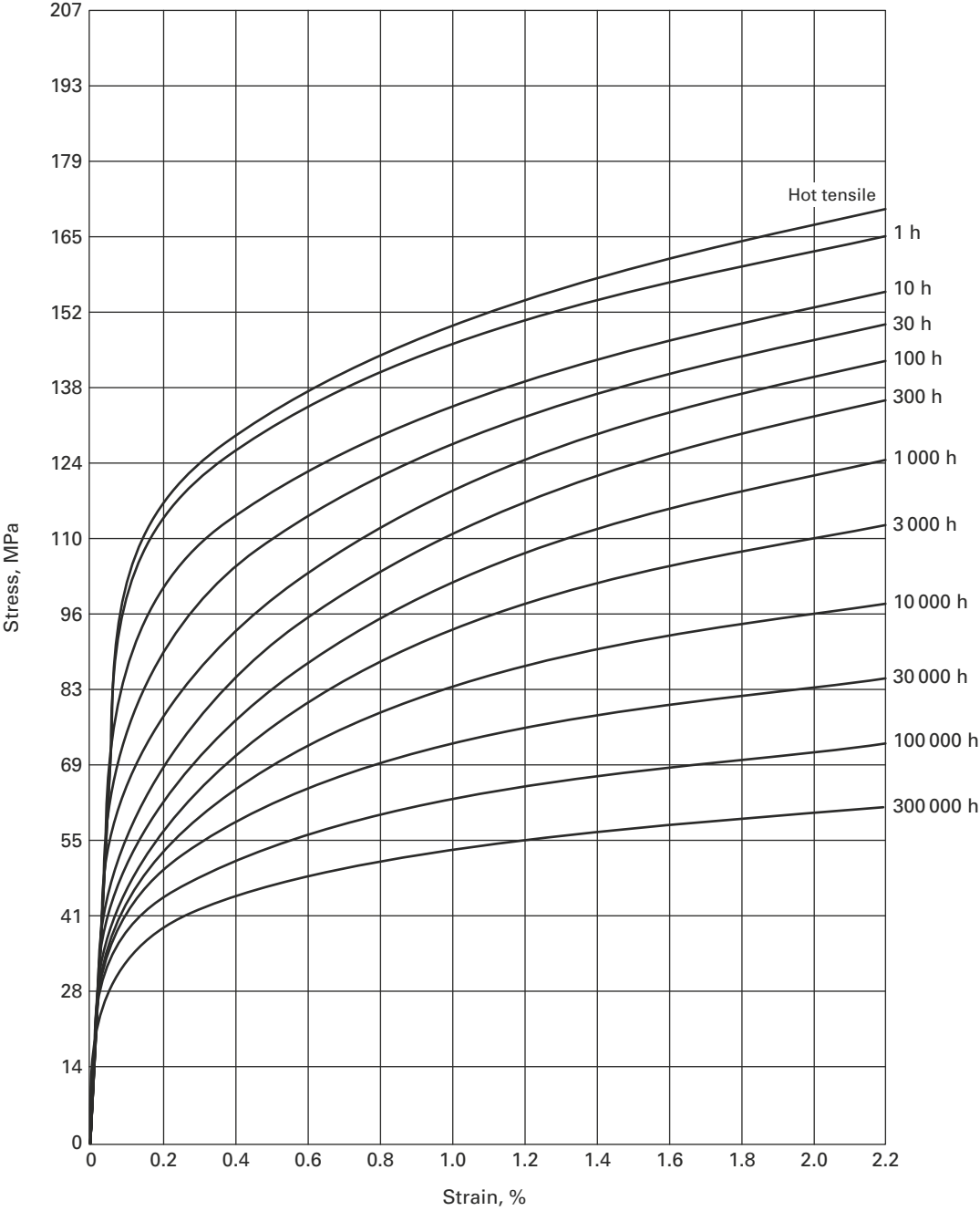


Figure E-100.18-9
Average Isochronous Stress-Strain Curves for Type 304 SS at 649°C

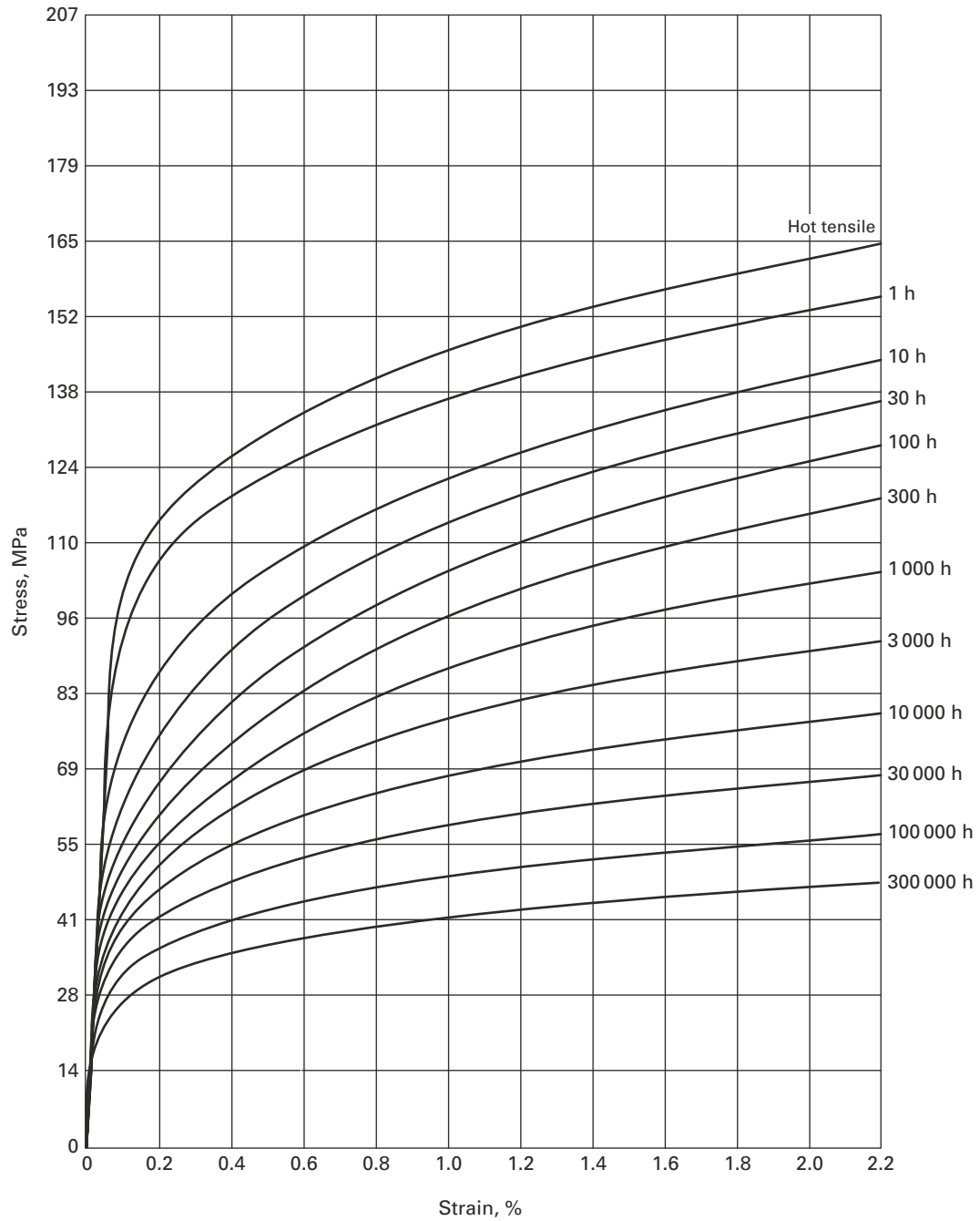


Figure E-100.18-10
Average Isochronous Stress-Strain Curves for Type 304 SS at 677°C

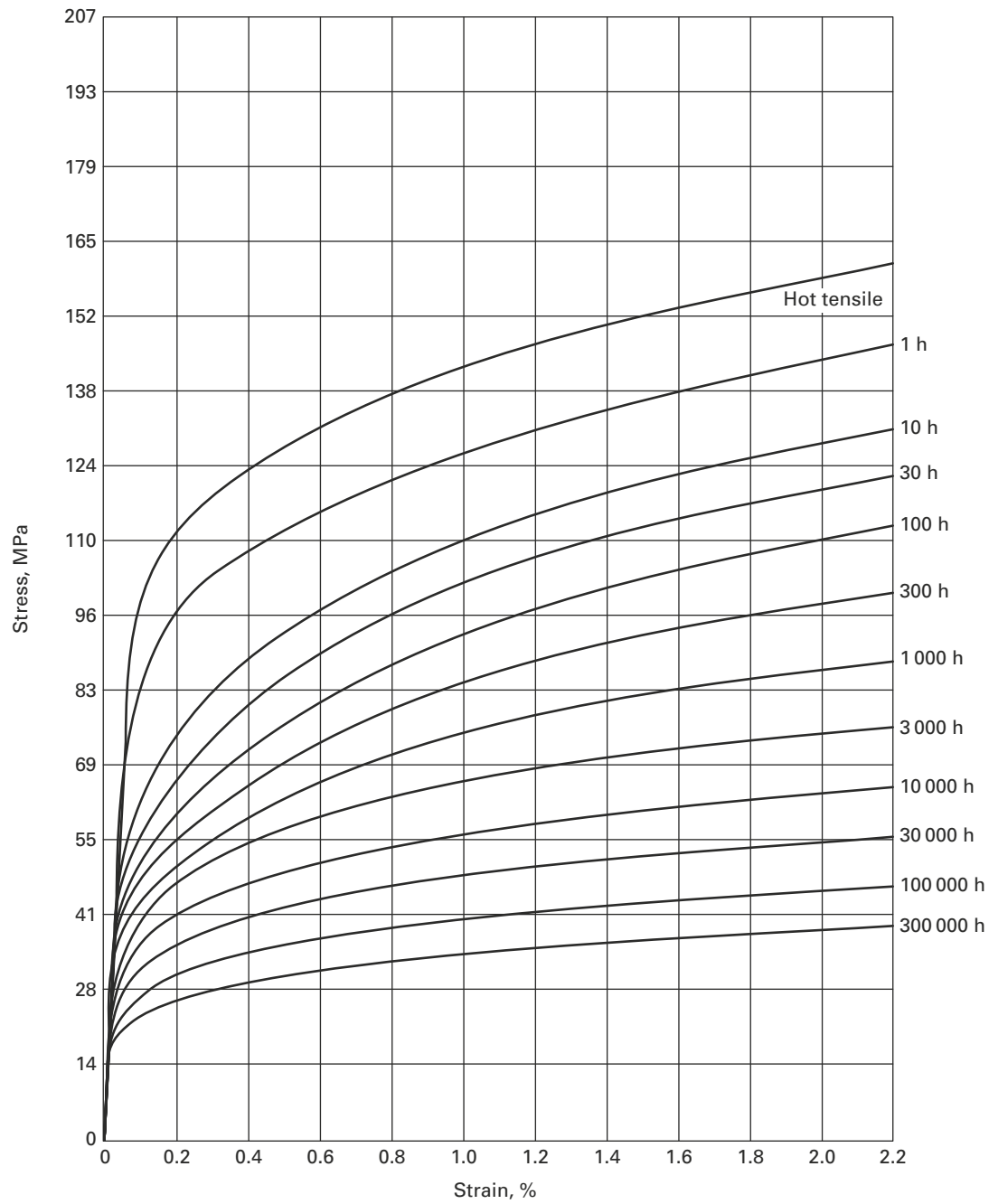


Figure E-100.18-11
Average Isochronous Stress-Strain Curves for Type 304 SS at 704°C

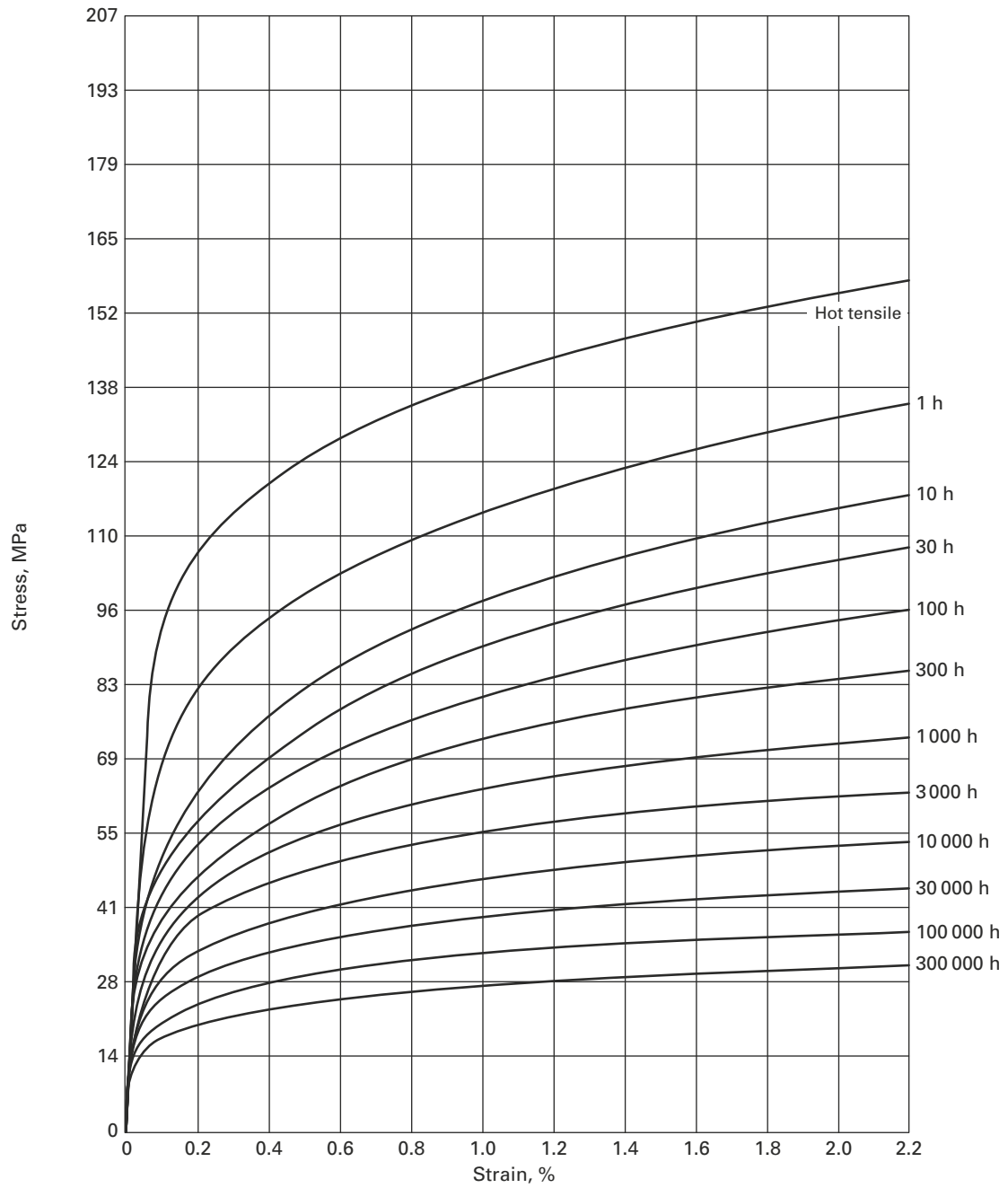


Figure E-100.18-12
Average Isochronous Stress-Strain Curves for Type 304 SS at 732°C

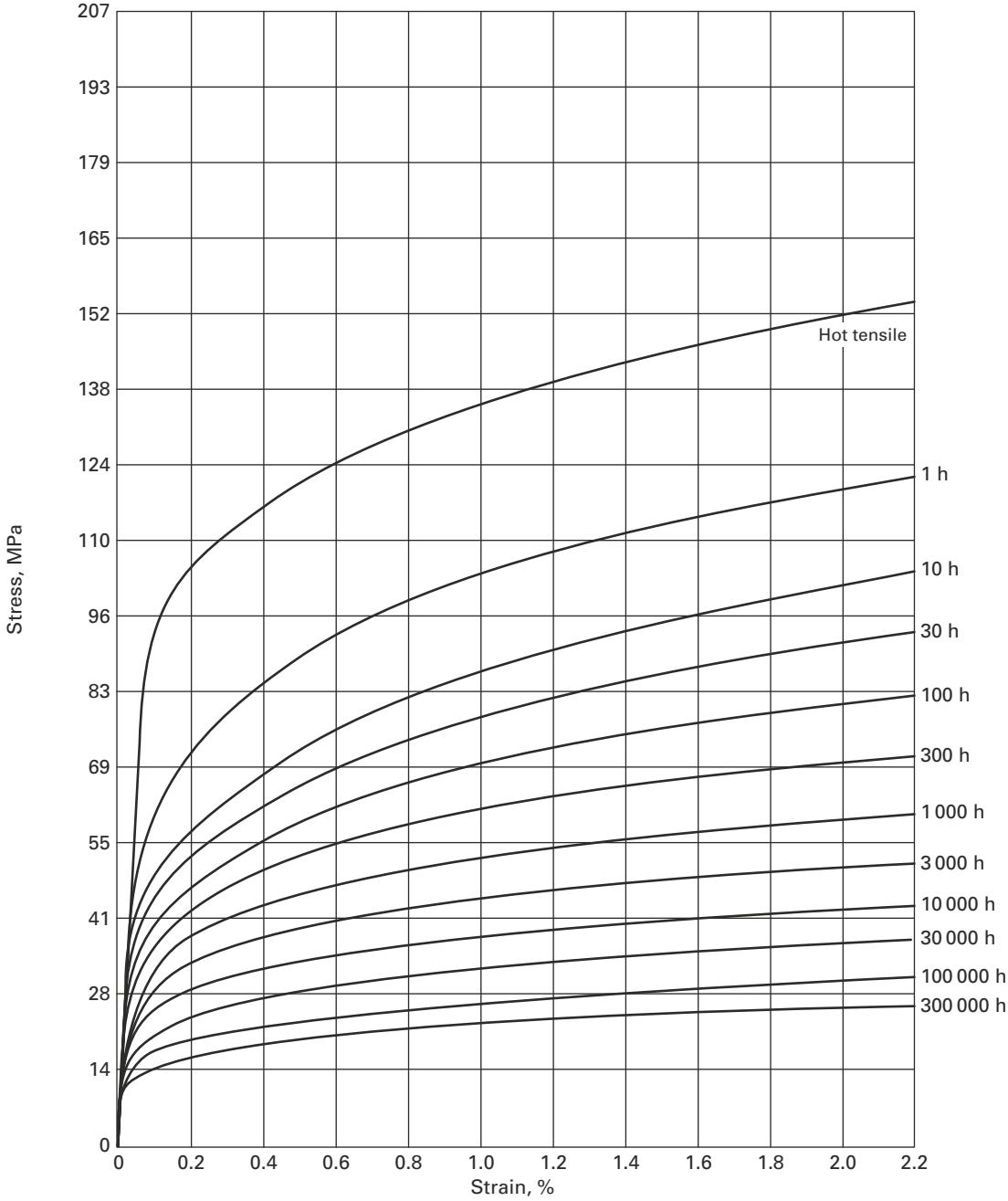


Figure E-100.18-13
Average Isochronous Stress-Strain Curves for Type 304 SS at 760°C

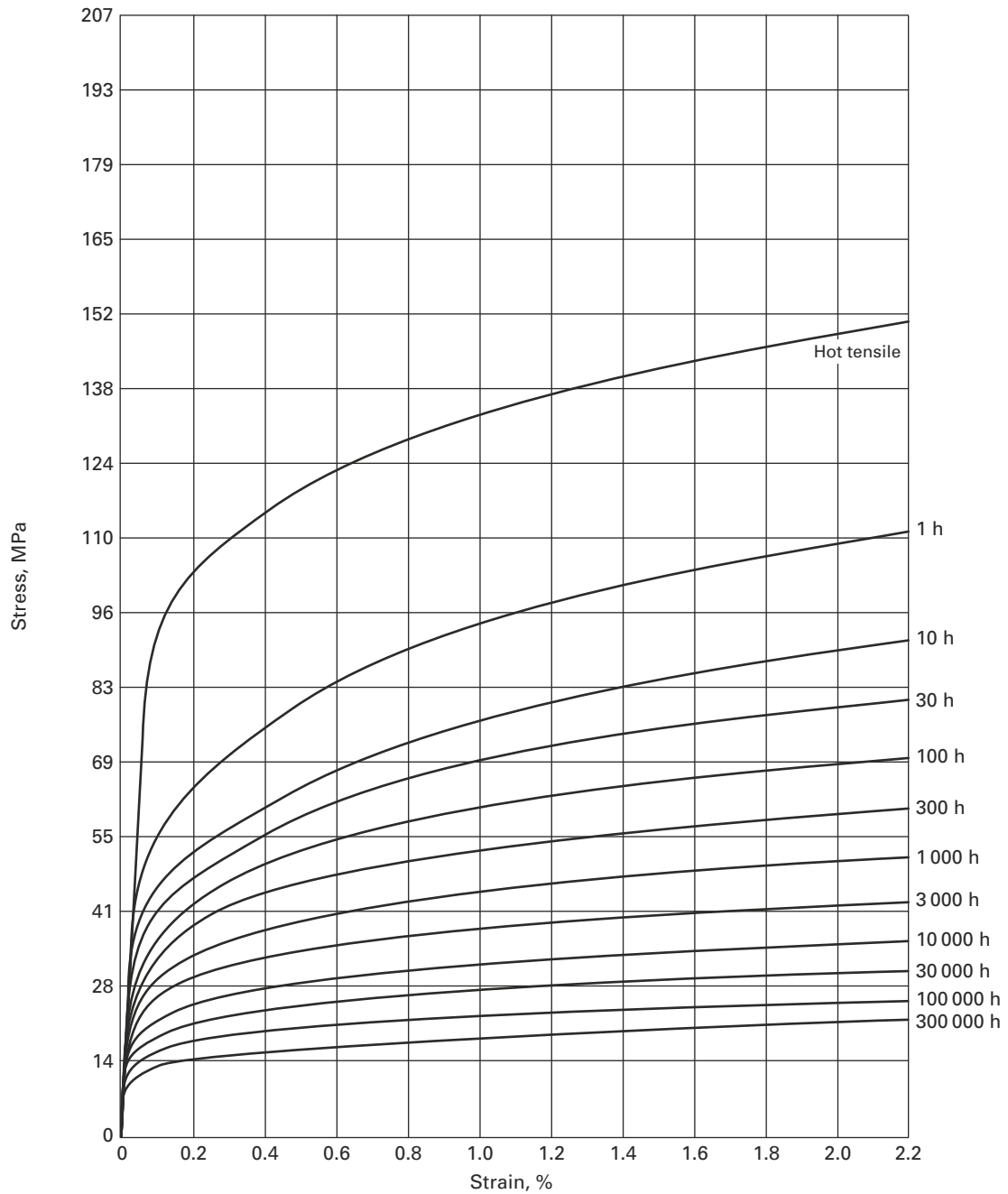


Figure E-100.18-14
Average Isochronous Stress-Strain Curves for Type 304 SS at 788°C

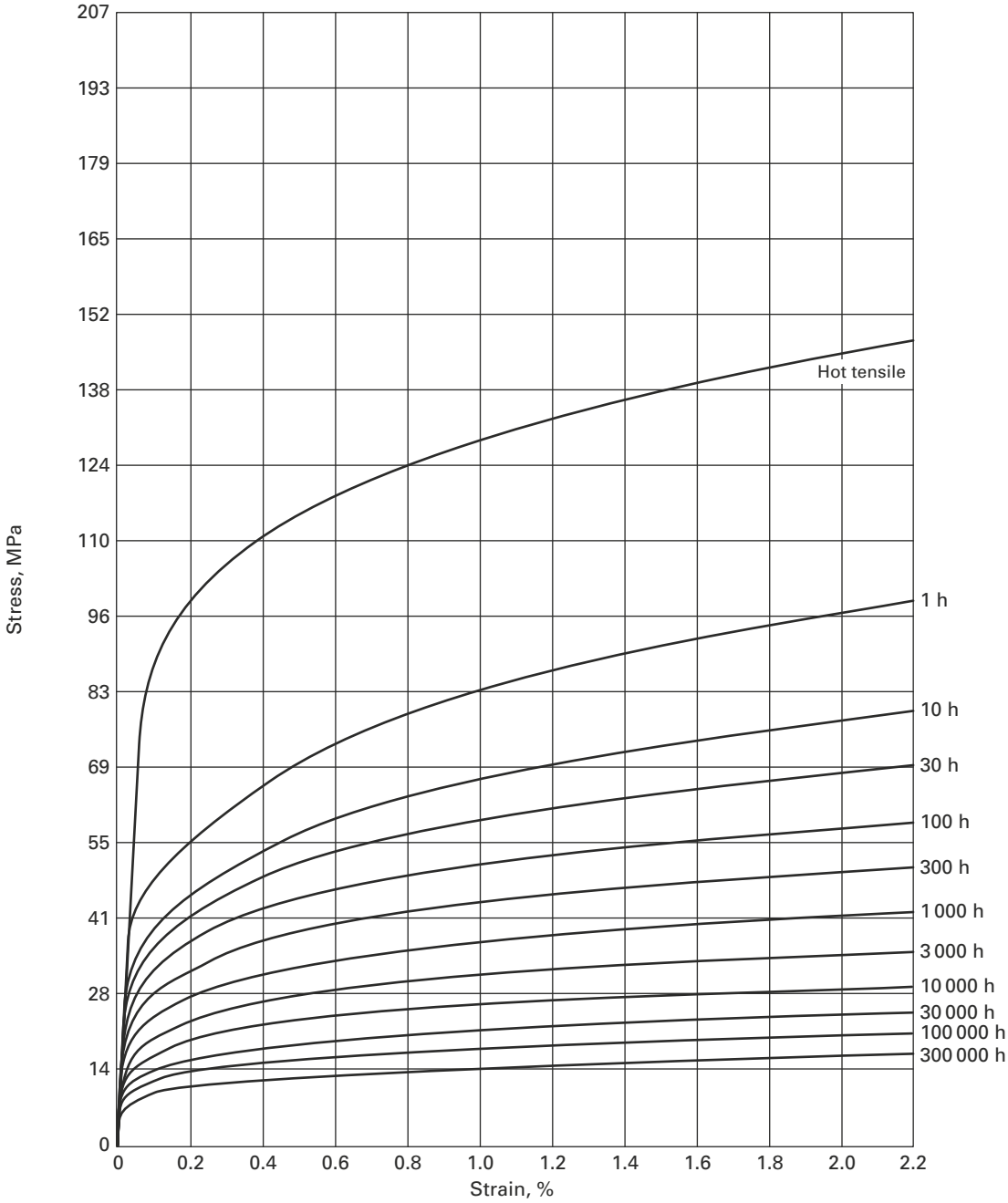


Figure E-100.18-15
Average Isochronous Stress-Strain Curves for Type 304 SS at 816°C

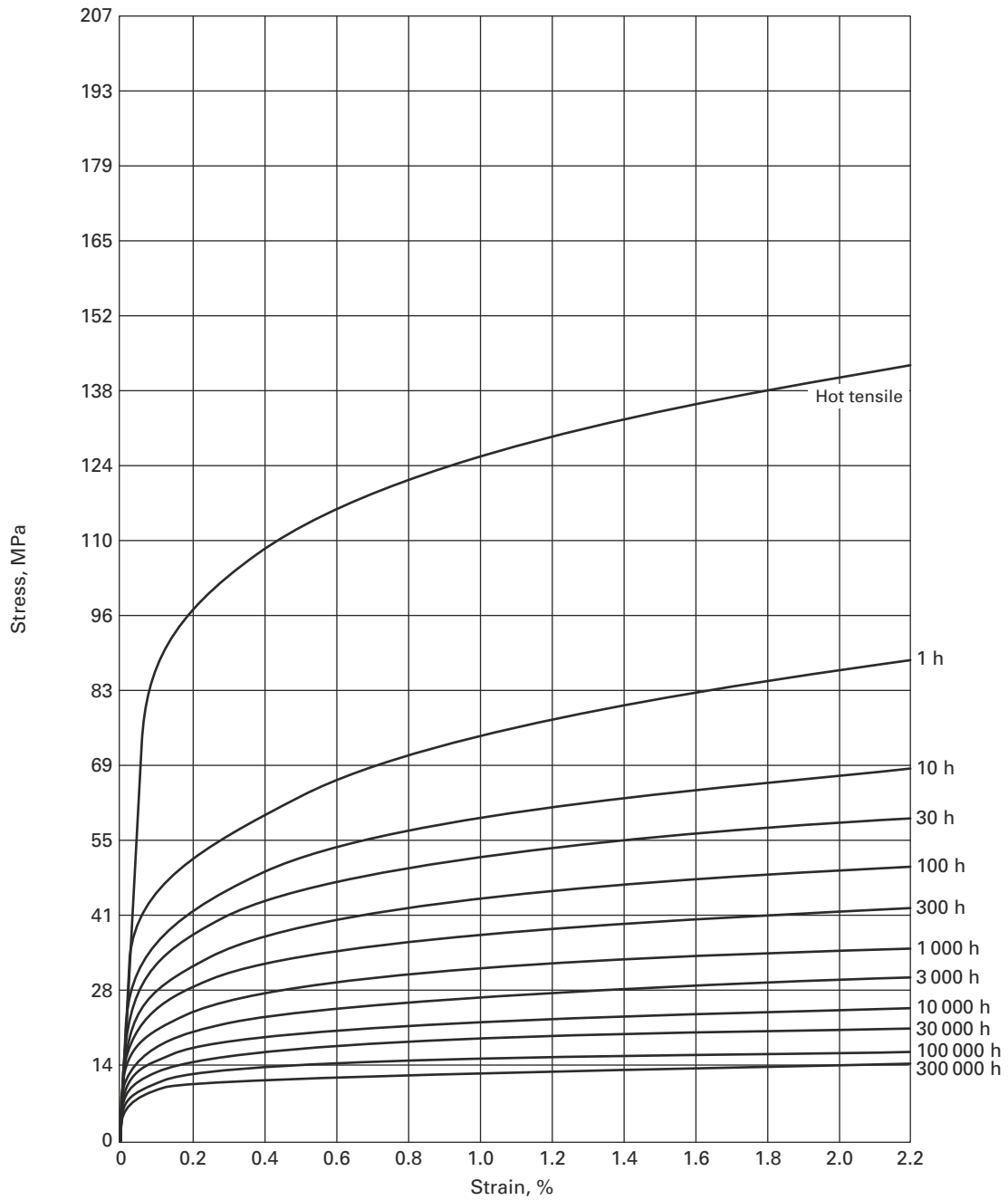


Figure E-100.19-1
Average Isochronous Stress-Strain Curves for Type 316 SS at 427°C

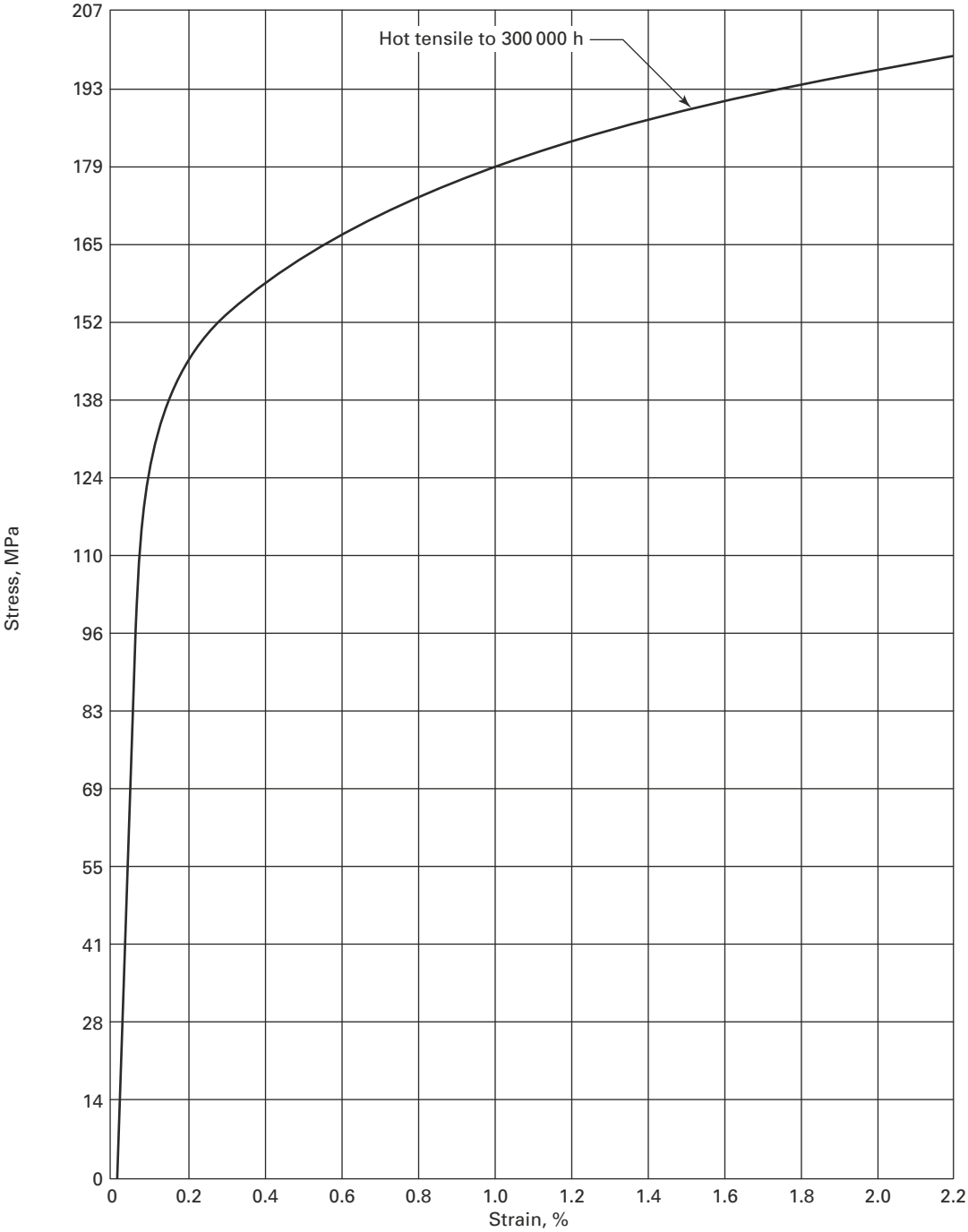


Figure E-100.19-2
Average Isochronous Stress-Strain Curves for Type 316 SS at 454°C

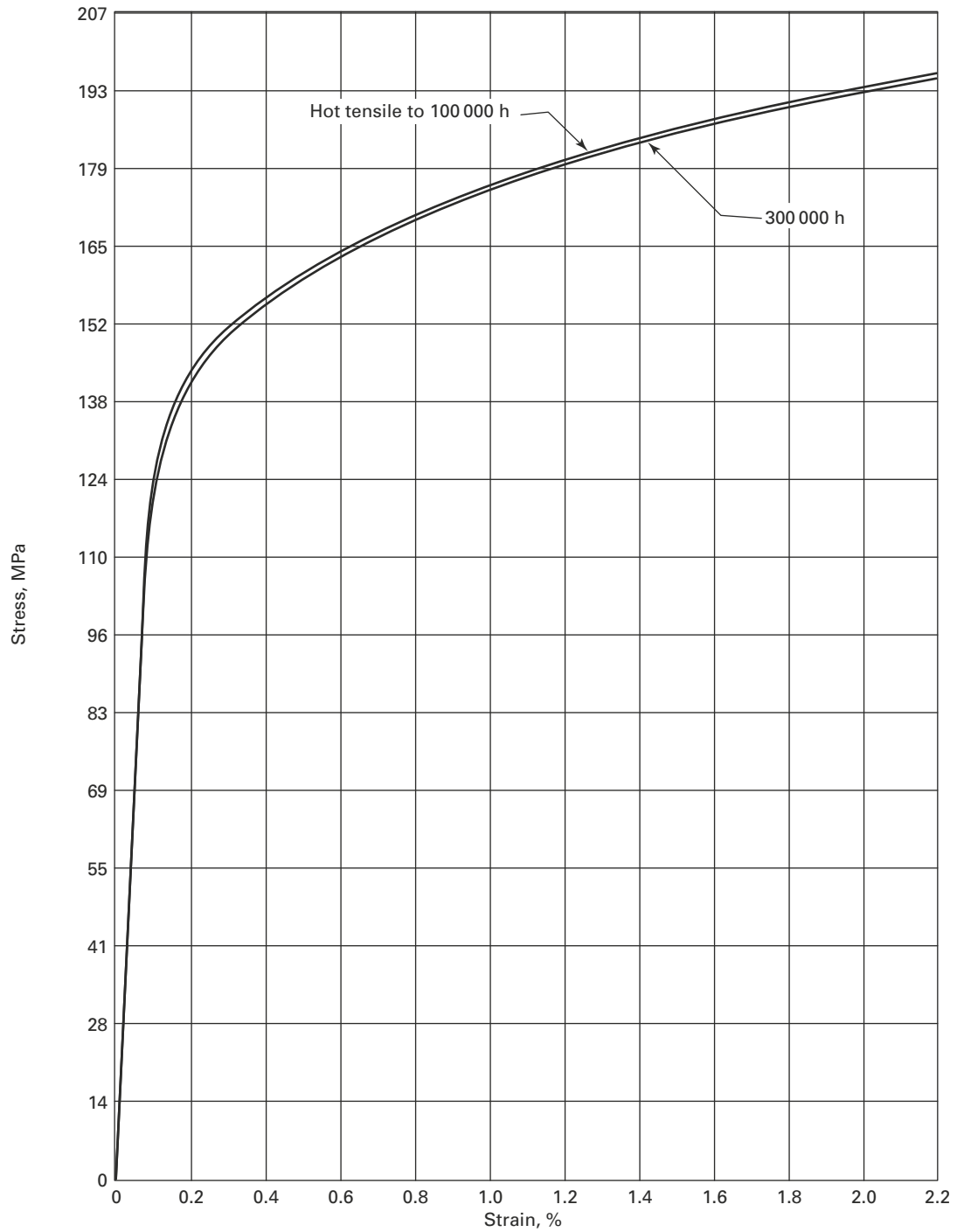


Figure E-100.19-3
Average Isochronous Stress-Strain Curves for Type 316 SS at 482°C

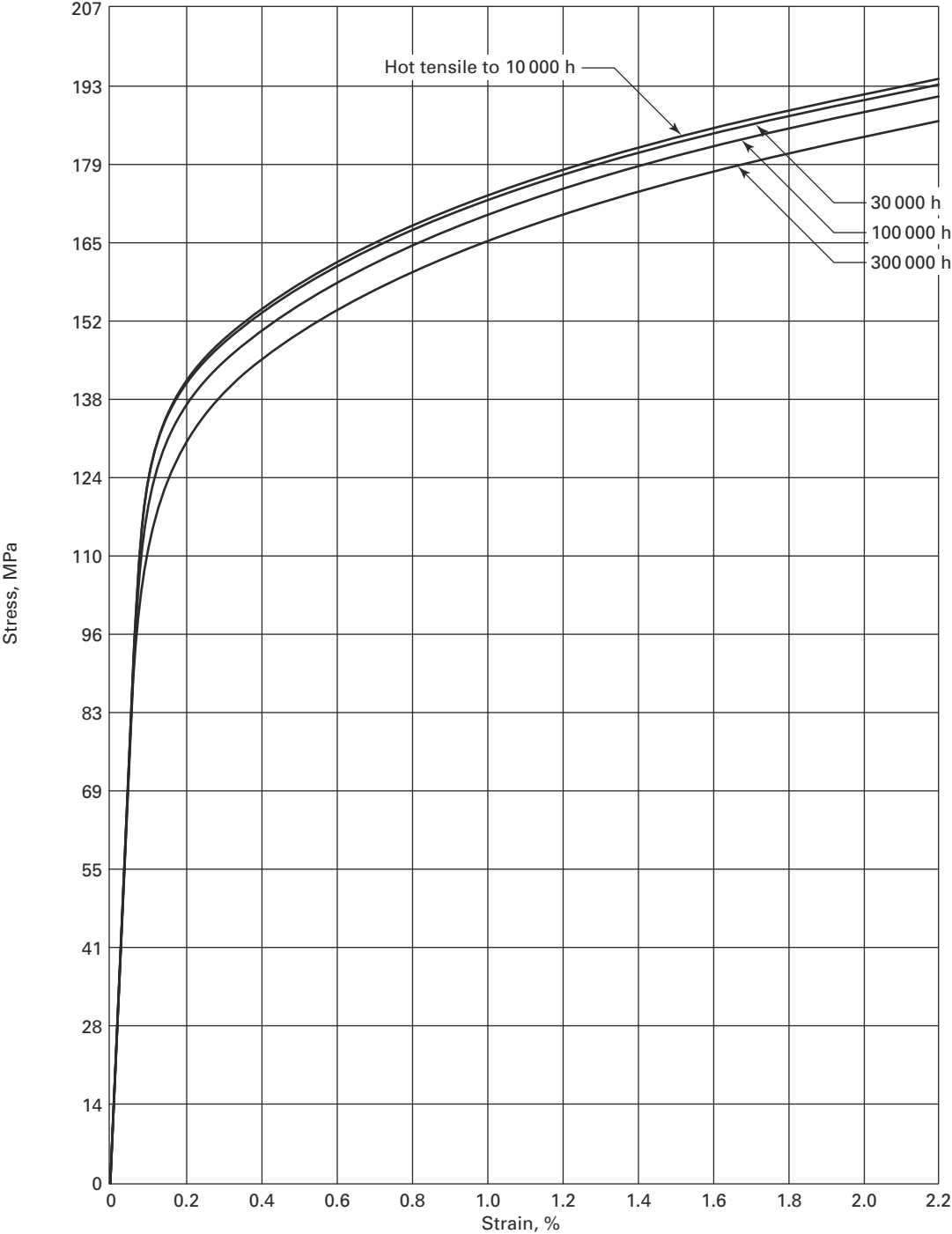


Figure E-100.19-4
Average Isochronous Stress-Strain Curves for Type 316 SS at 510°C

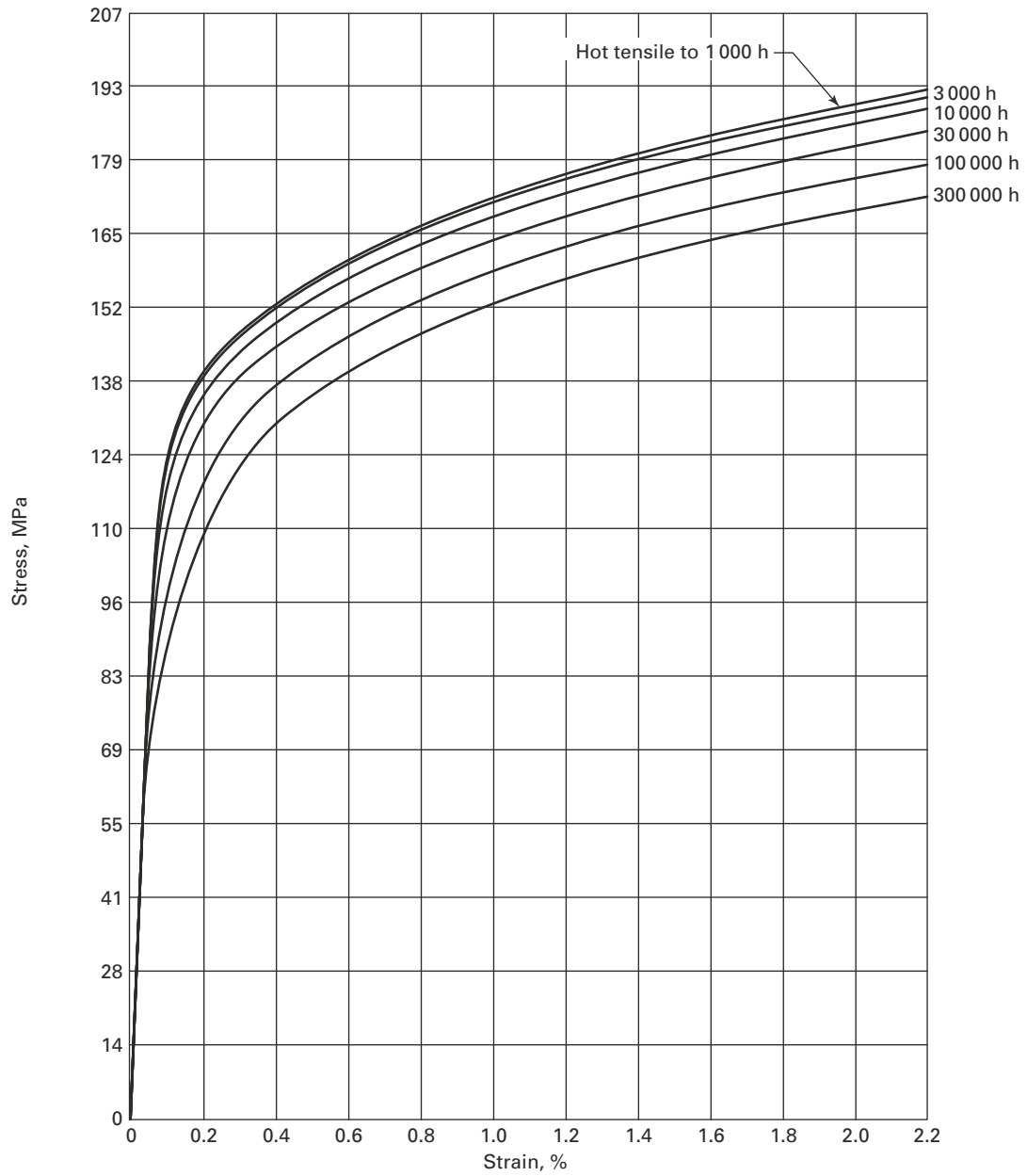


Figure E-100.19-5
Average Isochronous Stress-Strain Curves for Type 316 SS at 538°C

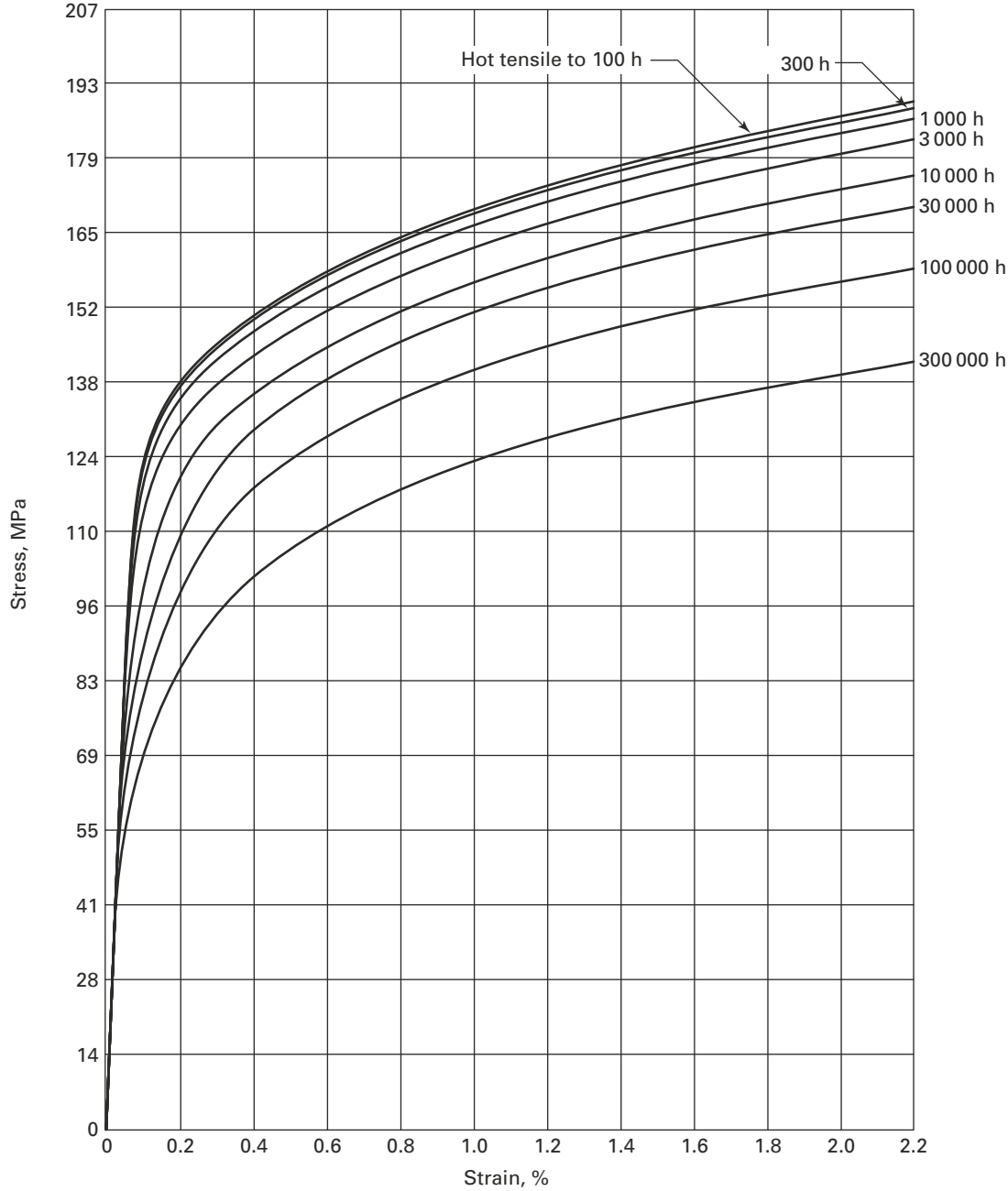


Figure E-100.19-6
Average Isochronous Stress-Strain Curves for Type 316 SS at 566°C

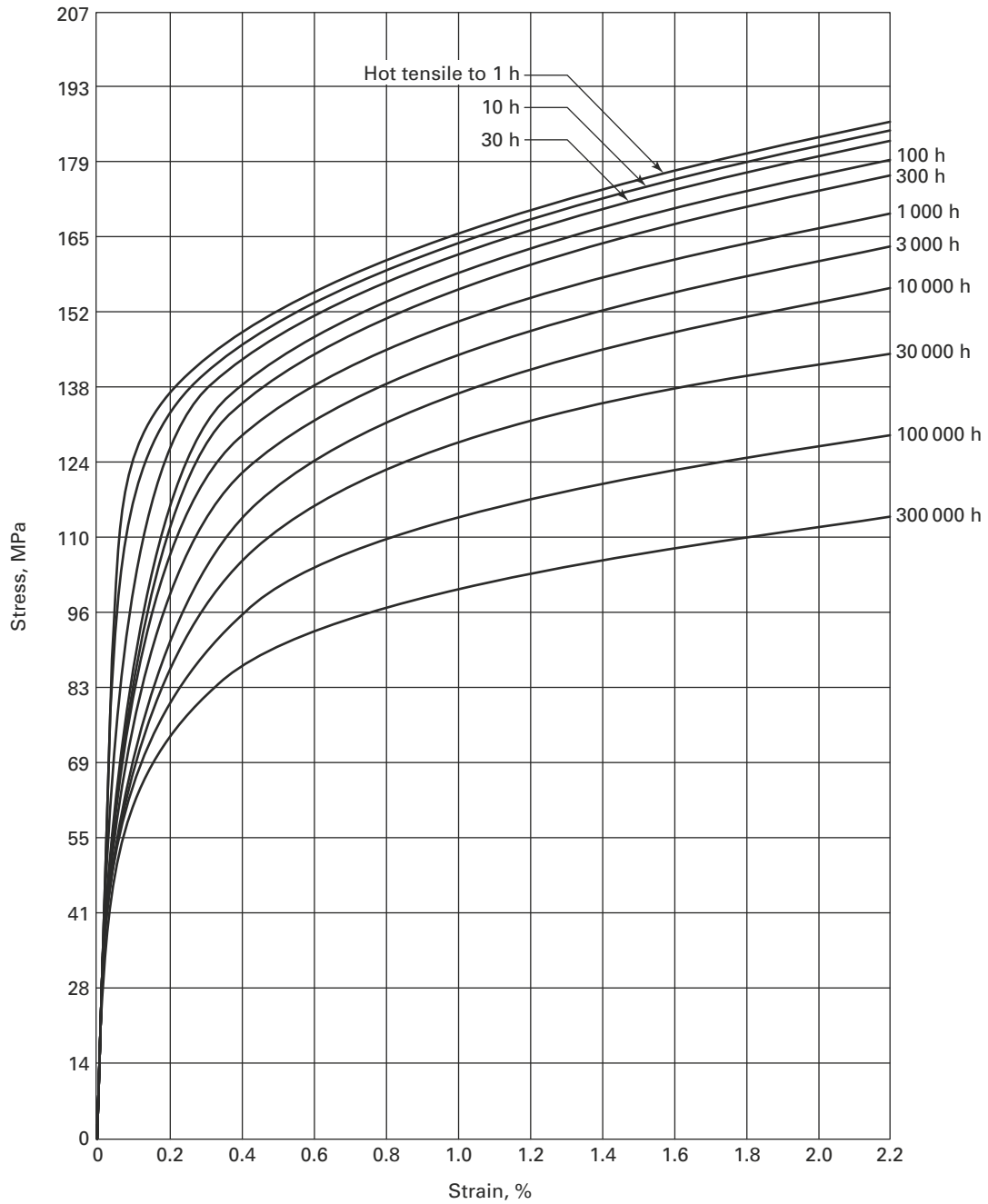


Figure E-100.19-7
Average Isochronous Stress-Strain Curves for Type 316 SS at 593°C

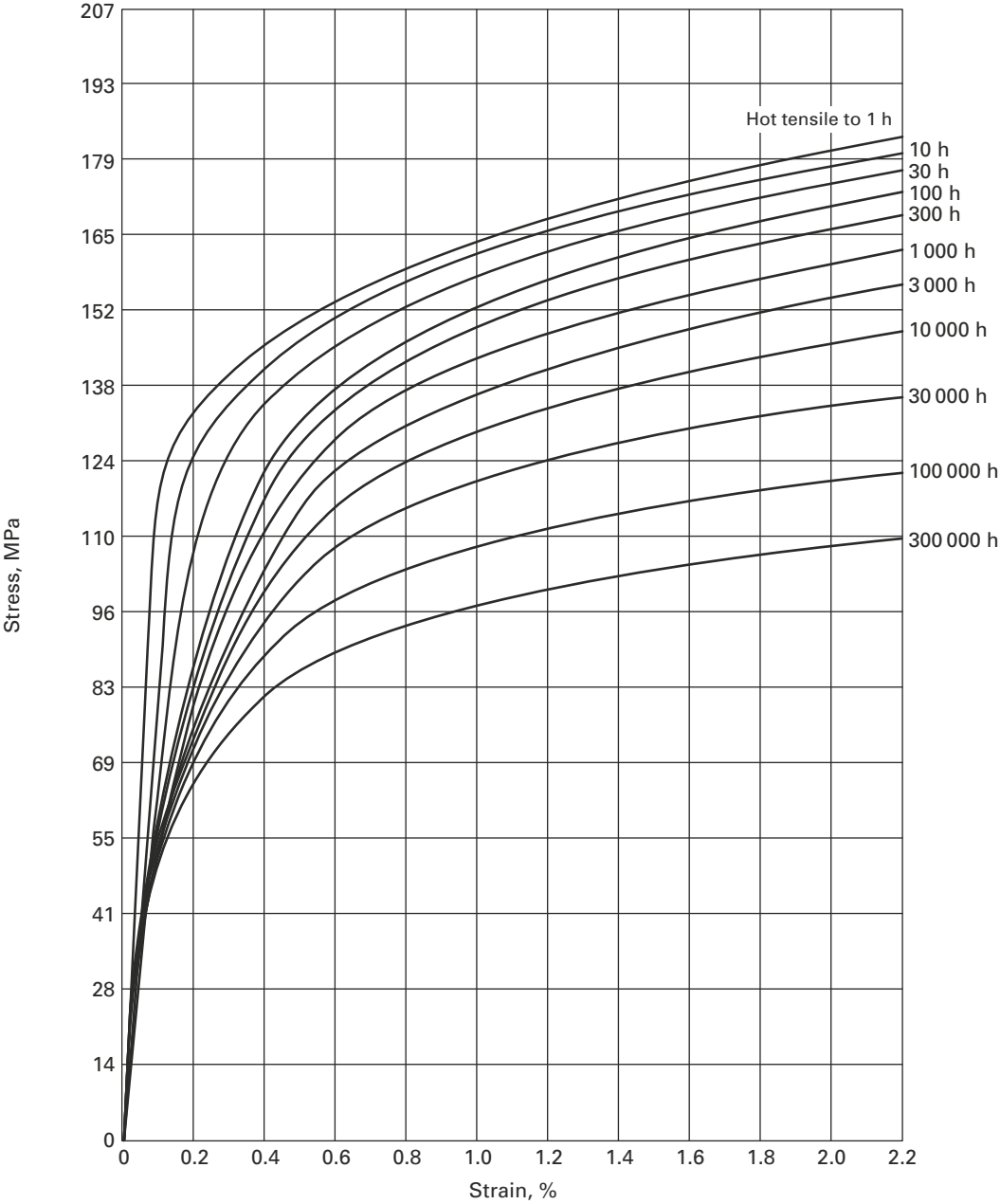


Figure E-100.19-8
Average Isochronous Stress-Strain Curves for Type 316 SS at 621°C

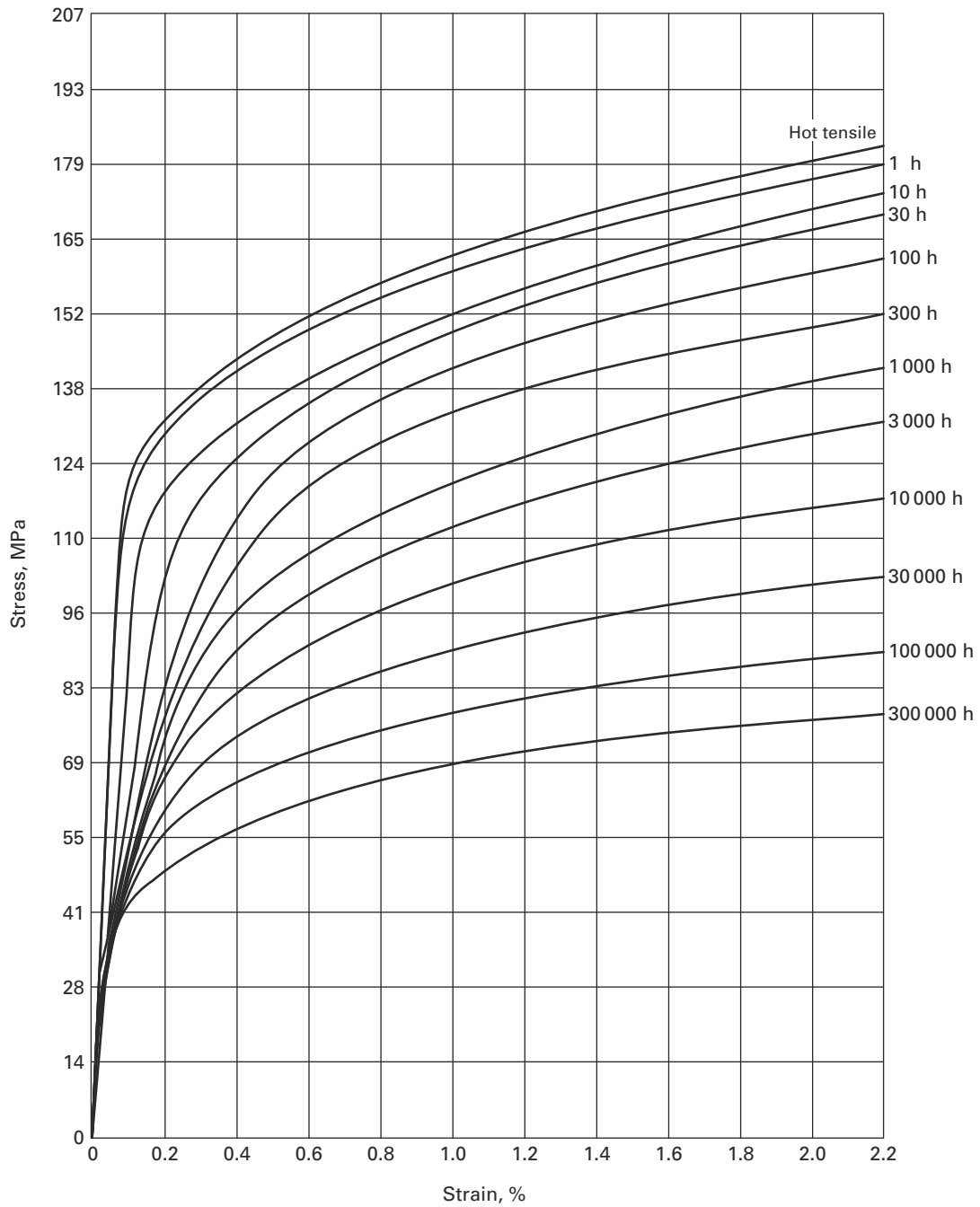


Figure E-100.19-9
Average Isochronous Stress-Strain Curves for Type 316 SS at 649°C

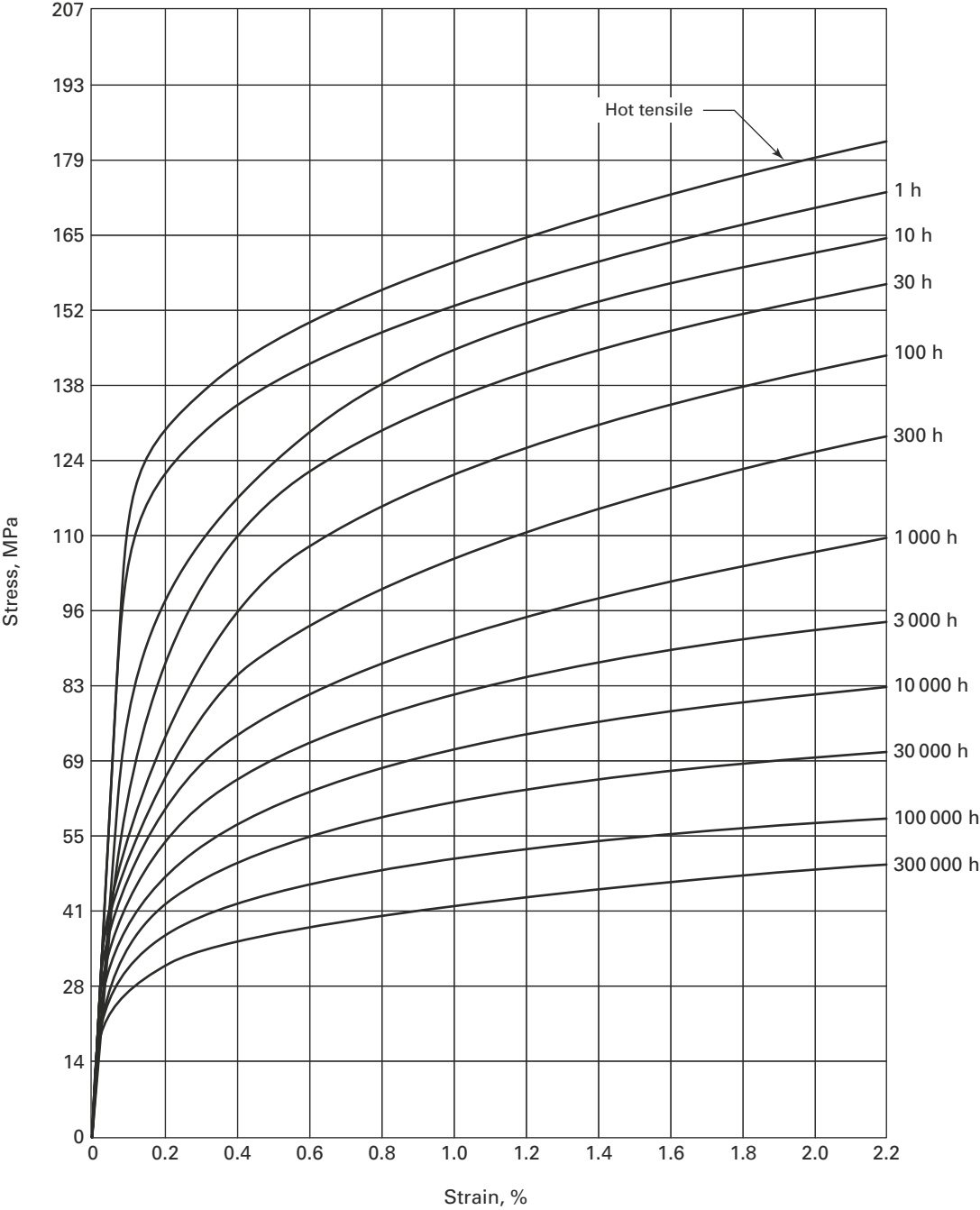


Figure E-100.19-10
Average Isochronous Stress-Strain Curves for Type 316 SS at 677°C

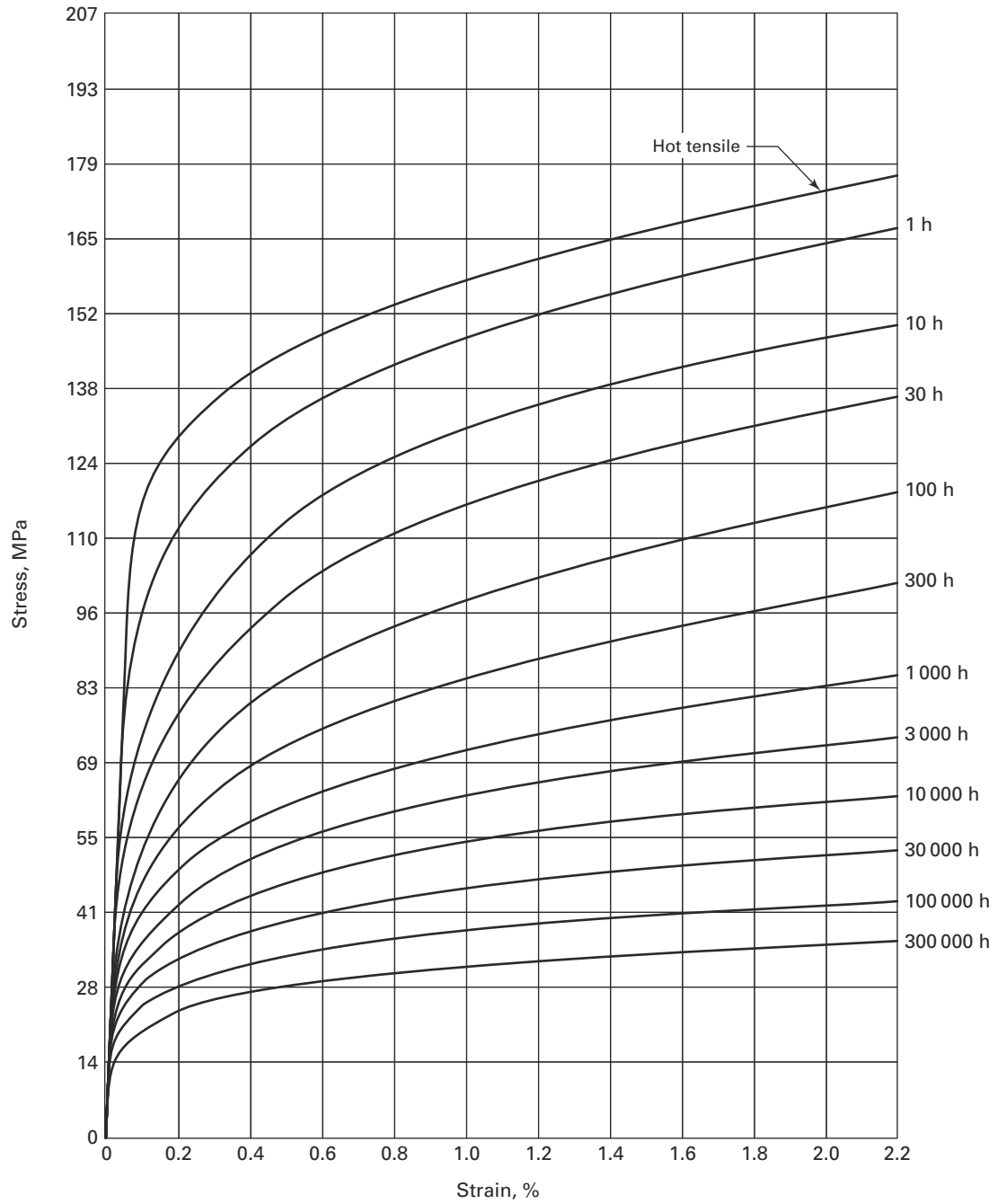


Figure E-100.19-11
Average Isochronous Stress-Strain Curves for Type 316 SS at 704°C

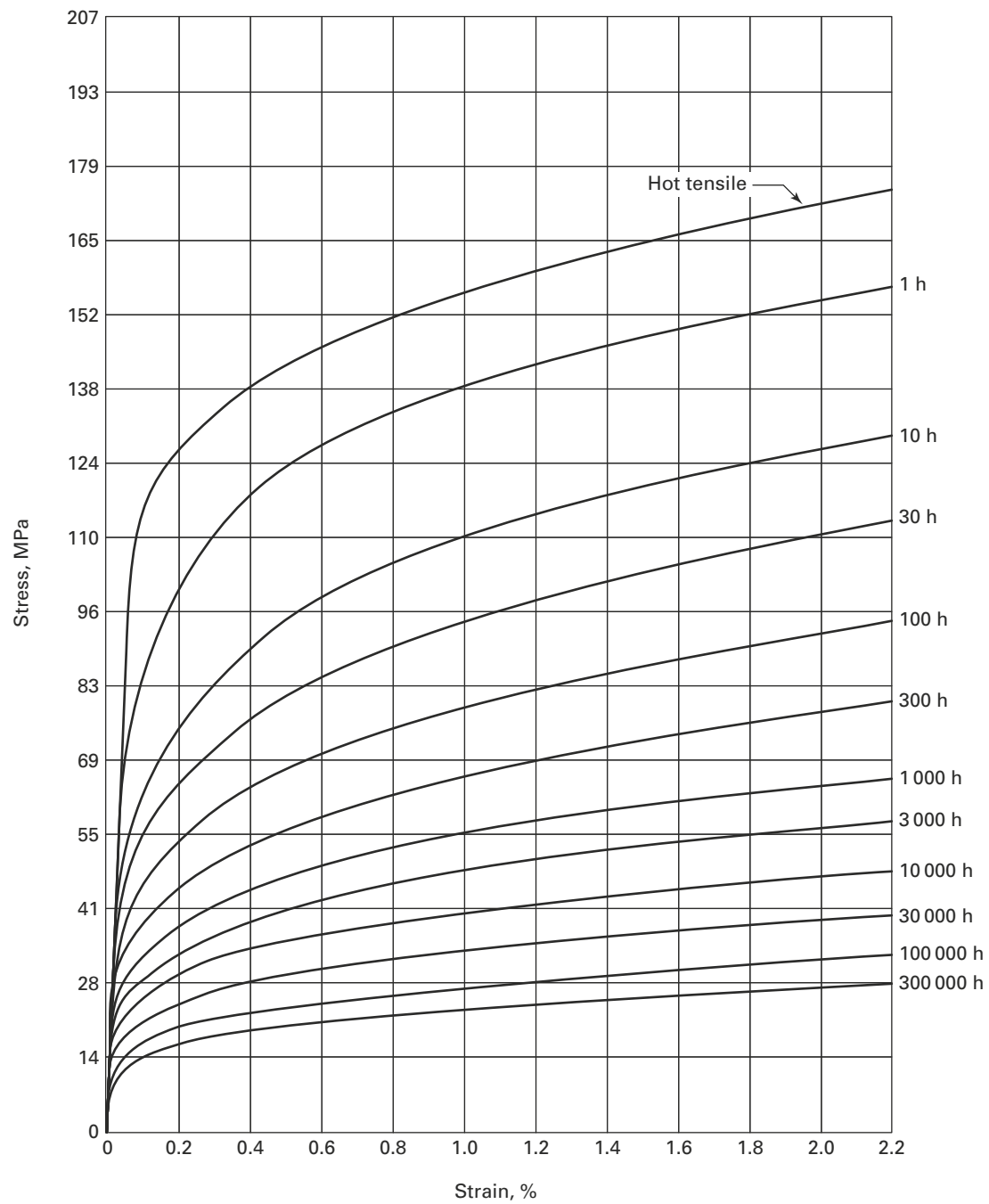


Figure E-100.19-12
Average Isochronous Stress-Strain Curves for Type 316 SS at 732°C

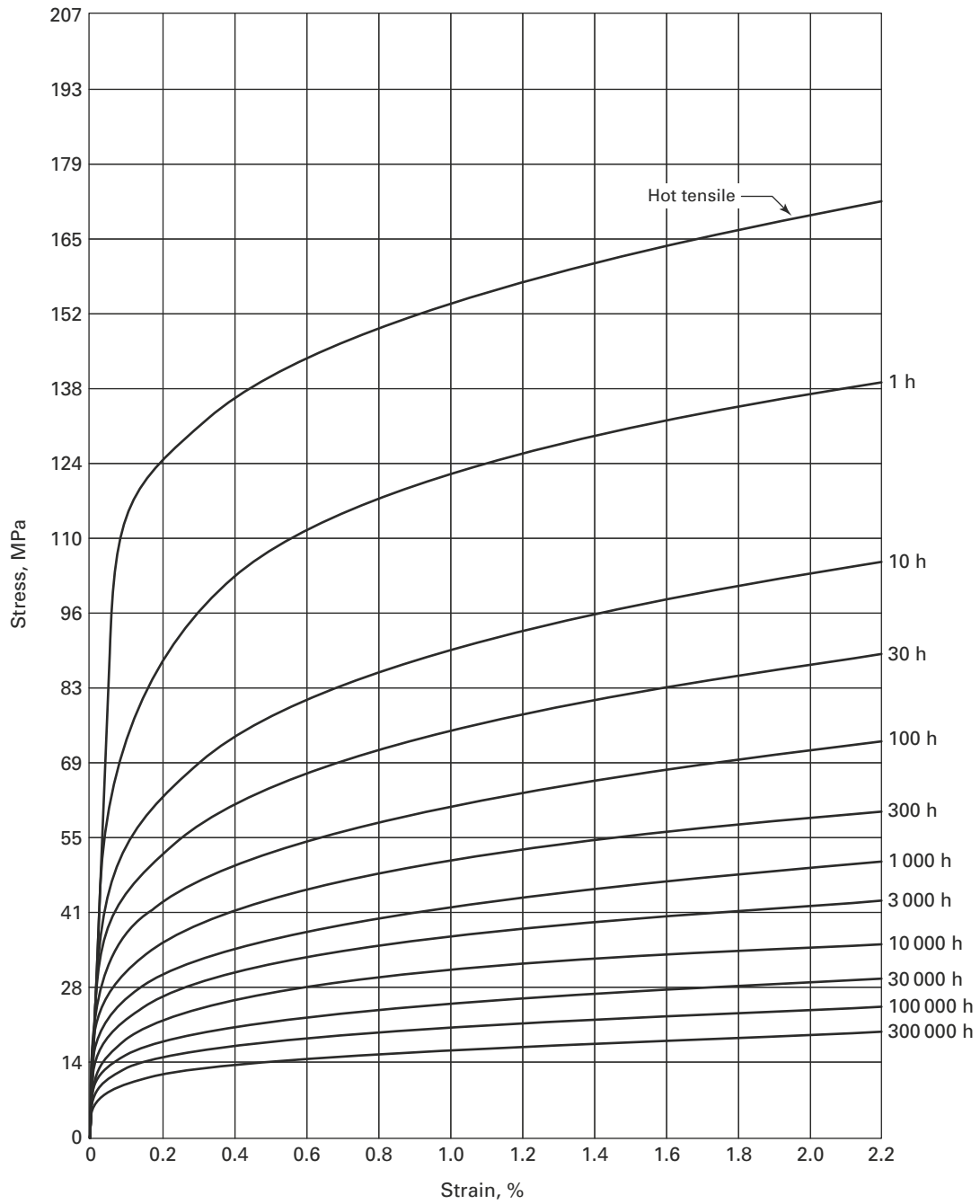


Figure E-100.19-13
Average Isochronous Stress-Strain Curves for Type 316 SS at 760°C

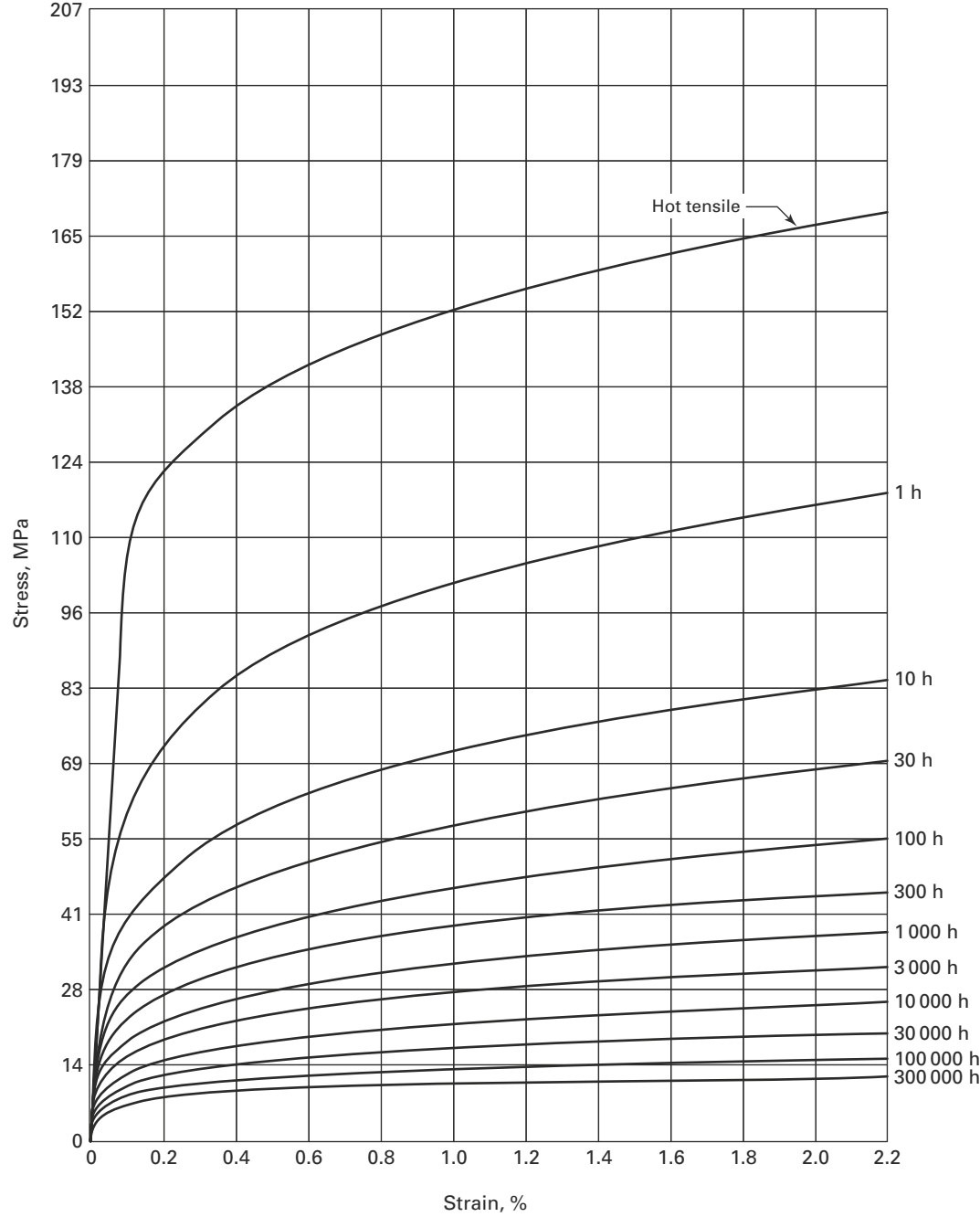


Figure E-100.19-14
Average Isochronous Stress-Strain Curves for Type 316 SS at 788°C

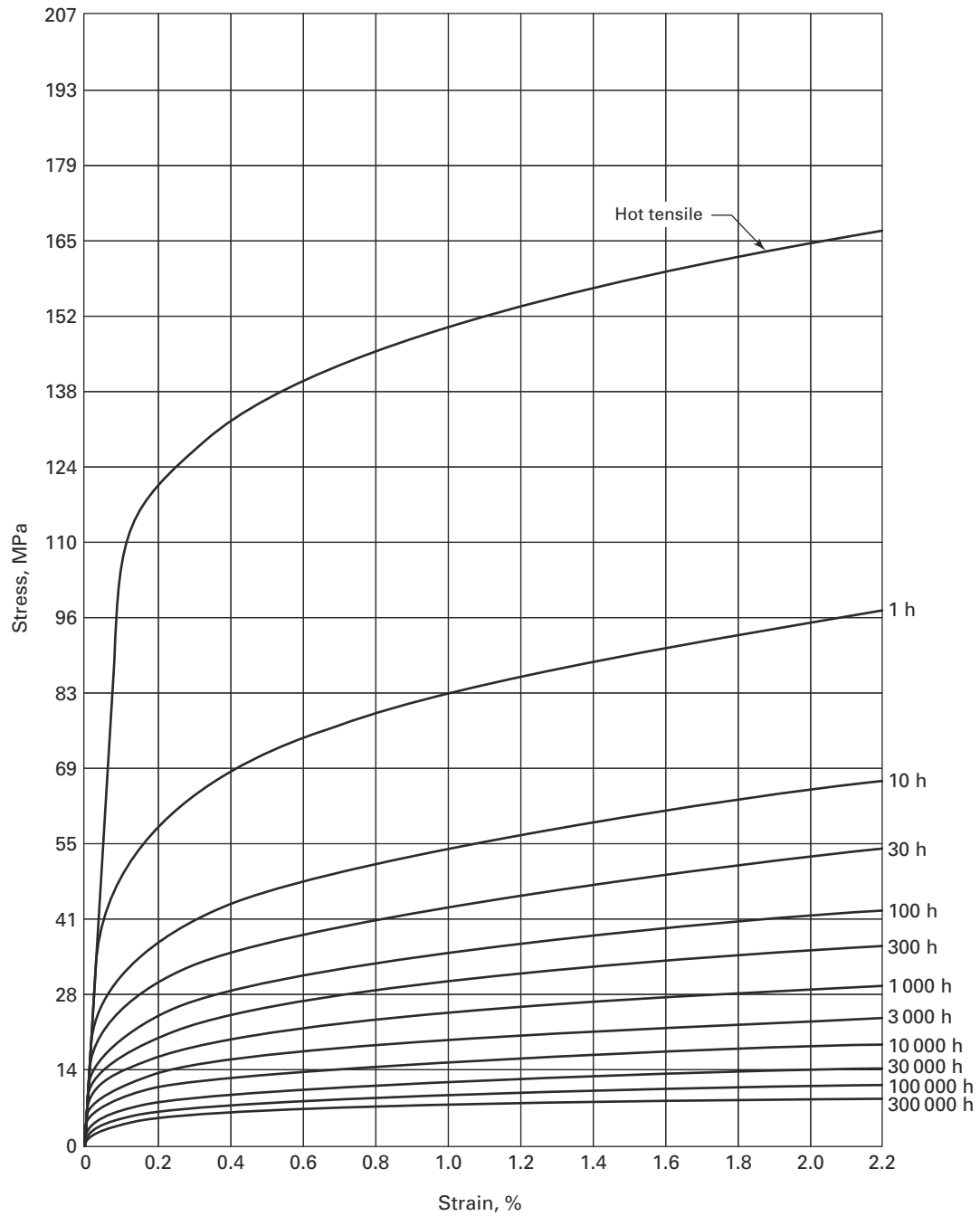


Figure E-100.19-15
Average Isochronous Stress-Strain Curves for Type 316 SS at 816°C

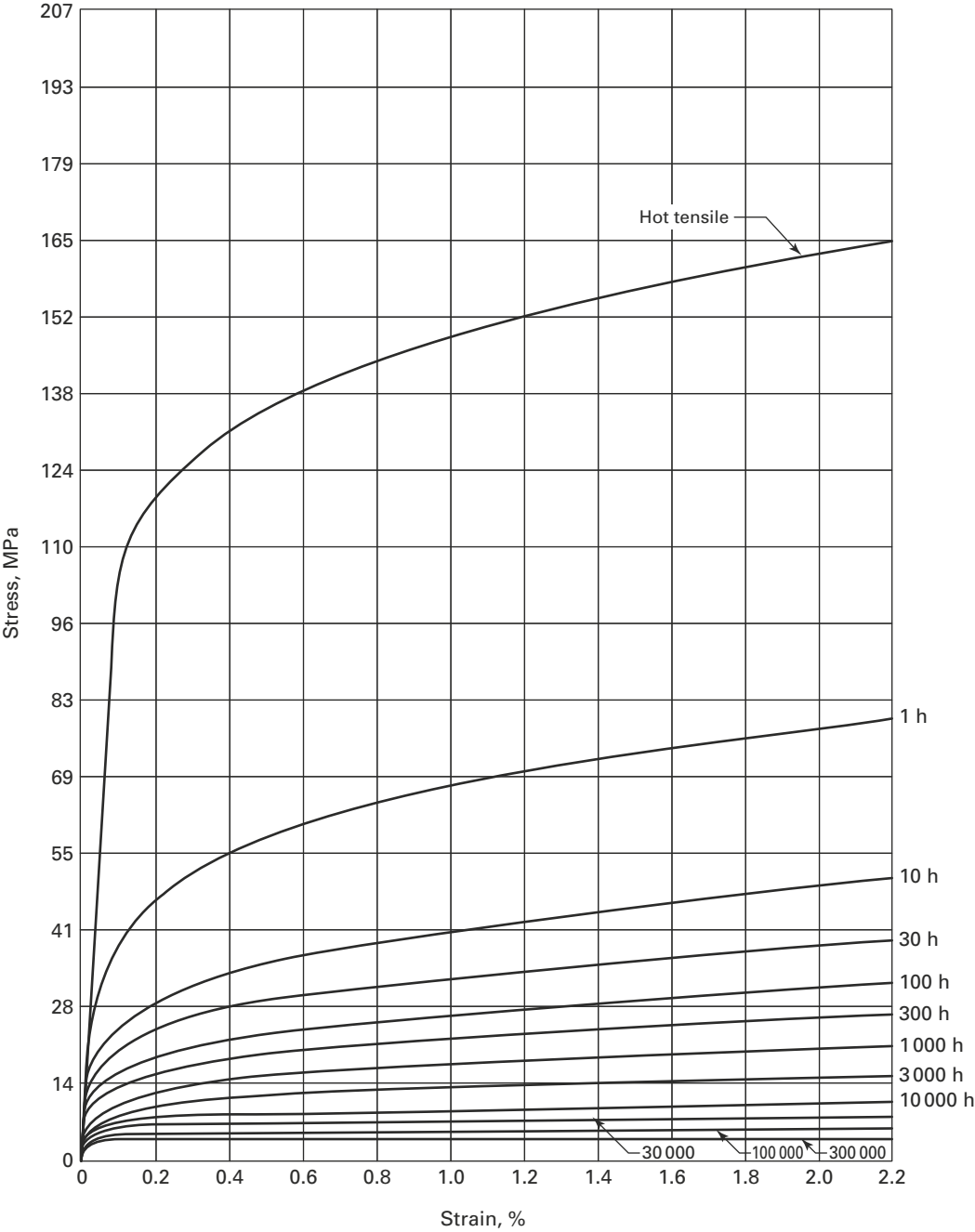


Figure E-100.20-1
Average Isochronous Stress-Strain Curves for Alloy 800H at 427°C and 454°C

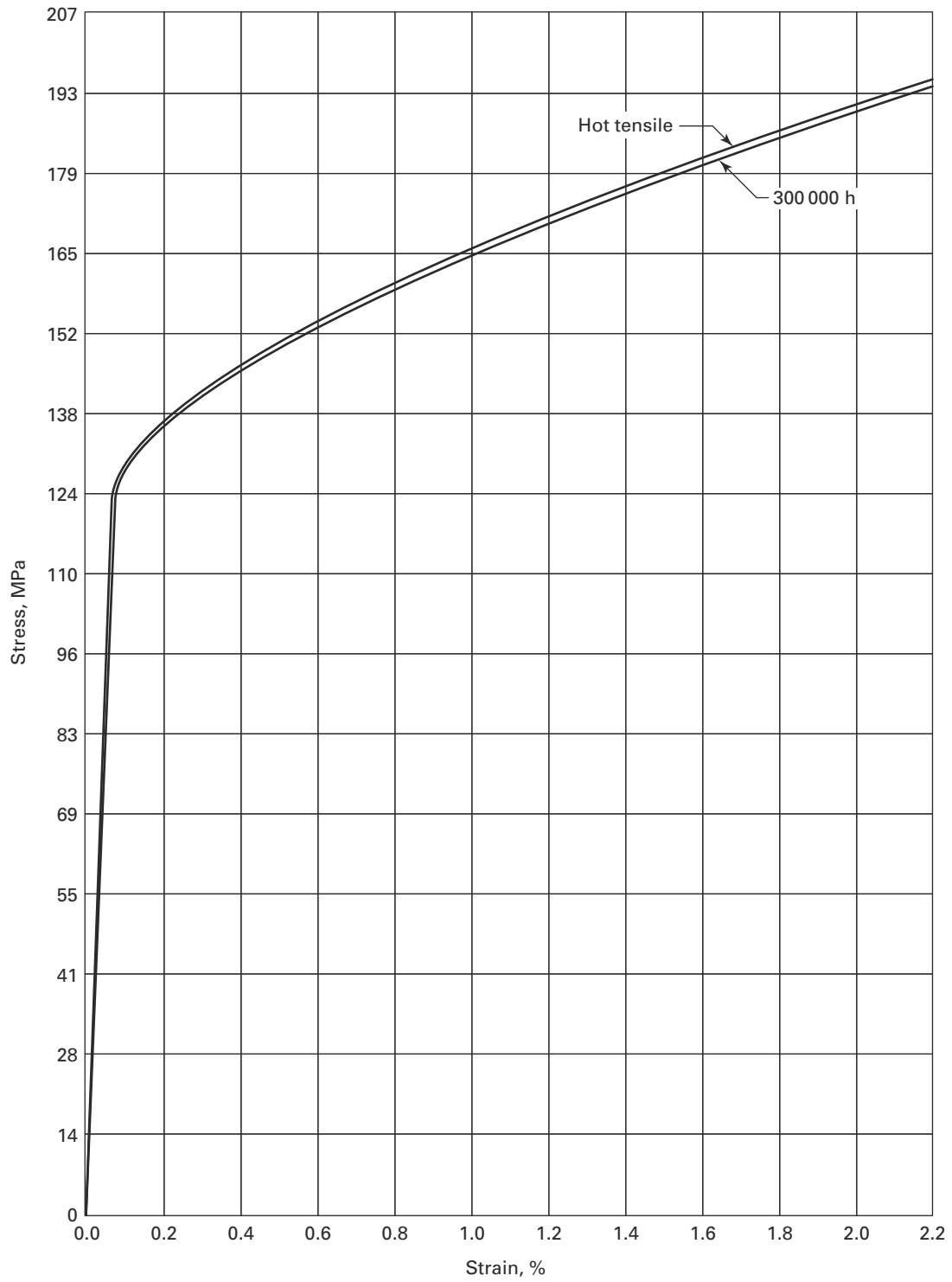


Figure E-100.20-2
Average Isochronous Stress–Strain Curves for Alloy 800H at 482°C

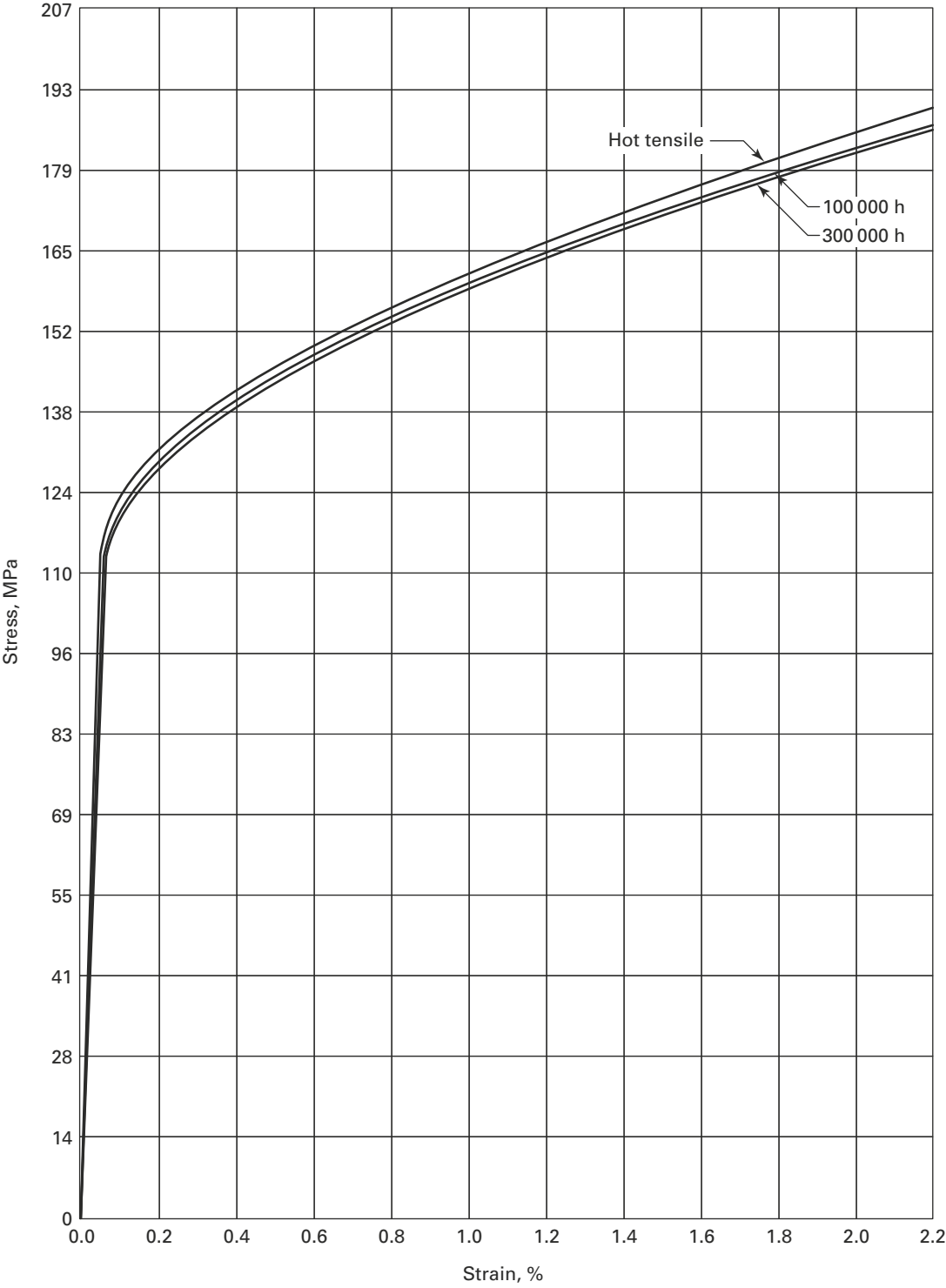


Figure E-100.20-3
Average Isochronous Stress-Strain Curves for Alloy 800H at 510°C

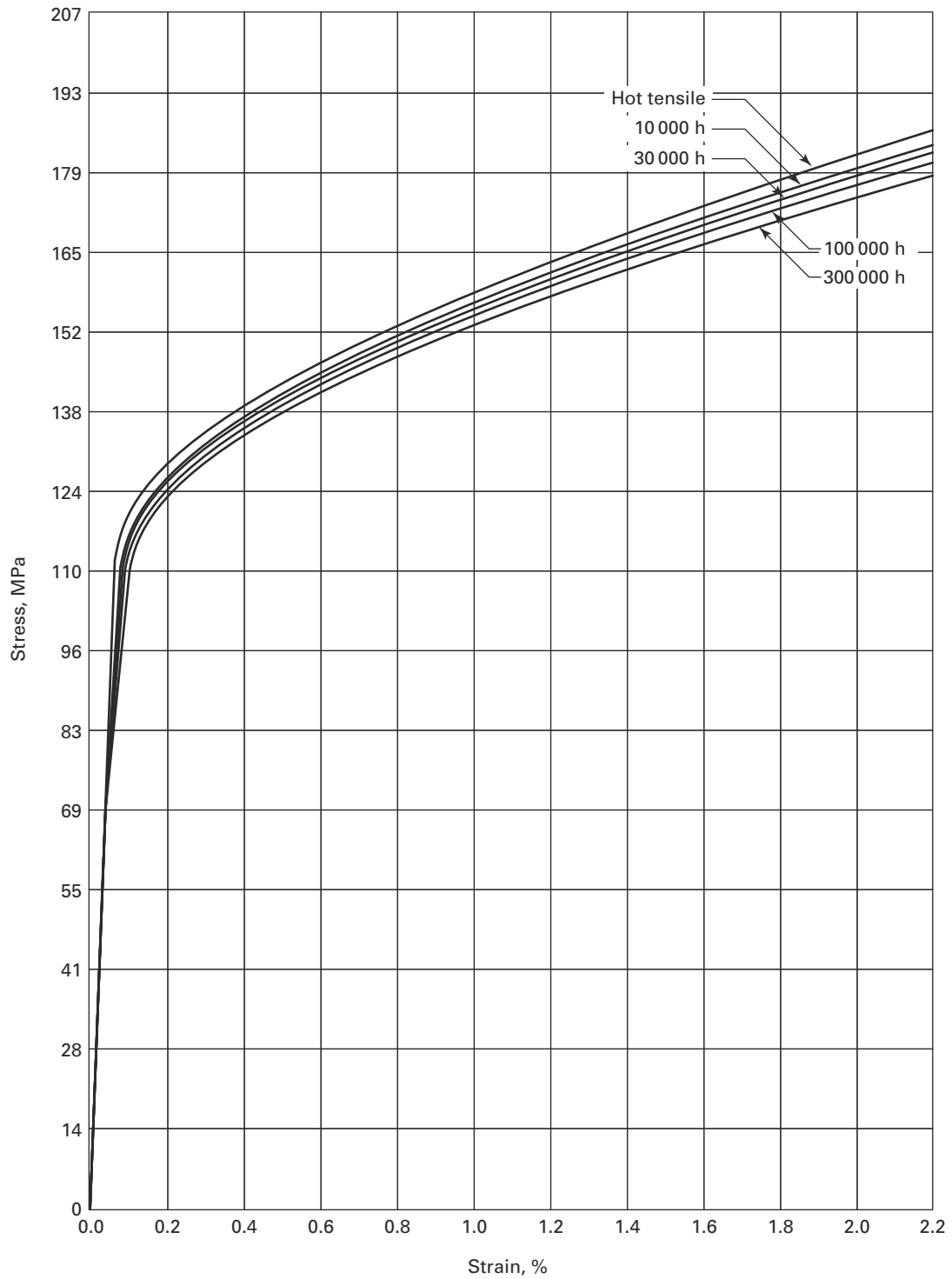


Figure E-100.20-4
Average Isochronous Stress–Strain Curves for Alloy 800H at 538°C

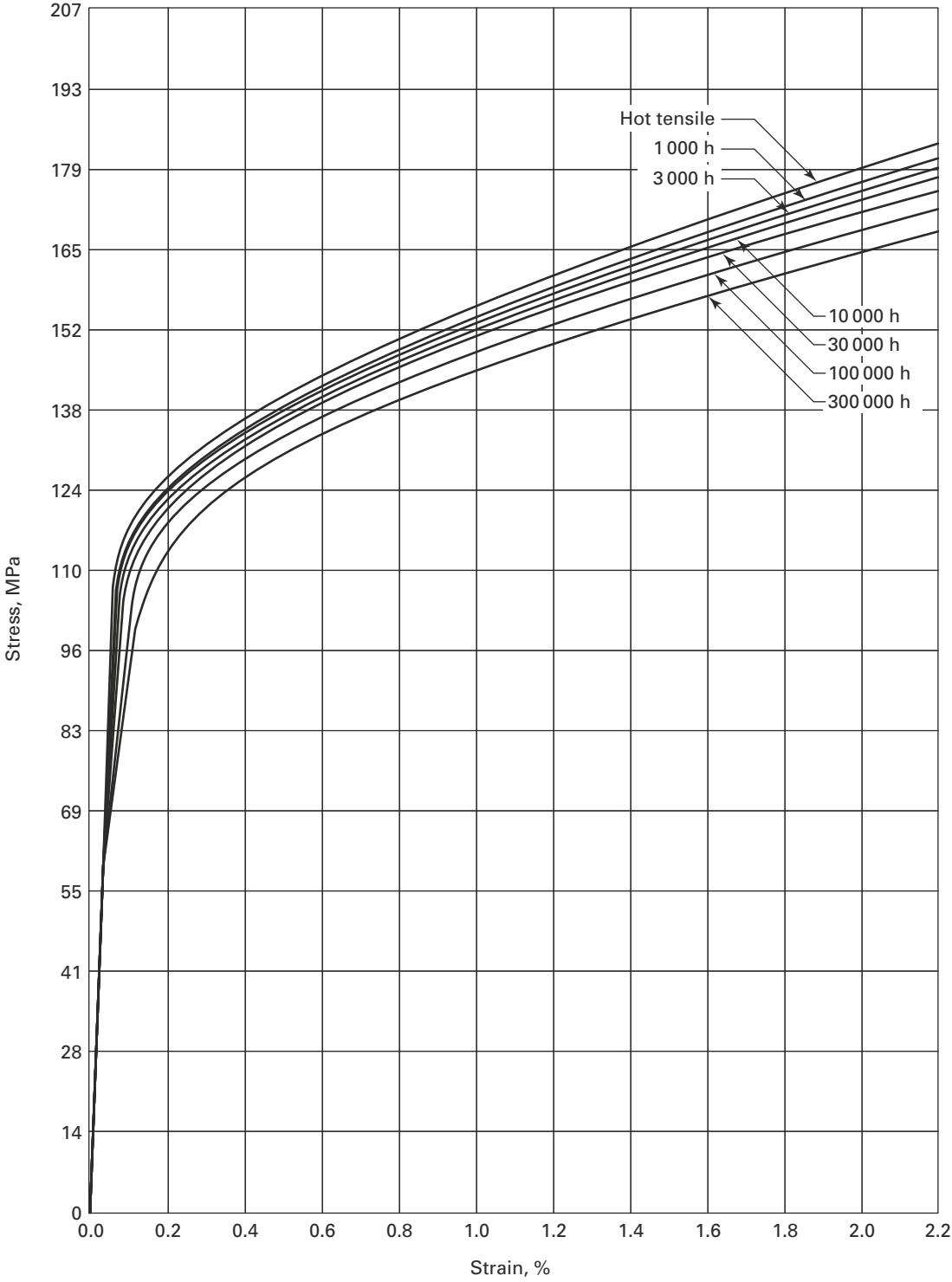


Figure E-100.20-5
Average Isochronous Stress-Strain Curves for Alloy 800H at 566°C

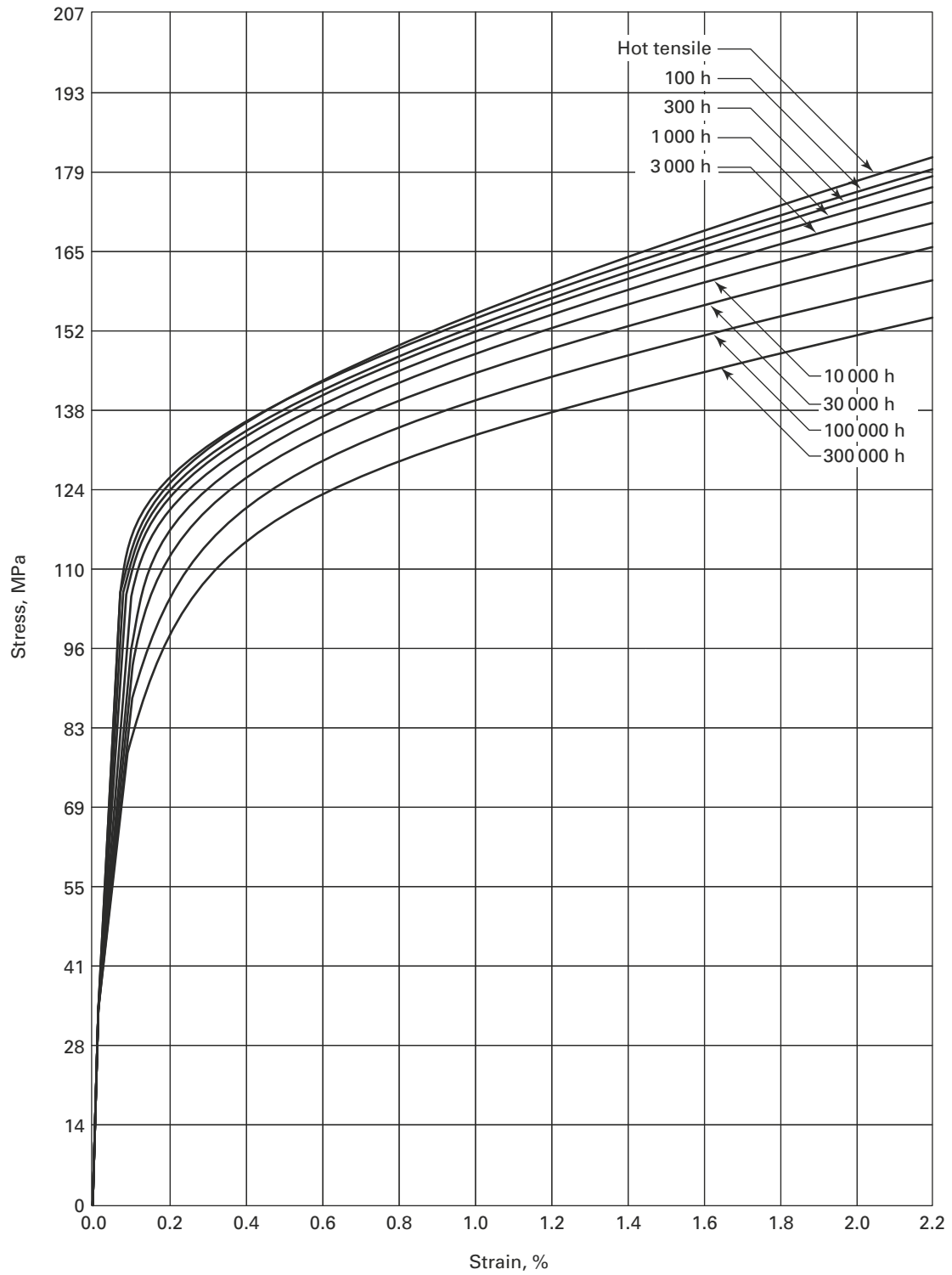


Figure E-100.20-6
Average Isochronous Stress–Strain Curves for Alloy 800H at 593°C

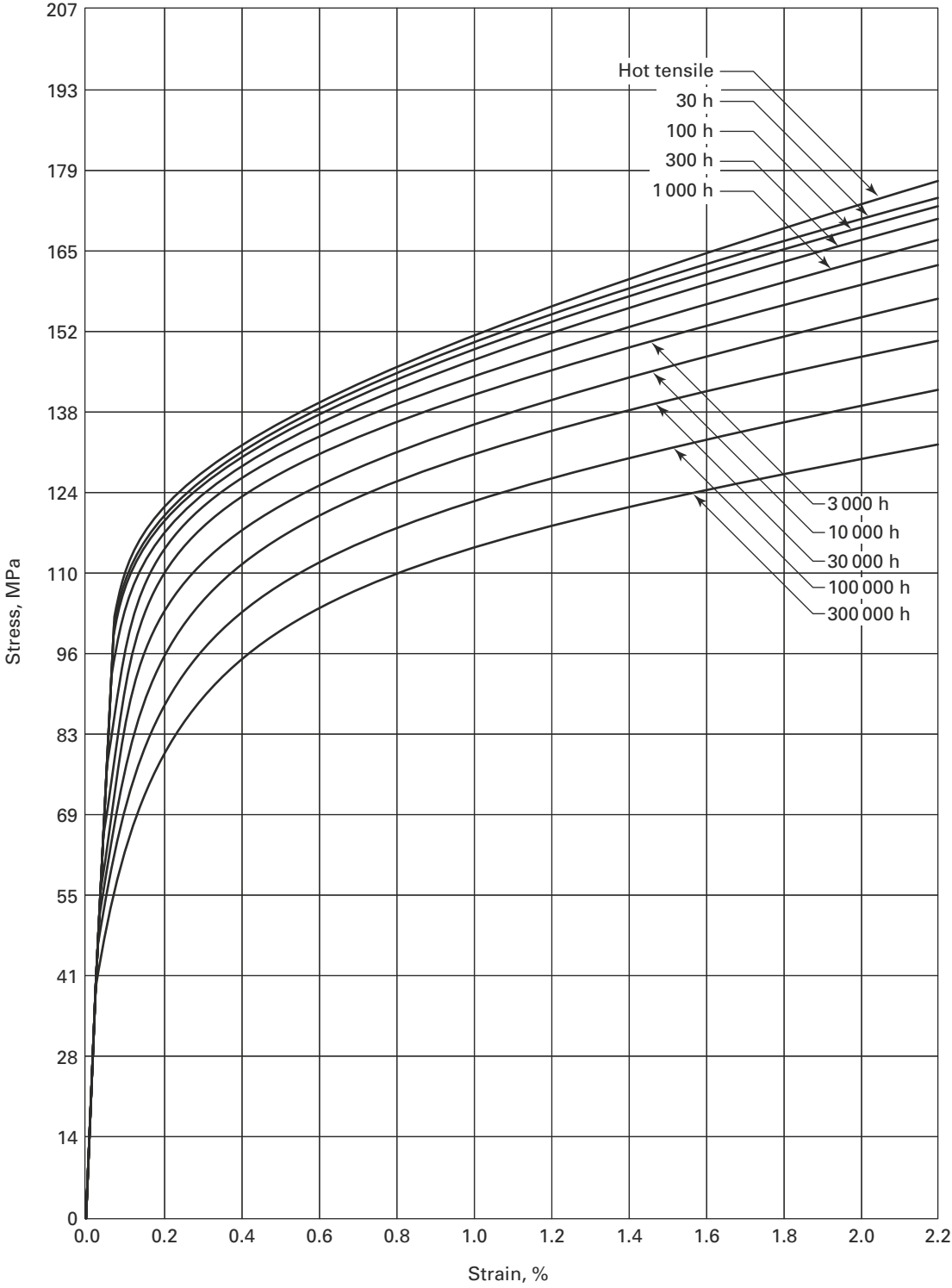


Figure E-100.20-7
Average Isochronous Stress-Strain Curves for Alloy 800H at 621°C

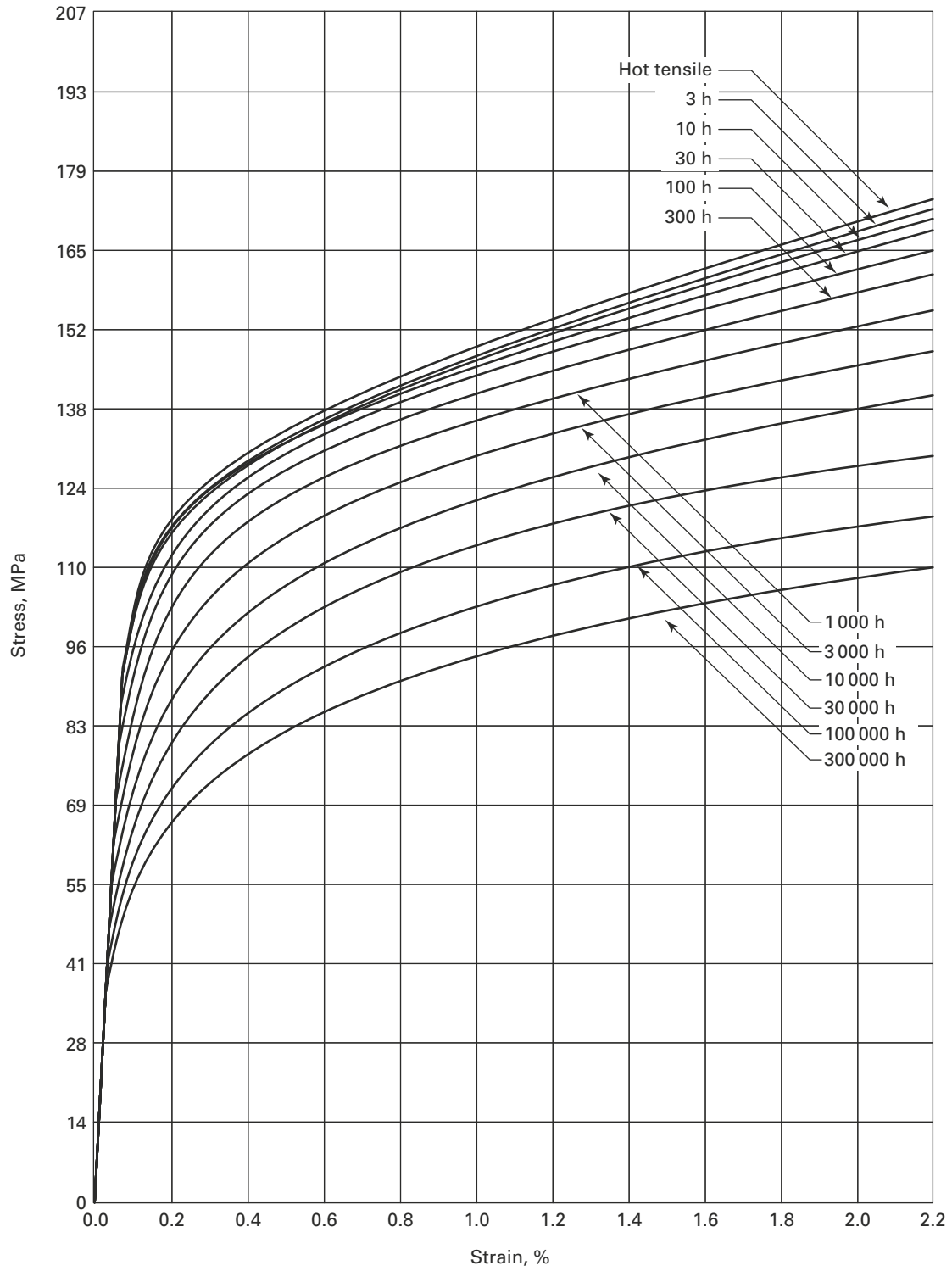


Figure E-100.20-8
Average Isochronous Stress-Strain Curves for Alloy 800H at 649°C

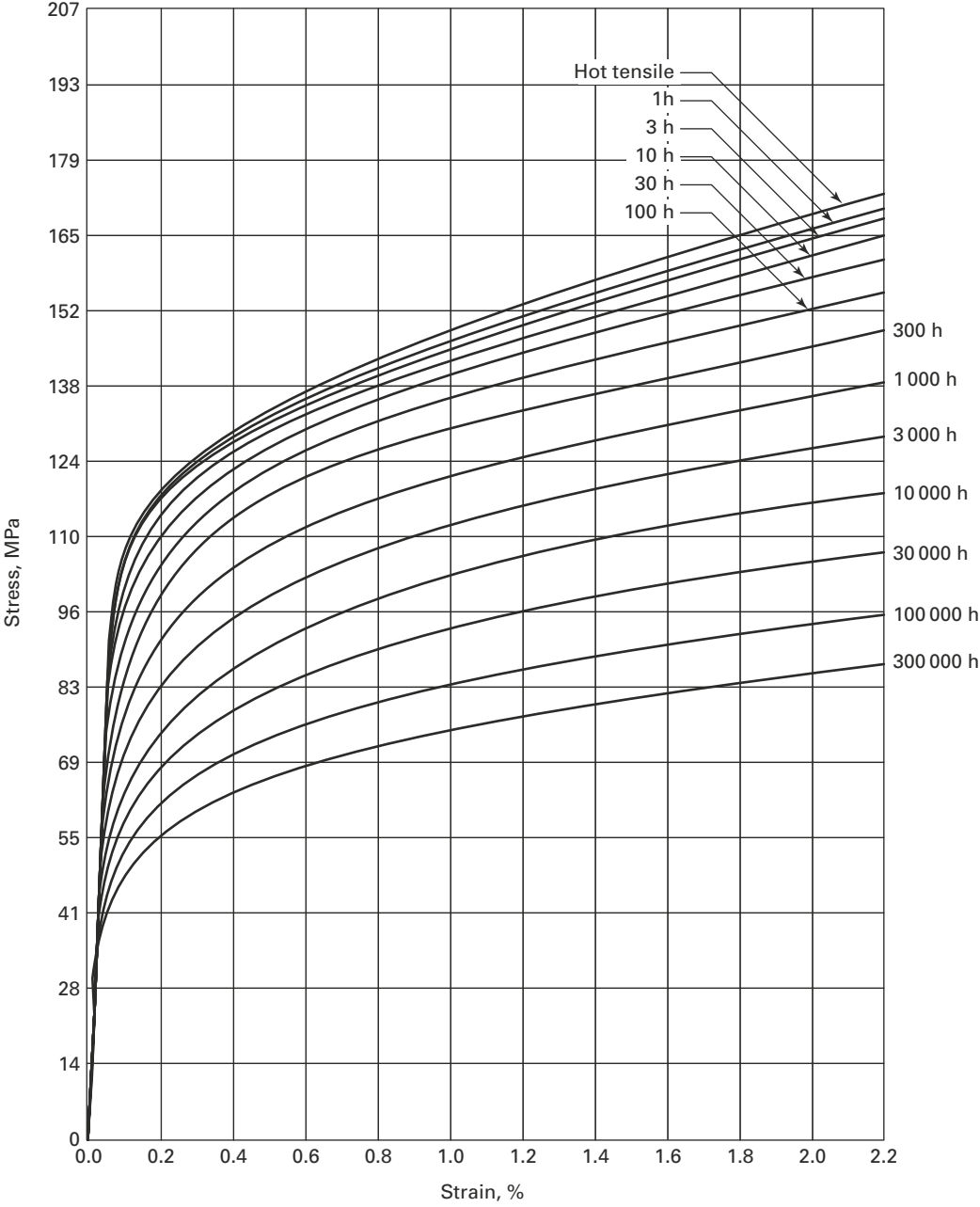


Figure E-100.20-9
Average Isochronous Stress-Strain Curves for Alloy 800H at 677°C

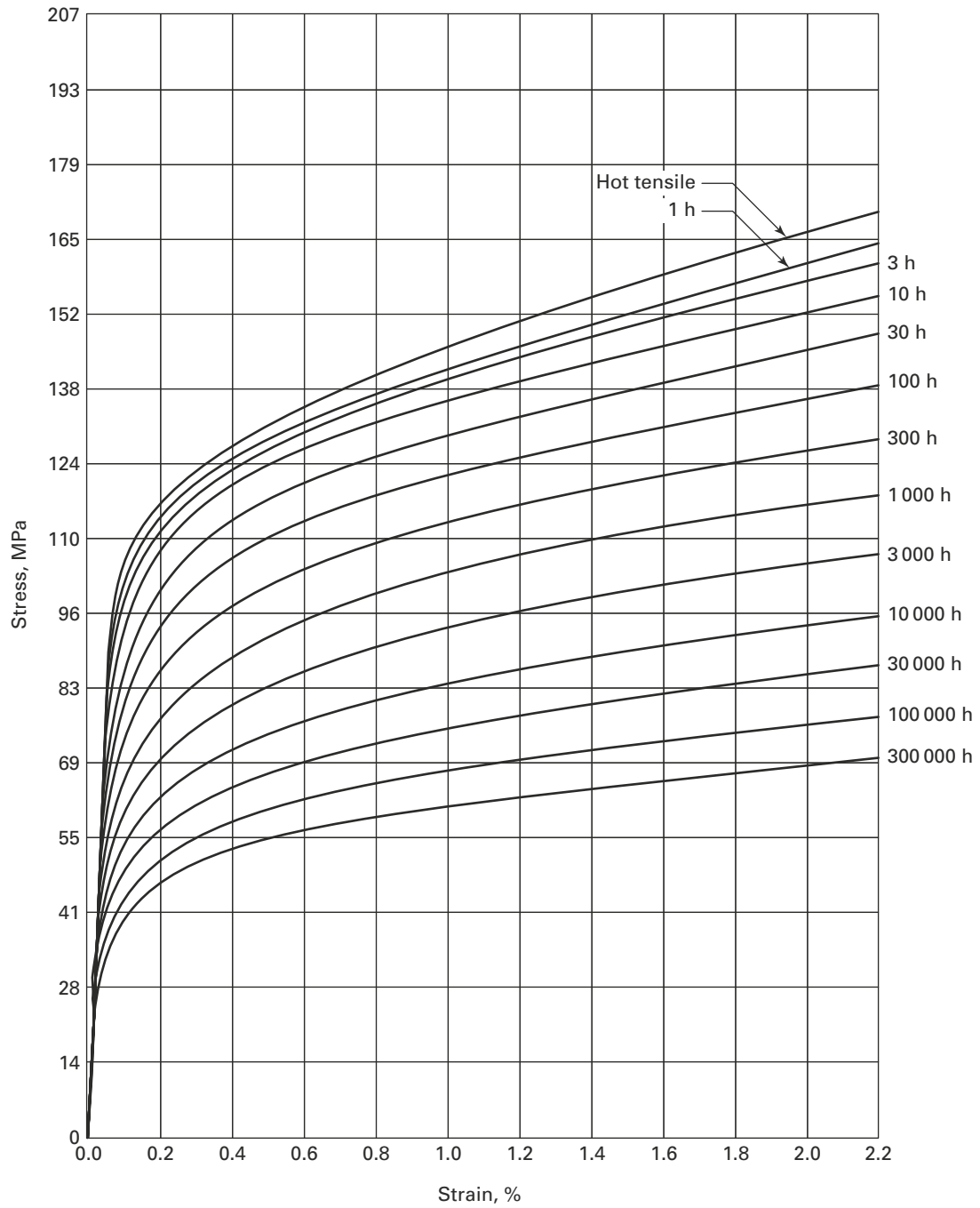


Figure E-100.20-10
Average Isochronous Stress–Strain Curves for Alloy 800H at 704°C

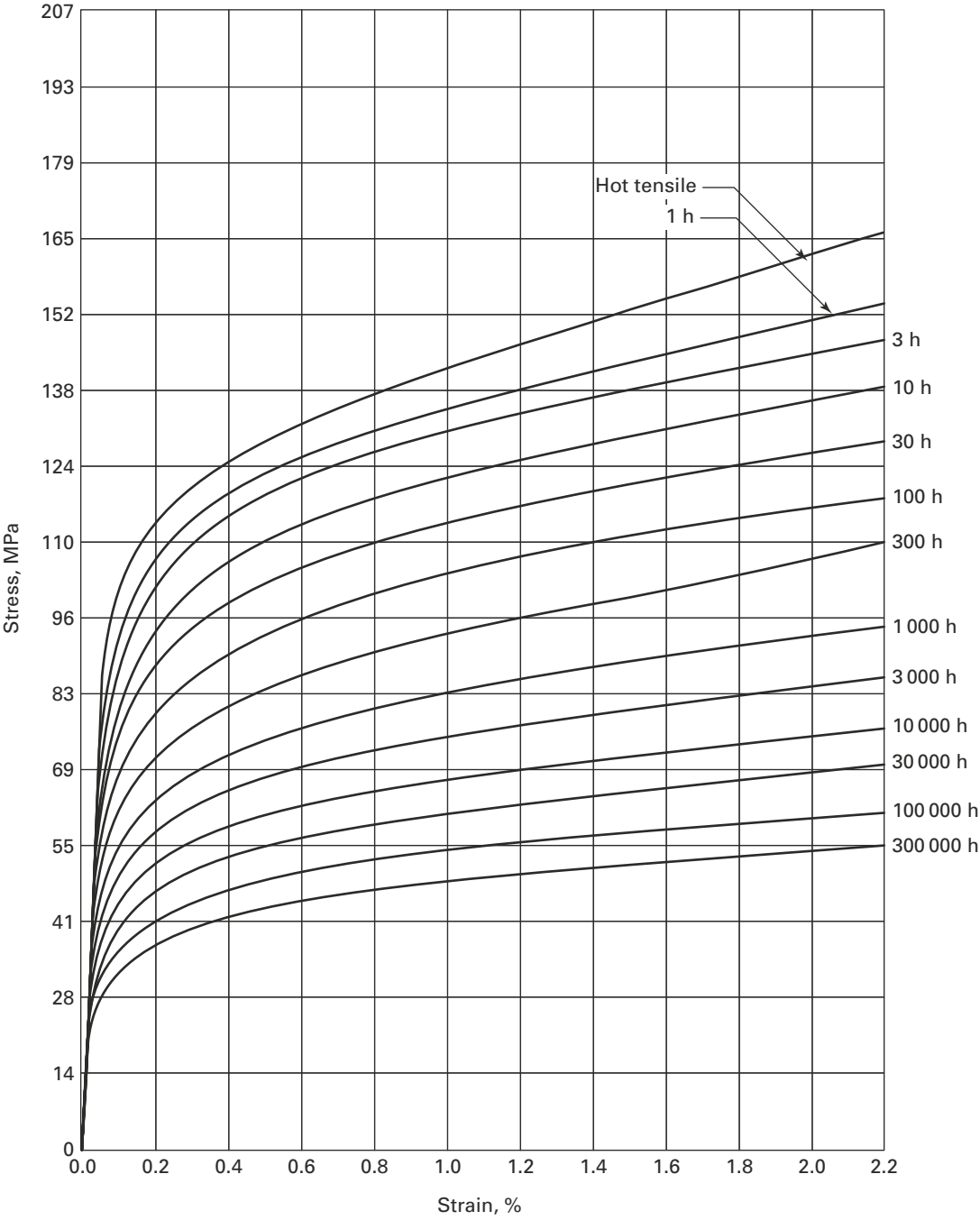


Figure E-100.20-11
Average Isochronous Stress-Strain Curves for Alloy 800H at 732°C

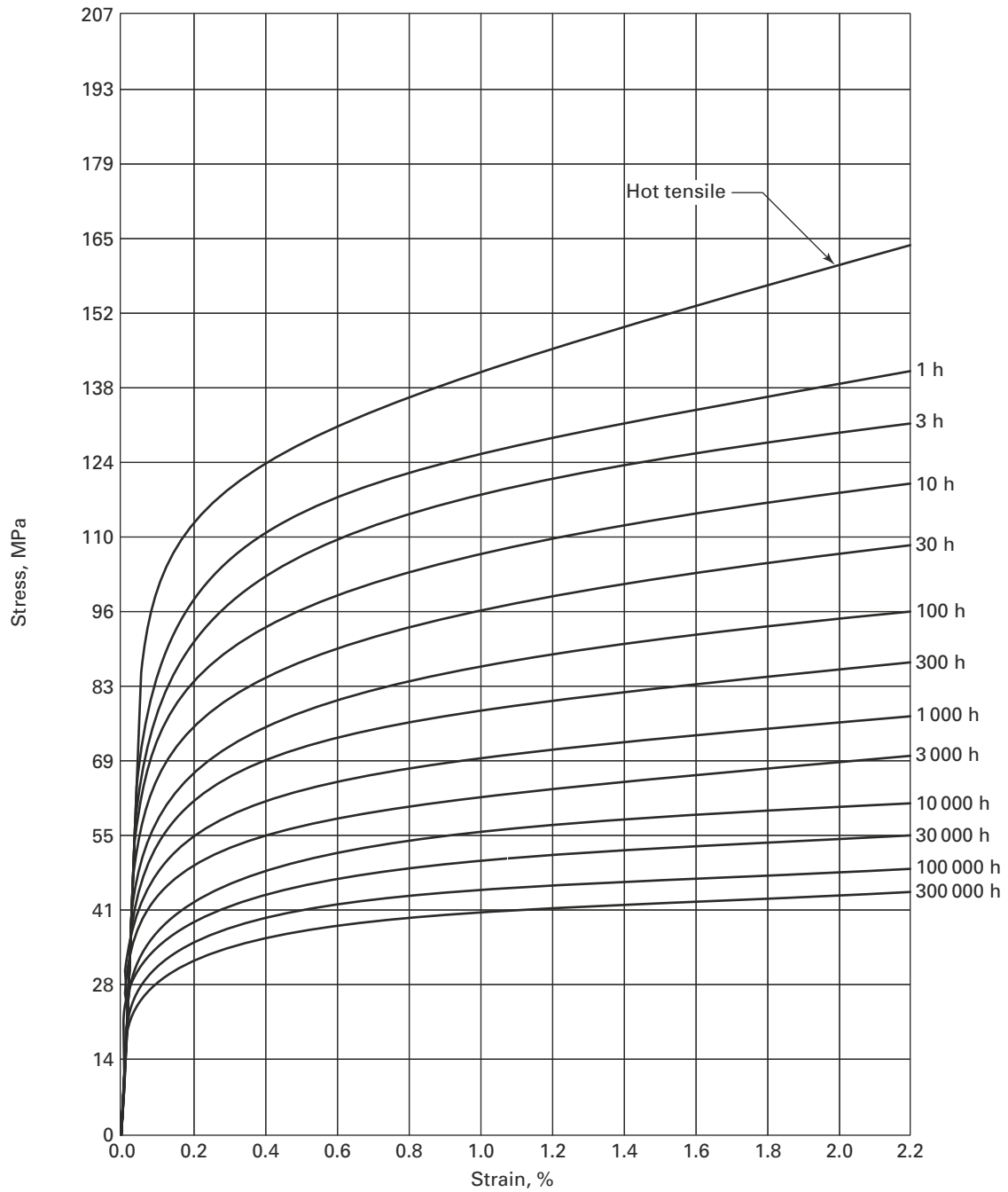


Figure E-100.20-12
Average Isochronous Stress–Strain Curves for Alloy 800H at 760°C

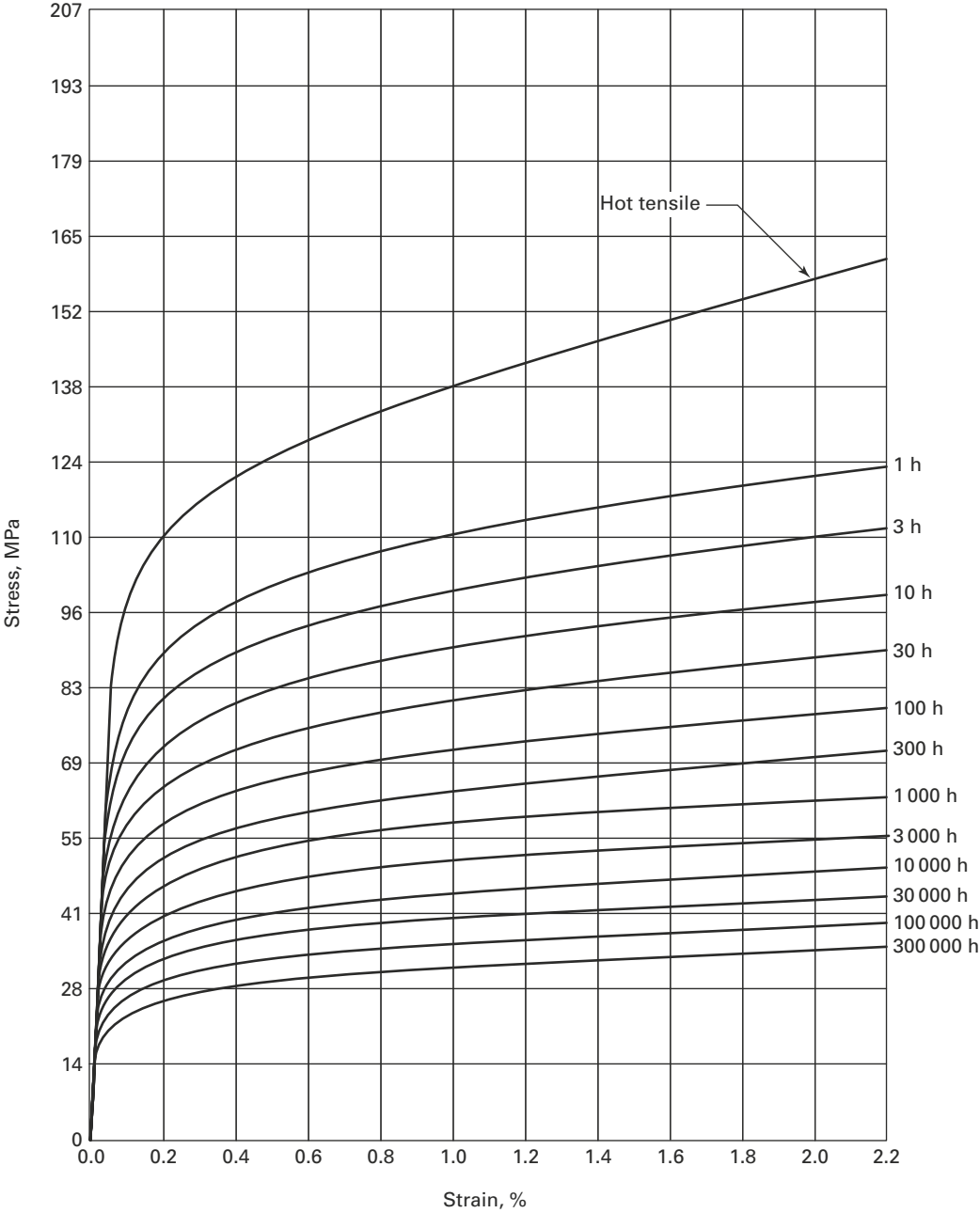


Figure E-100.21-1
Average Isochronous Stress-Strain Curves for Annealed $2\frac{1}{4}$ Cr-1Mo at 371°C

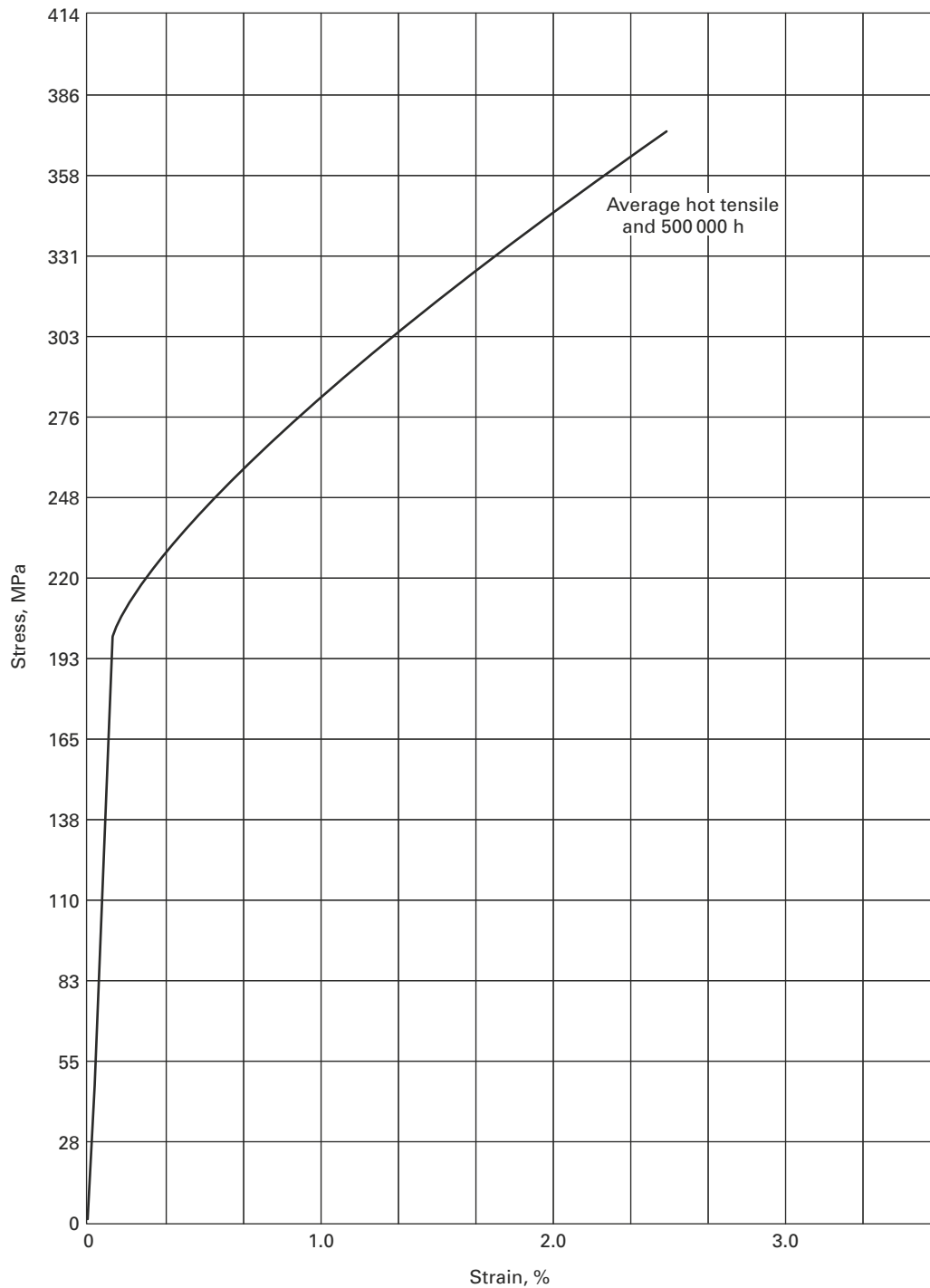


Figure E-100.21-2
Average Isochronous Stress-Strain Curves for Annealed 2¼Cr-1Mo at 399°C

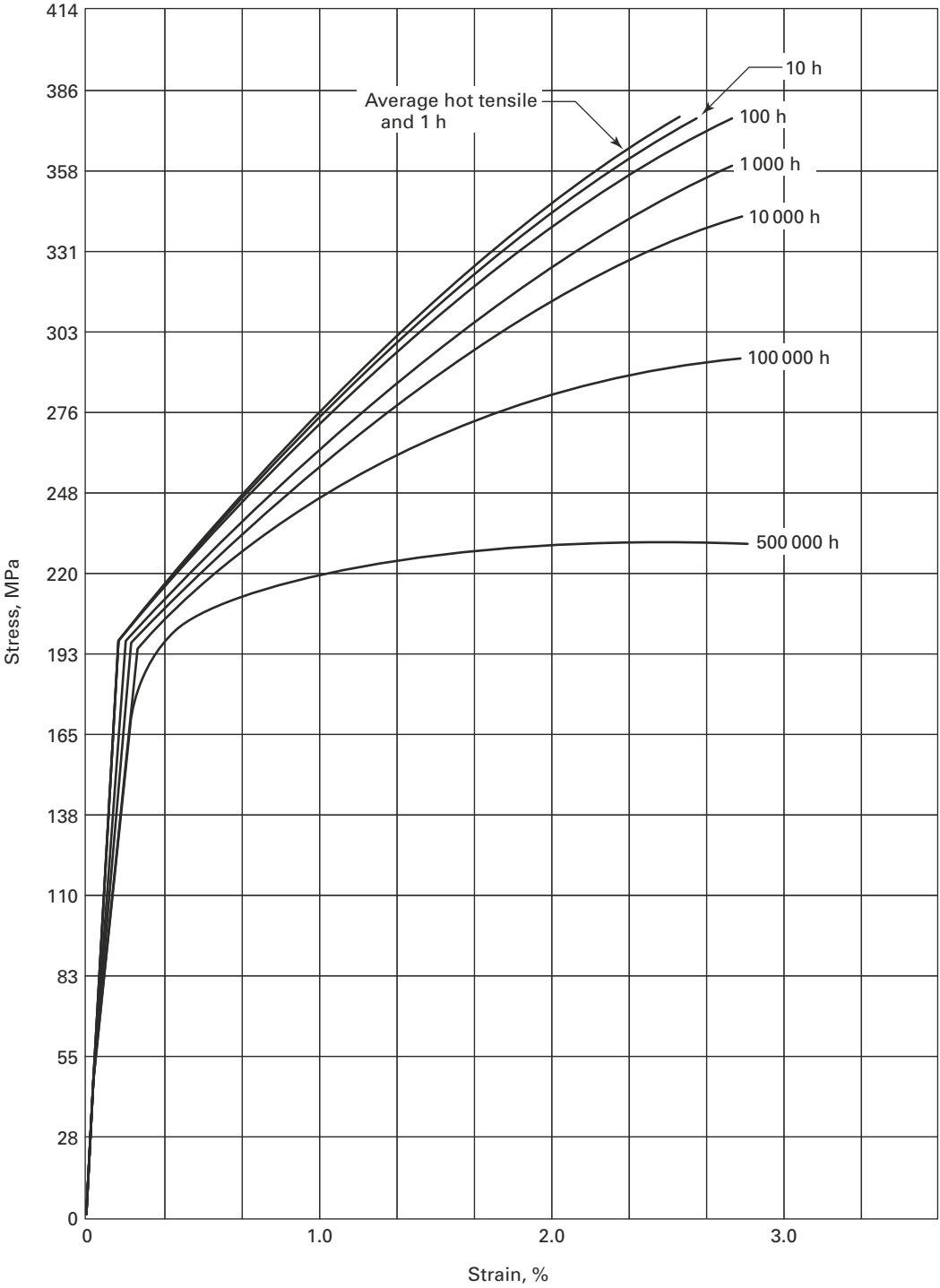


Figure E-100.21-3
Average Isochronous Stress-Strain Curves for Annealed $2\frac{1}{4}$ Cr-1Mo at 427°C

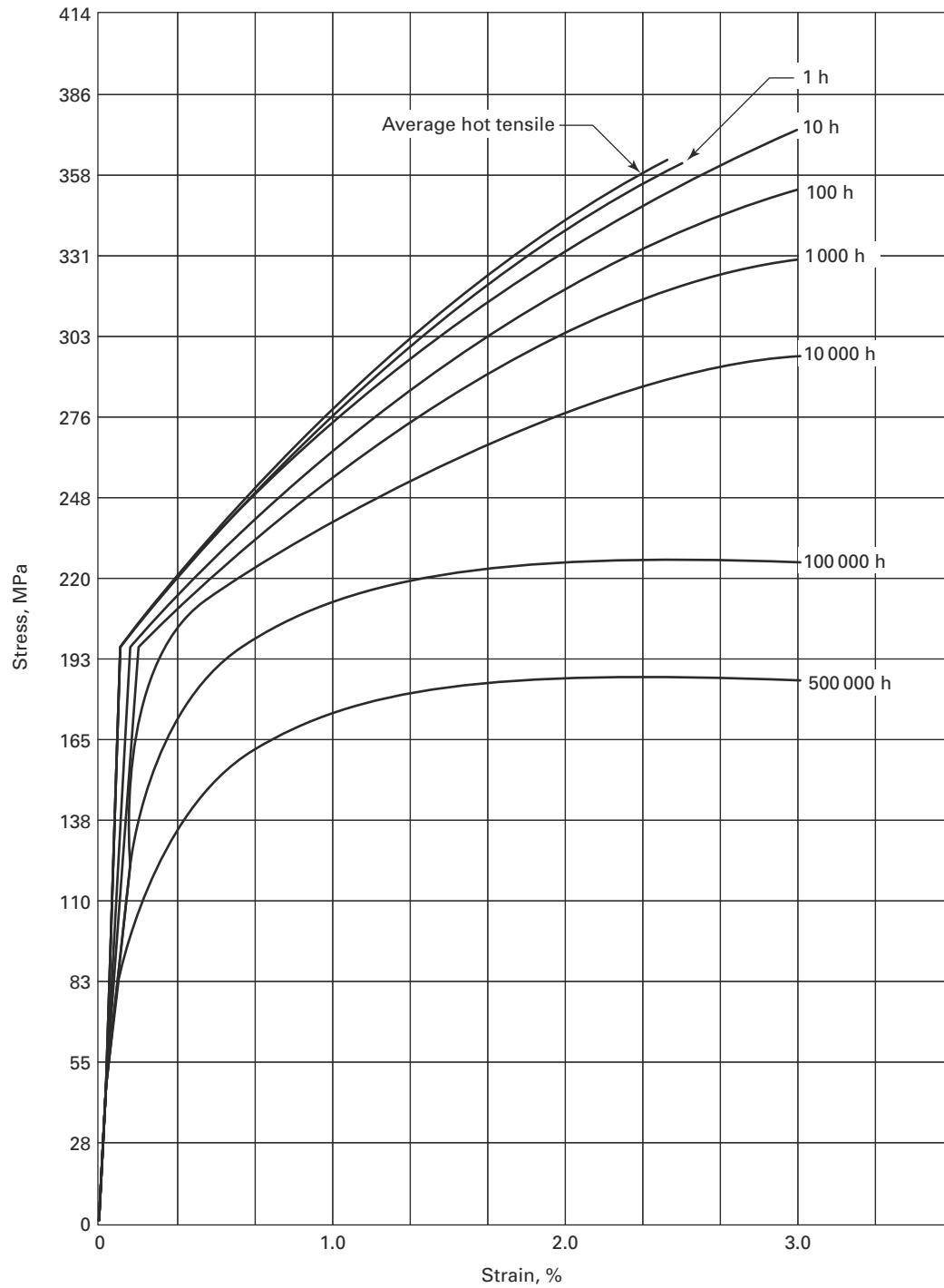


Figure E-100.21-4
Average Isochronous Stress-Strain Curves for Annealed 2½Cr-1Mo at 454°C

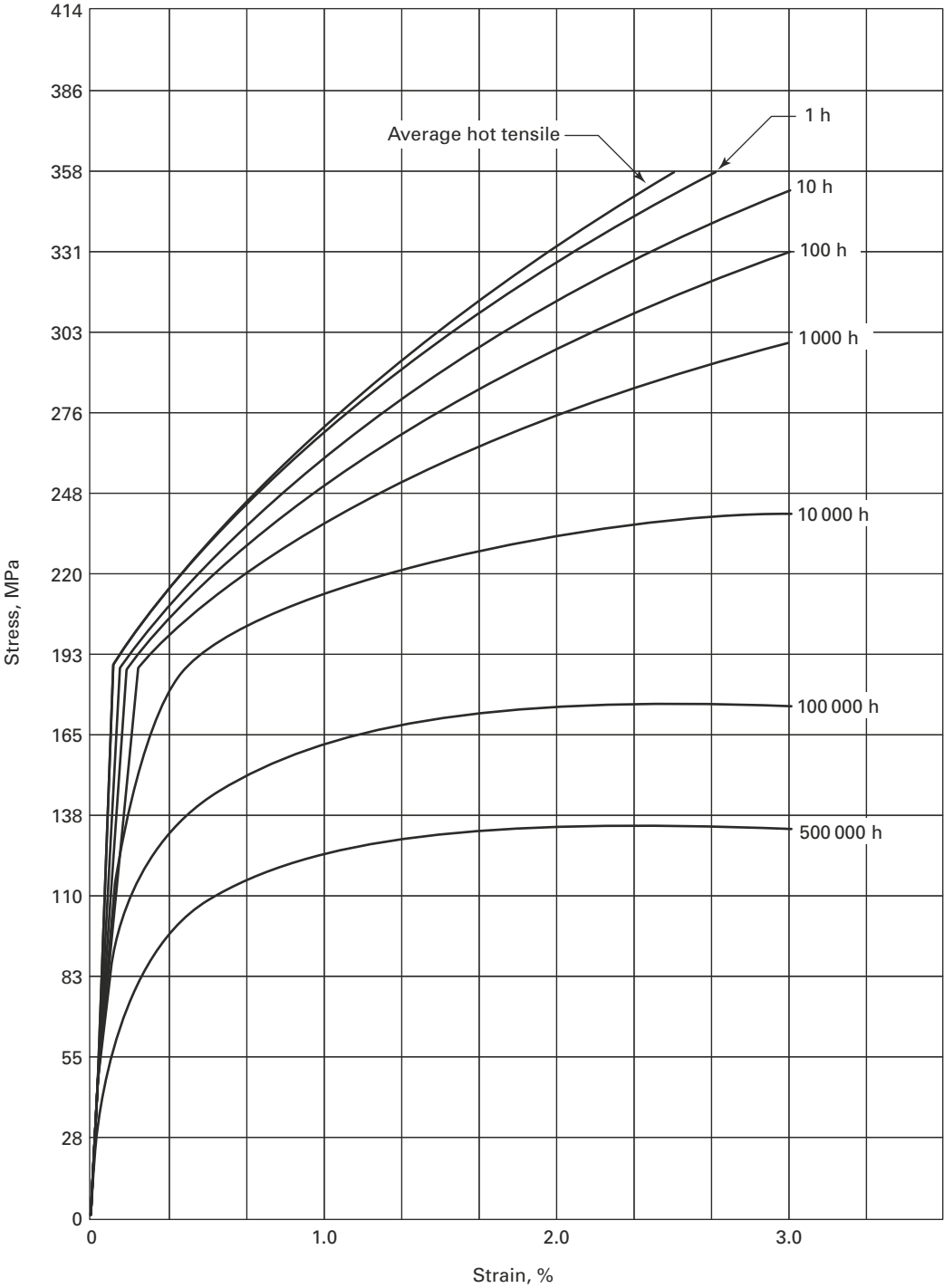


Figure E-100.21-5
Average Isochronous Stress-Strain Curves for Annealed $2\frac{1}{4}$ Cr-1Mo at 482°C

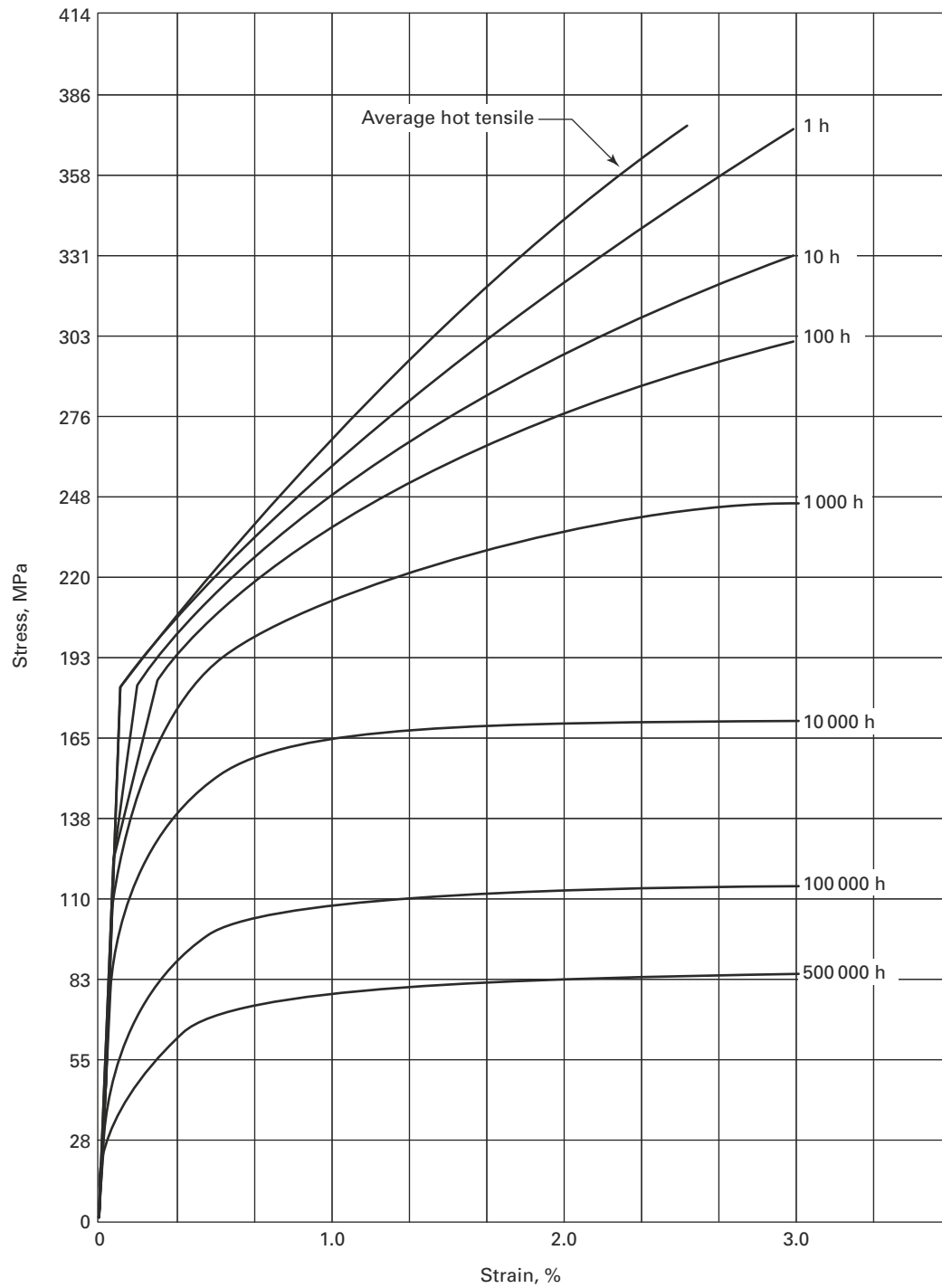


Figure E-100.21-6
Average Isochronous Stress-Strain Curves for Annealed 2¼Cr-1Mo at 510°C

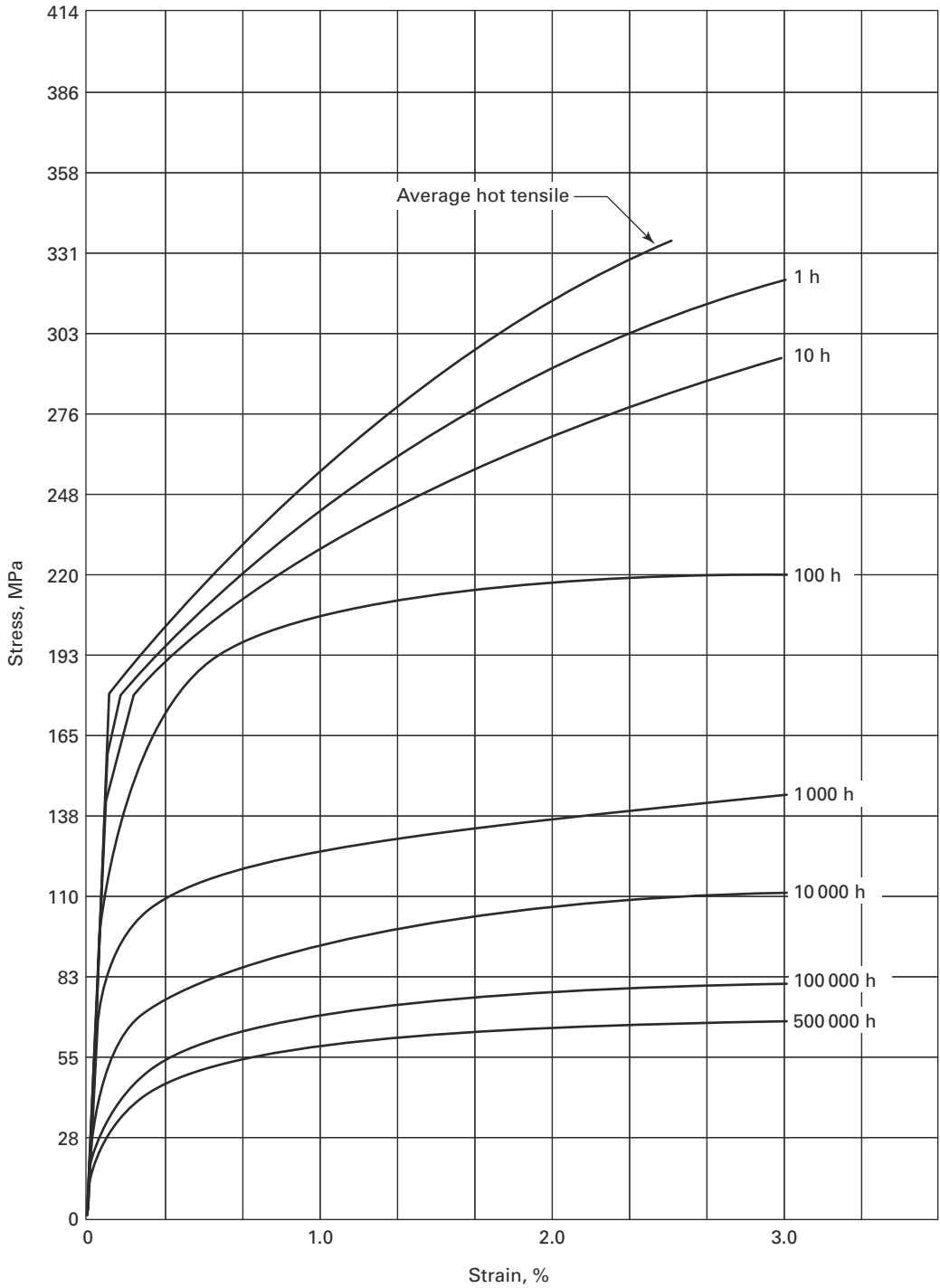


Figure E-100.21-7
Average Isochronous Stress-Strain Curves for Annealed 2¼Cr-1Mo at 538°C

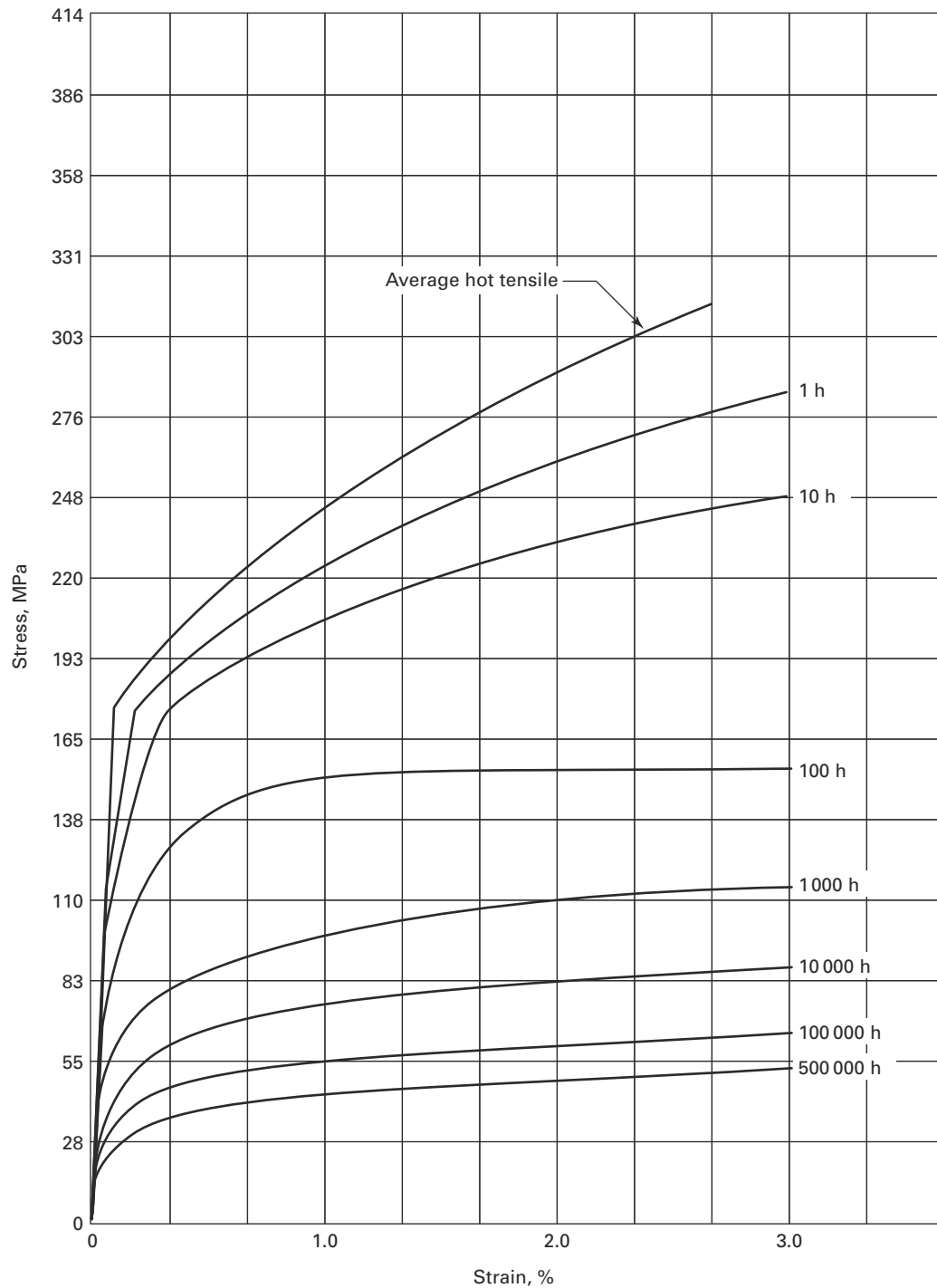


Figure E-100.21-8
Average Isochronous Stress-Strain Curves for Annealed $2\frac{1}{4}$ Cr-1Mo at 566°C

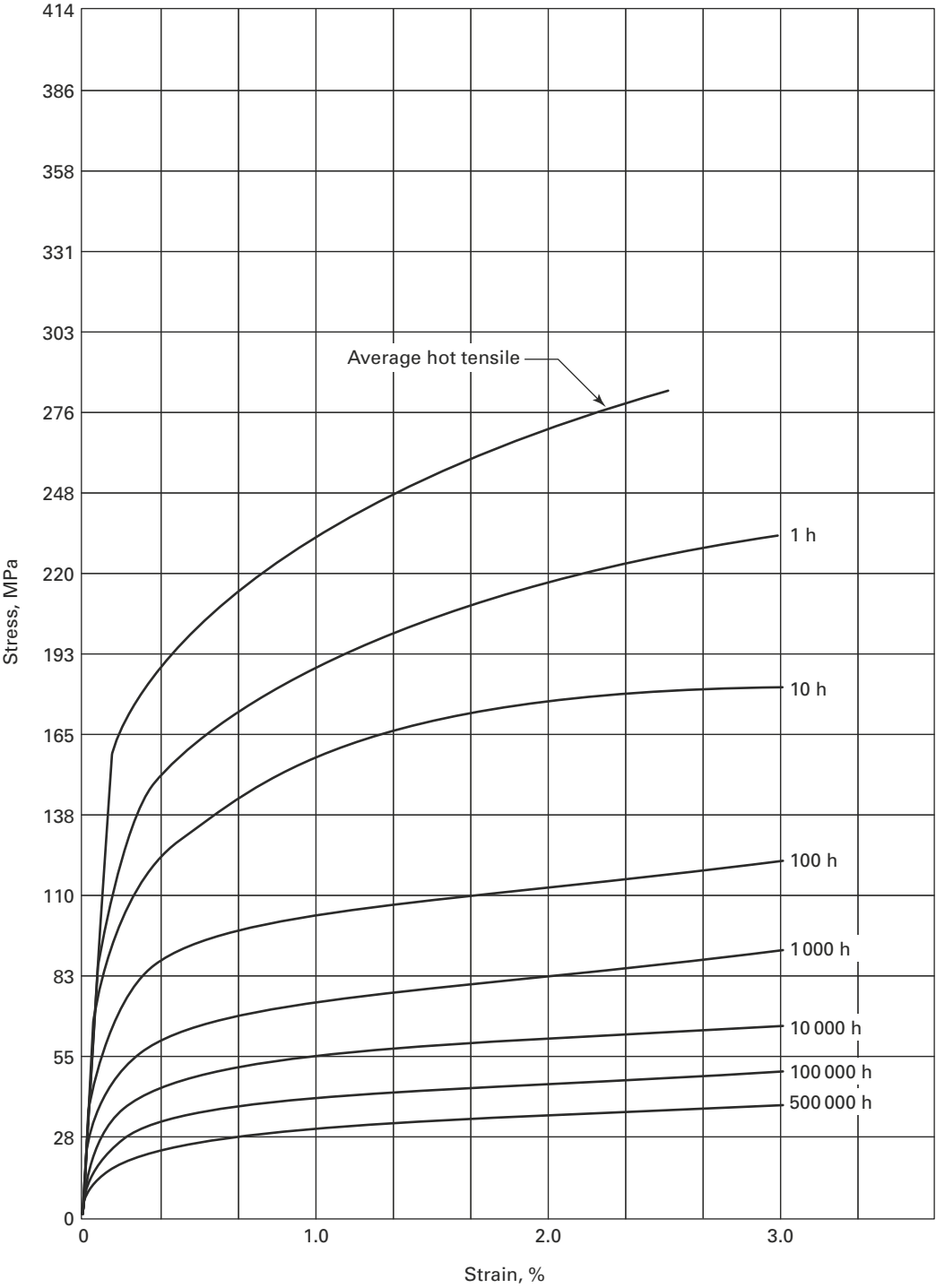


Figure E-100.21-9
Average Isochronous Stress-Strain Curves for Annealed 2 $\frac{1}{4}$ Cr-1Mo at 593°C

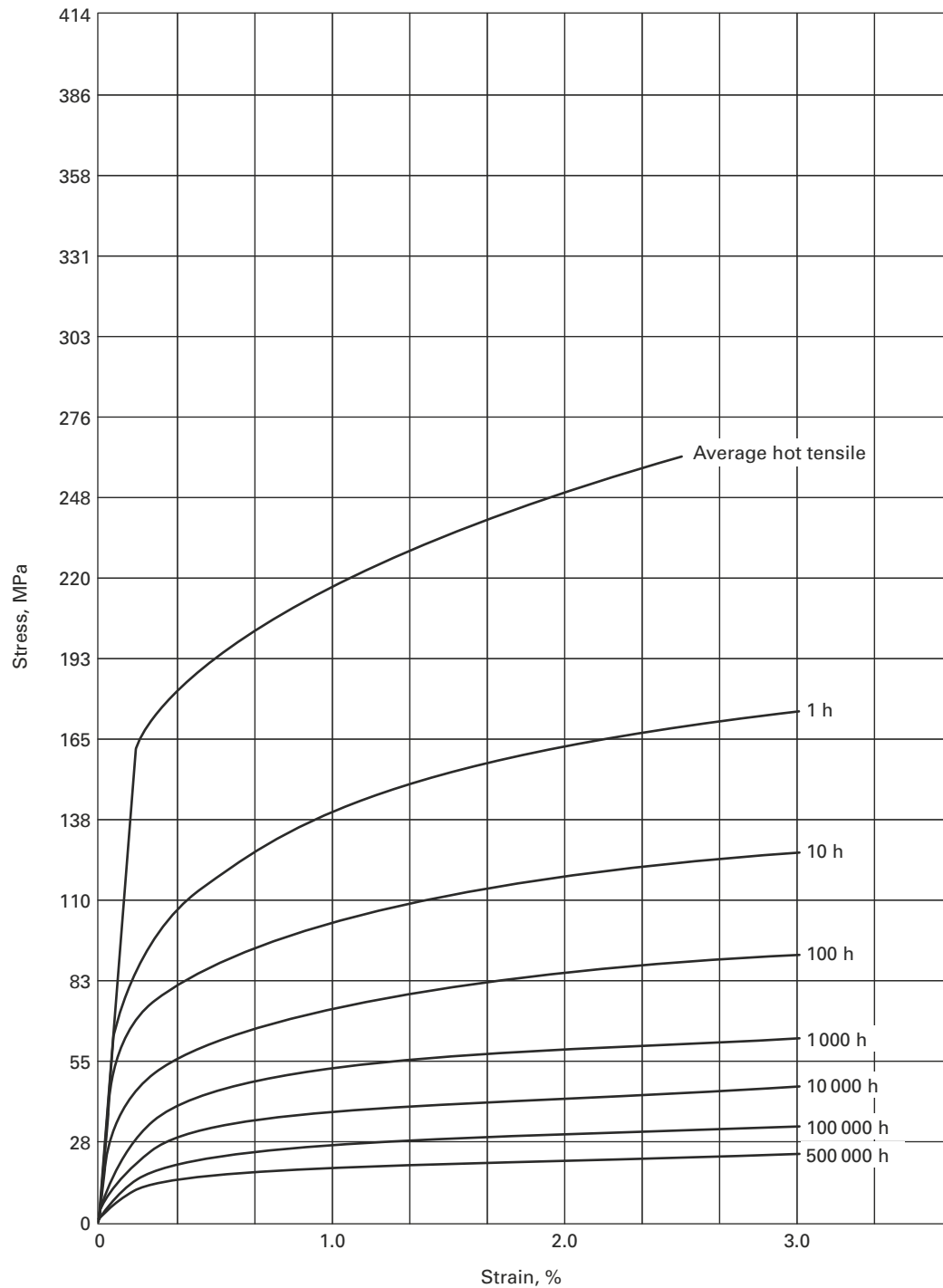


Figure E-100.21-10
Average Isochronous Stress-Strain Curves for Annealed 2¼Cr-1Mo at 621°C

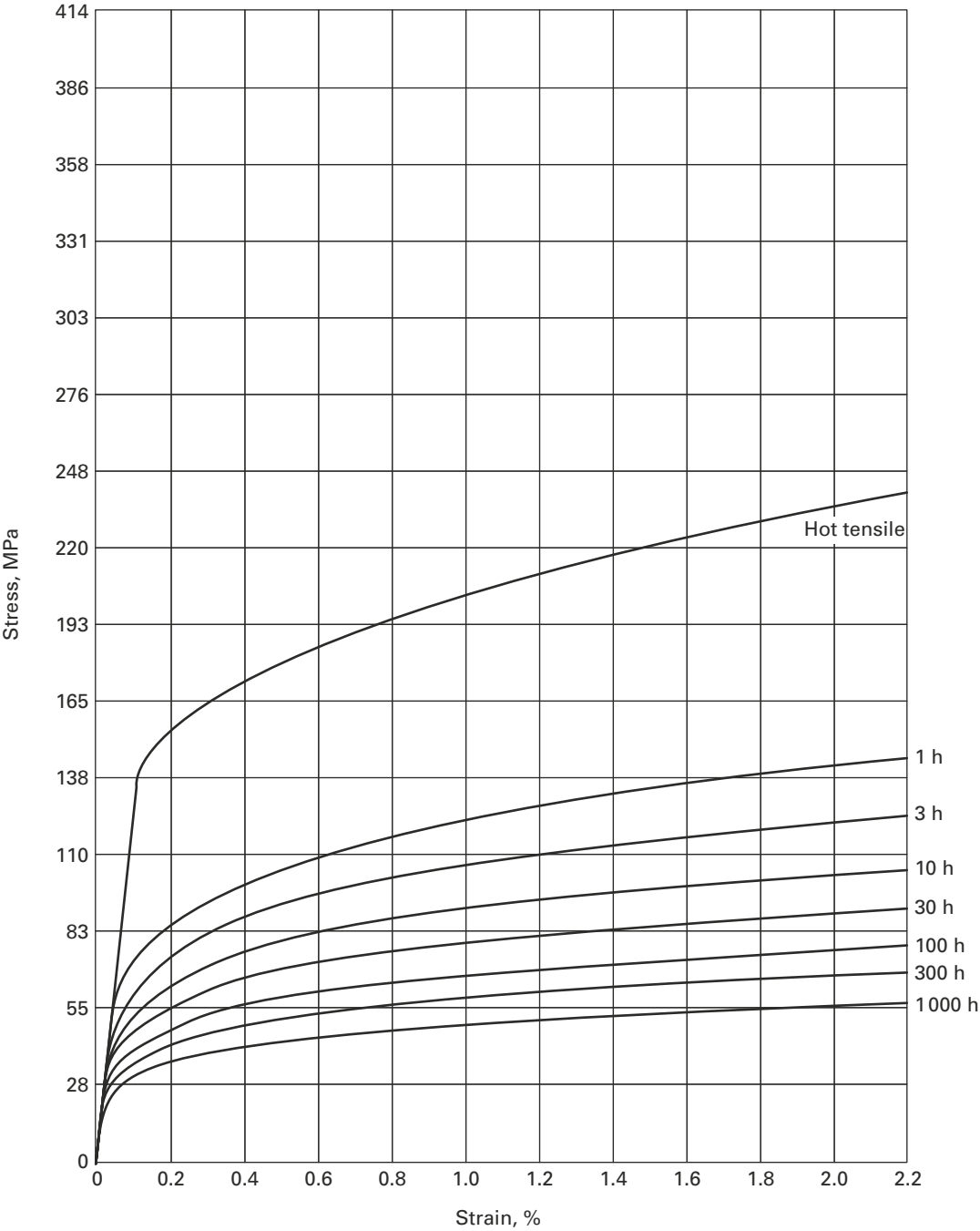


Figure E-100.21-11
Average Isochronous Stress-Strain Curves for Annealed $2\frac{1}{4}$ Cr-1Mo at 649°C

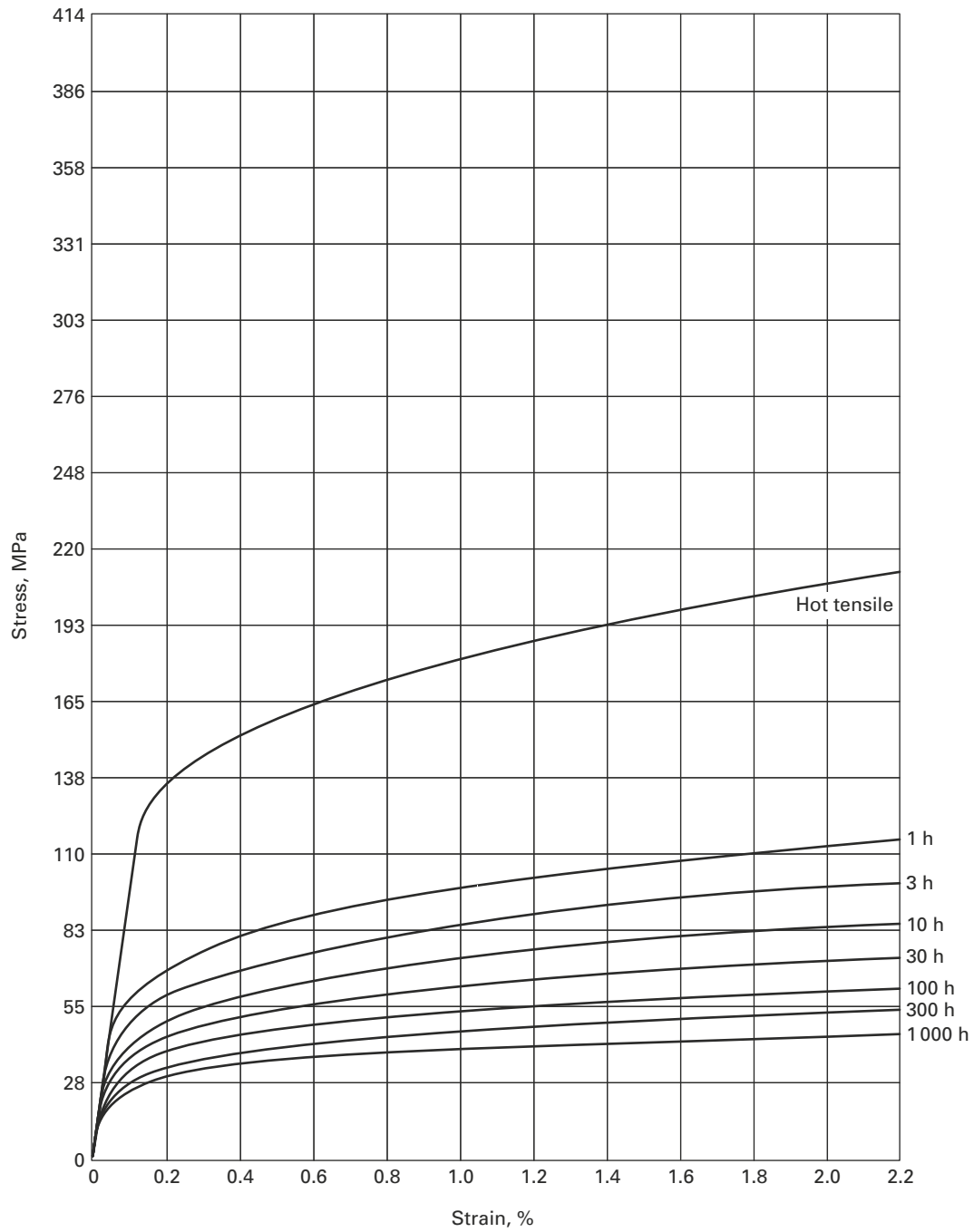


Figure E-100.22-1
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 371°C

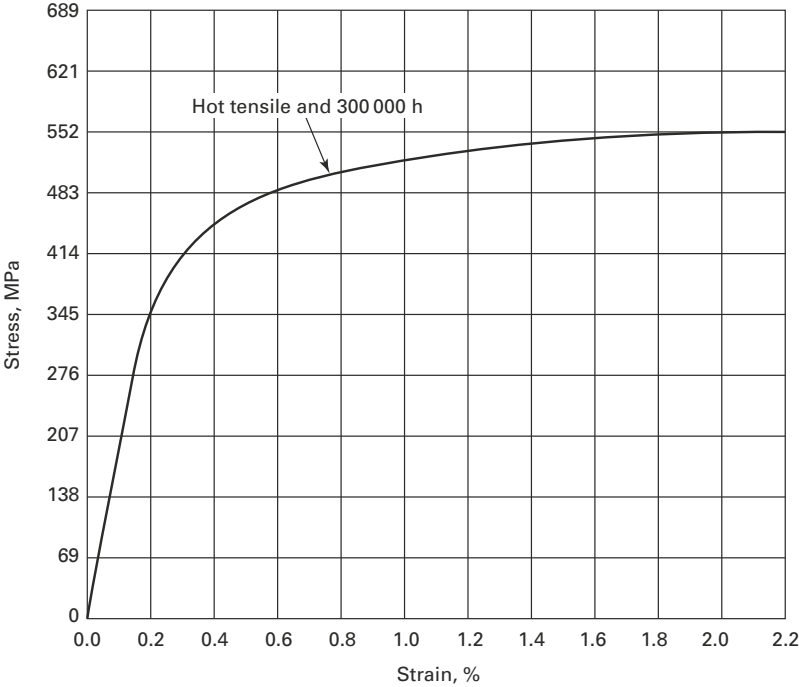


Figure E-100.22-2
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 399°C

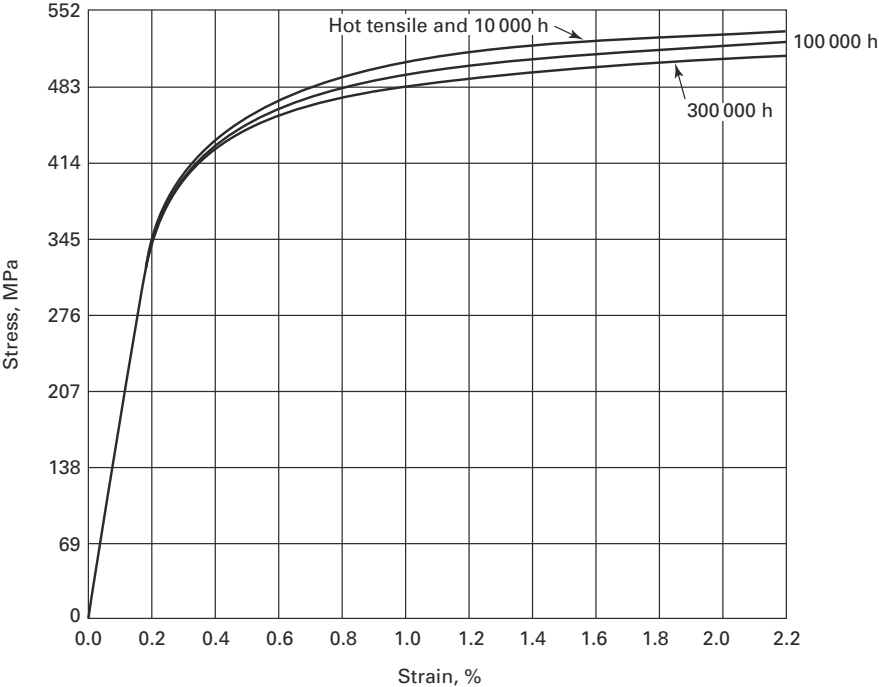


Figure E-100.22-3
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 426°C

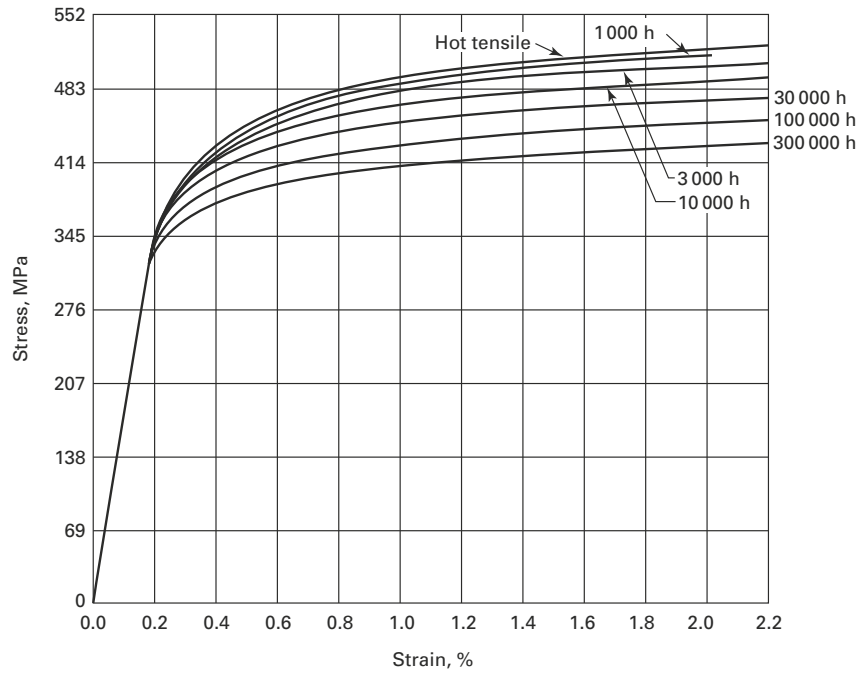


Figure E-100.22-4
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 454°C

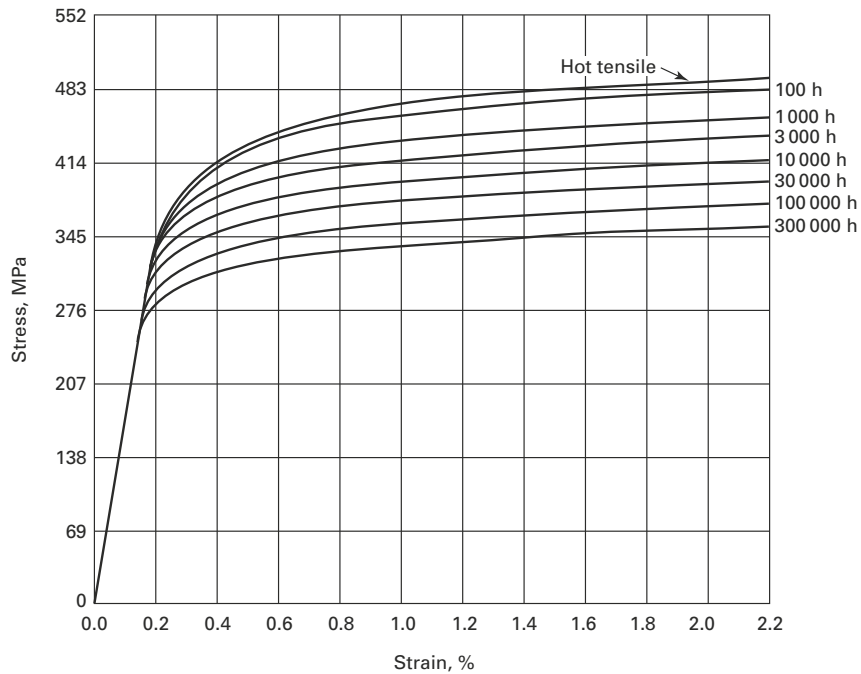


Figure E-100.22-5
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 482°C

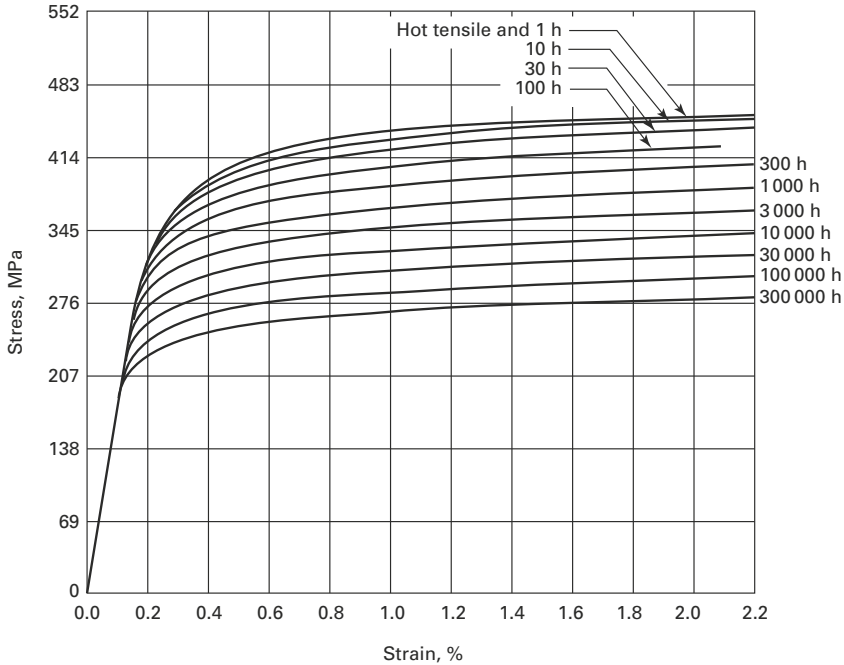


Figure E-100.22-6
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 510°C

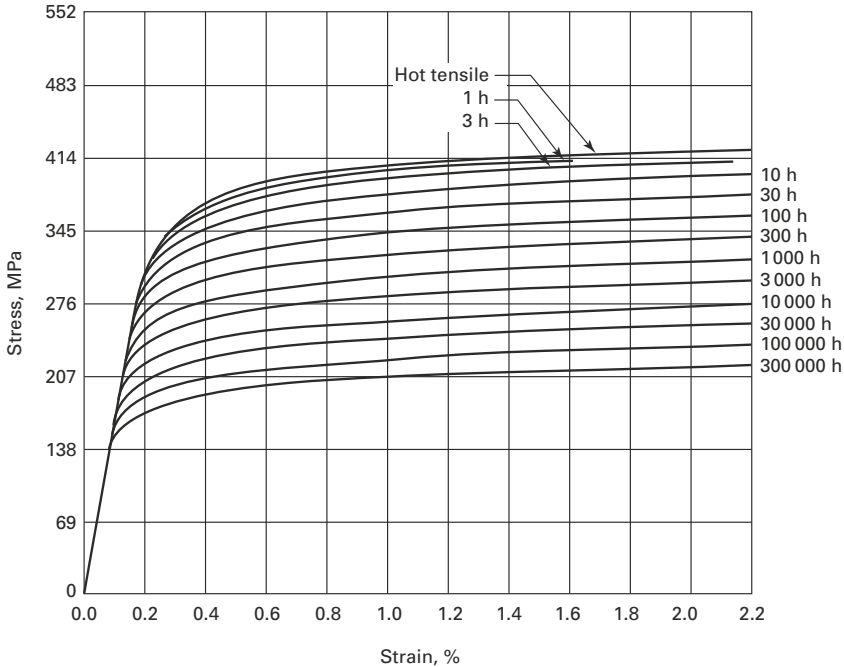


Figure E-100.22-7
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 538°C

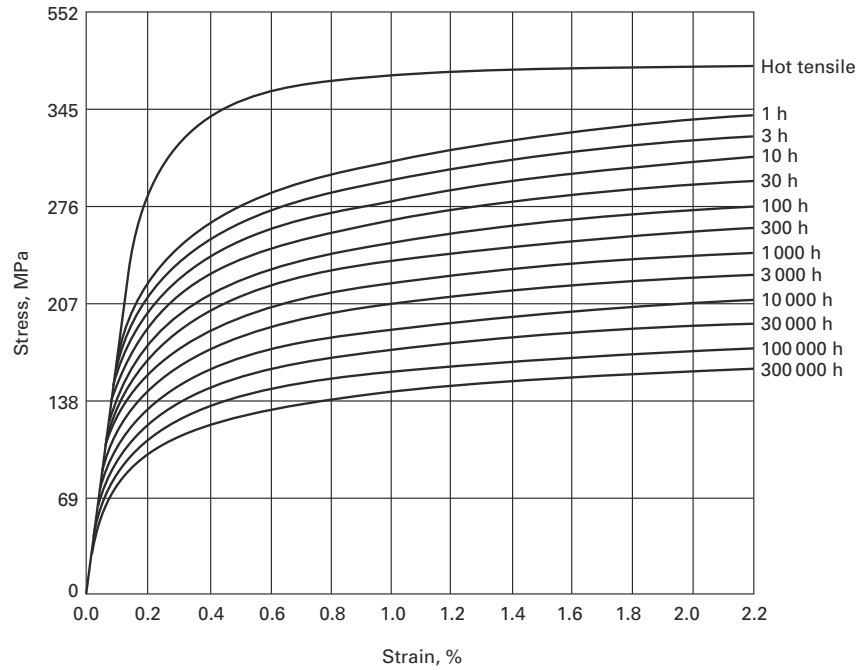


Figure E-100.22-8
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 566°C

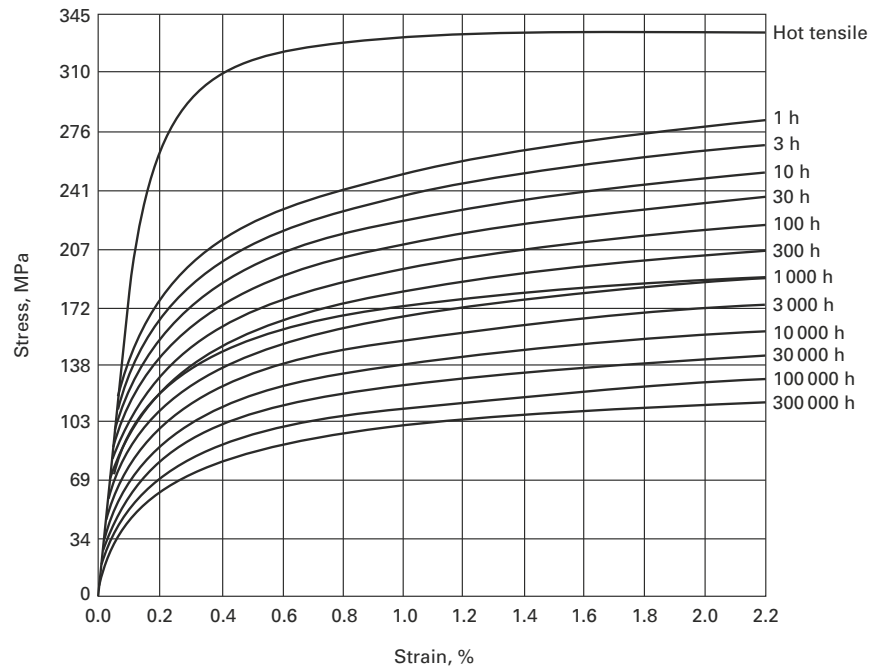


Figure E-100.22-9
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 593°C

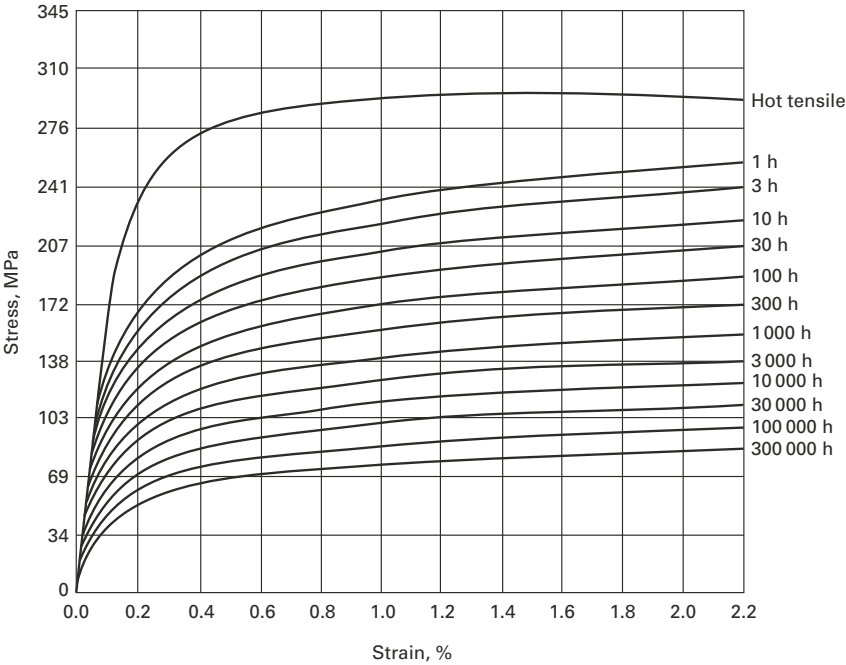


Figure E-100.22-10
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 621°C

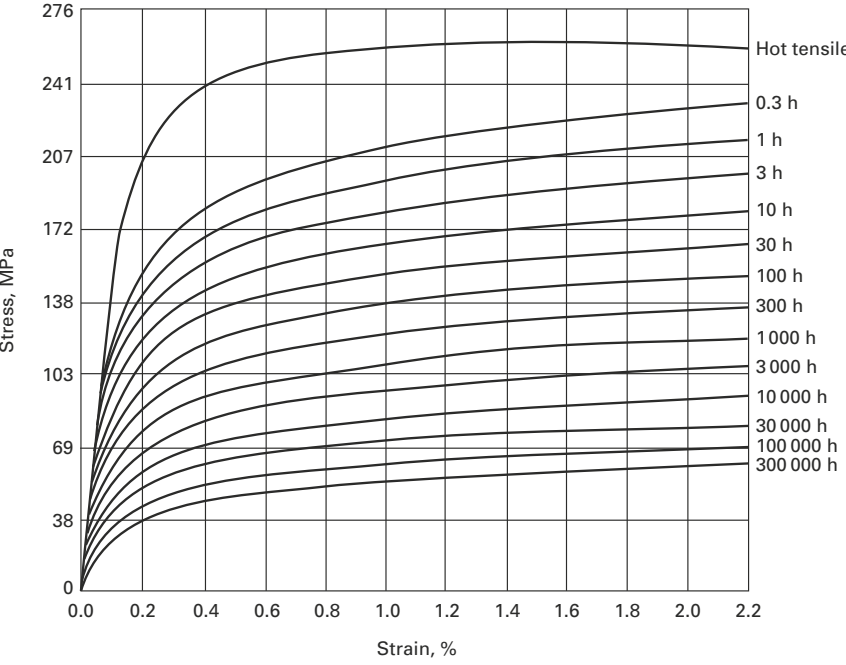


Figure E-100.22-11
Average Isochronous Stress–Strain Curves for 9Cr–1Mo–V at 649°C

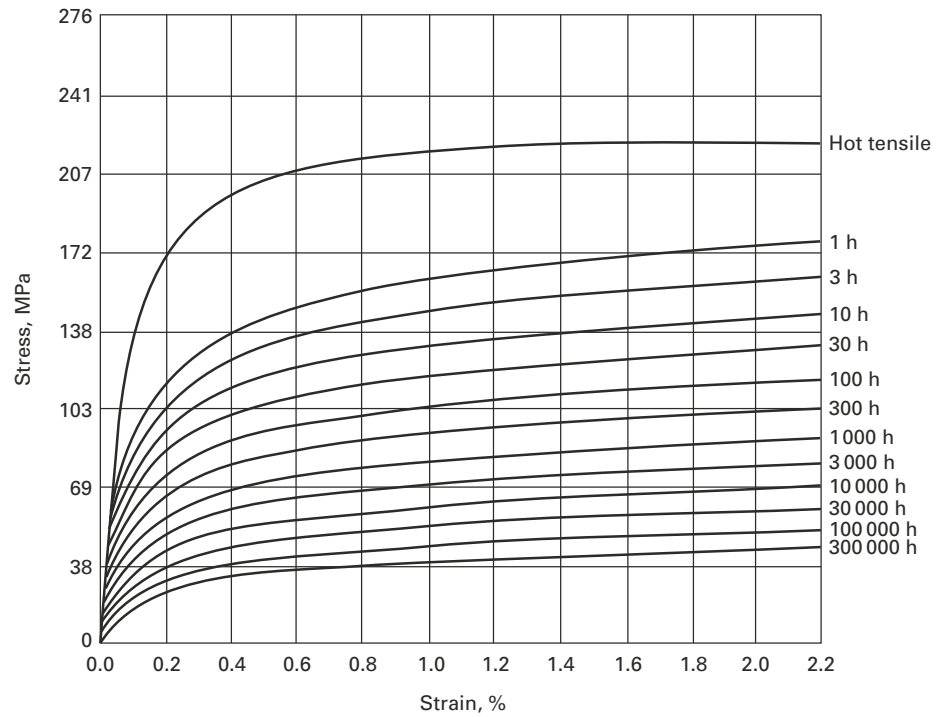


Table E-100.23-1
Recommended Restrictions

Element	Type 304	Type 316
(a) Chemical composition [Note (1)]		
Carbon	0.04–0.06	0.04–0.06
Nitrogen	0.04–0.07	0.04–0.07
Silicon	0.6	0.6
Manganese	1.0–2.0	1.0–2.0
Nickel	8.00–10.00	11.00–12.5
Chromium	18.5–20.00	17.00–18.00
Molybdenum	0.2	2.5–3.0
Sulfur	0.02	<0.02
Phosphorus	0.045	<0.03
Niobium	0.02 [Note (2)]	...
Aluminum	0.05	0.05
Antimony	0.02	0.02
Boron	...	0.003 [Note (3)]
Lead	0.003	0.003
Selenium	0.015	0.015
Tin	0.015	0.015
Vanadium	0.05	0.05
Zinc	0.01	0.01
(b) Grain size (ASTM)	3–6	3–6
(c) Melt practice	AOD or AOD/ESR	AOD or AOD/ESR
(d) Suggested upper long-term use limit for improved performance:		
Temperature, °C	595	595

NOTES:

- (1) All values are maximum percentages unless indicated as ranges.
(2) To further reduce data scatter, a minimum value of 0.005% should be specified.
(3) To further reduce data scatter, a minimum value of 0.0015% should be specified.

Table E-100.24-1
Cross-Reference Table of Section II, Part D and Section III, Subsection NH 2015 Edition

Subsection NH Designation	Subsection NH Title	Nonmandatory Appendix E Designation
Figure NH-4212-1	Permissible Time/Temperature Conditions for Material Which Has Been Cold Worked > 5% and < 20% and Subjected to Short-Time High Temperature Transients	Figure E-100.2-1
Figure NH-I-14.3A	S_{mt} — Type 304 SS	Figure E-100.4-1
Figure NH-I-14.3B	S_{mt} — Type 316 SS	Figure E-100.4-2
Figure NH-I-14.3C	S_{mt} — Ni-Fe-Cr (Alloy 800H)	Figure E-100.4-3
Figure NH-I-14.3D	S_{mt} — $2\frac{1}{4}$ Cr-1Mo	Figure E-100.4-4
Figure NH-I-14.3E	S_{mt} — 9Cr-1Mo-V	Figure E-100.4-5
Figure NH-I-14.4A	S_t — Type 304 SS	Figure E-100.5-1
Figure NH-I-14.4B	S_t — Type 316 SS	Figure E-100.5-2
Figure NH-I-14.4C	S_t — Ni-Fe-Cr (Alloy 800H)	Figure E-100.5-3
Figure NH-I-14.4D	S_t — $2\frac{1}{4}$ Cr-1Mo	Figure E-100.5-4
Figure NH-I-14.4E	S_t — 9Cr-1Mo-V	Figure E-100.5-5
Figure NH-I-14.6A	Minimum Stress-to-Rupture	Figure E-100.7-1
Figure NH-I-14.6B	Minimum Stress-to-Rupture	Figure E-100.7-2
Figure NH-I-14.6C	Minimum Stress-to-Rupture — Ni-Fe-Cr (Alloy 800H)	Figure E-100.7-3
Figure NH-I-14.6D	$2\frac{1}{4}$ Cr-1Mo — 100% of the Minimum Stress-to-Rupture	Figure E-100.7-4
Figure NH-I-14.6E	Minimum Stress-to-Rupture, Alloy 718	Figure E-100.7-5
Figure NH-I-14.6F	9Cr-1Mo-V — Expected Minimum Stress-to-Rupture, MPa	Figure E-100.7-6
Figure NH-I-14.13A	S_{mt} — Allowable Stress Intensity, Type 304 SS, Bolting	Figure E-100.15-1

Table E-100.24-1
Cross-Reference Table of Section II, Part D and Section III, Subsection NH 2015 Edition (Cont'd)

Subsection NH Designation	Subsection NH Title	Nonmandatory Appendix E Designation
Figure NH-I-14.13B	S_{mt} — Allowable Stress Intensity, Type 316 SS, Bolting	Figure E-100.15-2
Figure NH-I-14.13C	S_{mt} — Allowable Stress, Alloy 718, Bolting	Figure E-100.15-3
Figure NH-T-1420-1A	Design Fatigue Strain Range, ϵ_t , for 304 SS	Figure E-100.16-1
Figure NH-T-1420-1B	Design Fatigue Strain Range, ϵ_t , for 316 SS	Figure E-100.16-2
Figure NH-T-1420-1C	Design Fatigue Strain Range, ϵ_t , for Ni-Fe-Cr Alloy 800H	Figure E-100.16-3
Figure NH-T-1420-1D	Design Fatigue Strain Range, ϵ_t , for 2 $\frac{1}{4}$ Cr-1Mo Steel	Figure E-100.16-4
Figure NH-T-1420-1E	Design Fatigue Strain Range, ϵ_t , for 9Cr-1Mo-V Steel	Figure E-100.16-5
Figure NH-T-1522-1	Time-Temperature Limits for Application of Section II External Pressure Charts	Figure E-100.17-1
Figure NH-T-1522-2	Time-Temperature Limits for Application of Section II External Pressure Charts	Figure E-100.17-2
Figure NH-T-1522-3	Temperature Limits for Application of Section II External Pressure Charts	Figure E-100.17-3
Figure NH-T-1800-A-1	Average Isochronous Stress-Strain Curves (304 SS 427°C)	Figure E-100.18-1
Figure NH-T-1800-A-2	Average Isochronous Stress-Strain Curves (304 SS 454°C)	Figure E-100.18-2
Figure NH-T-1800-A-3	Average Isochronous Stress-Strain Curves (304 SS 482°C)	Figure E-100.18-3
Figure NH-T-1800-A-4	Average Isochronous Stress-Strain Curves (304 SS 510°C)	Figure E-100.18-4
Figure NH-T-1800-A-5	Average Isochronous Stress-Strain Curves (304 SS 538°C)	Figure E-100.18-5
Figure NH-T-1800-A-6	Average Isochronous Stress-Strain Curves (304 SS 566°C)	Figure E-100.18-6
Figure NH-T-1800-A-7	Average Isochronous Stress-Strain Curves (304 SS 593°C)	Figure E-100.18-7
Figure NH-T-1800-A-8	Average Isochronous Stress-Strain Curves (304 SS 621°C)	Figure E-100.18-8
Figure NH-T-1800-A-9	Average Isochronous Stress-Strain Curves (304 SS 649°C)	Figure E-100.18-9
Figure NH-T-1800-A-10	Average Isochronous Stress-Strain Curves (304 SS 677°C)	Figure E-100.18-10
Figure NH-T-1800-A-11	Average Isochronous Stress-Strain Curves (304 SS 704°C)	Figure E-100.18-11
Figure NH-T-1800-A-12	Average Isochronous Stress-Strain Curves (304 SS 732°C)	Figure E-100.18-12
Figure NH-T-1800-A-13	Average Isochronous Stress-Strain Curves (304 SS 760°C)	Figure E-100.18-13
Figure NH-T-1800-A-14	Average Isochronous Stress-Strain Curves (304 SS 788°C)	Figure E-100.18-14
Figure NH-T-1800-A-15	Average Isochronous Stress-Strain Curves (304 SS 816°C)	Figure E-100.18-15
Figure NH-T-1800-B-1	Average Isochronous Stress-Strain Curves (316 SS 427°C)	Figure E-100.19-1
Figure NH-T-1800-B-2	Average Isochronous Stress-Strain Curves (316 SS 454°C)	Figure E-100.19-2
Figure NH-T-1800-B-3	Average Isochronous Stress-Strain Curves (316 SS 482°C)	Figure E-100.19-3
Figure NH-T-1800-B-4	Average Isochronous Stress-Strain Curves (316 SS 510°C)	Figure E-100.19-4
Figure NH-T-1800-B-5	Average Isochronous Stress-Strain Curves (316 SS 538°C)	Figure E-100.19-5
Figure NH-T-1800-B-6	Average Isochronous Stress-Strain Curves (316 SS 566°C)	Figure E-100.19-6
Figure NH-T-1800-B-7	Average Isochronous Stress-Strain Curves (316 SS 593°C)	Figure E-100.19-7
Figure NH-T-1800-B-8	Average Isochronous Stress-Strain Curves (316 SS 621°C)	Figure E-100.19-8
Figure NH-T-1800-B-9	Average Isochronous Stress-Strain Curves (316 SS 649°C)	Figure E-100.19-9
Figure NH-T-1800-B-10	Average Isochronous Stress-Strain Curves (316 SS 677°C)	Figure E-100.19-10
Figure NH-T-1800-B-11	Average Isochronous Stress-Strain Curves (316 SS 704°C)	Figure E-100.19-11
Figure NH-T-1800-B-12	Average Isochronous Stress-Strain Curves (316 SS 732°C)	Figure E-100.19-12
Figure NH-T-1800-B-13	Average Isochronous Stress-Strain Curves (316 SS 760°C)	Figure E-100.19-13
Figure NH-T-1800-B-14	Average Isochronous Stress-Strain Curves (316 SS 788°C)	Figure E-100.19-14
Figure NH-T-1800-B-15	Average Isochronous Stress-Strain Curves (316 SS 816°C)	Figure E-100.19-15
Figure NH-T-1800-C-1	Average Isochronous Stress-Strain Curves (800H 427°C and 454°C)	Figure E-100.20-1
Figure NH-T-1800-C-2	Average Isochronous Stress-Strain Curves (800H 482°C)	Figure E-100.20-2
Figure NH-T-1800-C-3	Average Isochronous Stress-Strain Curves (800H 510°C)	Figure E-100.20-3
Figure NH-T-1800-C-4	Average Isochronous Stress-Strain Curves (800H 538°C)	Figure E-100.20-4
Figure NH-T-1800-C-5	Average Isochronous Stress-Strain Curves (800H 566°C)	Figure E-100.20-5
Figure NH-T-1800-C-6	Average Isochronous Stress-Strain Curves (800H 593°C)	Figure E-100.20-6
Figure NH-T-1800-C-7	Average Isochronous Stress-Strain Curves (800H 621°C)	Figure E-100.20-7
Figure NH-T-1800-C-8	Average Isochronous Stress-Strain Curves (800H 649°C)	Figure E-100.20-8
Figure NH-T-1800-C-9	Average Isochronous Stress-Strain Curves (800H 677°C)	Figure E-100.20-9
Figure NH-T-1800-C-10	Average Isochronous Stress-Strain Curves (800H 704°C)	Figure E-100.20-10

Table E-100.24-1
Cross-Reference Table of Section II, Part D and Section III, Subsection NH 2015 Edition (Cont'd)

Subsection NH Designation	Subsection NH Title	Nonmandatory Appendix E Designation
Figure NH-T-1800-C-11	Average Isochronous Stress–Strain Curves (800H 732°C)	Figure E-100.20-11
Figure NH-T-1800-C-12	Average Isochronous Stress–Strain Curves (800H 760°C)	Figure E-100.20-12
Figure NH-T-1800-D-1	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 371°C)	Figure E-100.21-1
Figure NH-T-1800-D-2	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 399°C)	Figure E-100.21-2
Figure NH-T-1800-D-3	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 427°C)	Figure E-100.21-3
Figure NH-T-1800-D-4	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 454°C)	Figure E-100.21-4
Figure NH-T-1800-D-5	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 482°C)	Figure E-100.21-5
Figure NH-T-1800-D-6	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 510°C)	Figure E-100.21-6
Figure NH-T-1800-D-7	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 538°C)	Figure E-100.21-7
Figure NH-T-1800-D-8	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 566°C)	Figure E-100.21-8
Figure NH-T-1800-D-9	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 593°C)	Figure E-100.21-9
Figure NH-T-1800-D-10	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 621°C)	Figure E-100.21-10
Figure NH-T-1800-D-11	Average Isochronous Stress–Strain Curves (Annealed 2¼Cr–1Mo 649°C)	Figure E-100.21-11
Figure NH-T-1800-E-1	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 371°C)	Figure E-100.22-1
Figure NH-T-1800-E-2	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 399°C)	Figure E-100.22-2
Figure NH-T-1800-E-3	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 426°C)	Figure E-100.22-3
Figure NH-T-1800-E-4	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 454°C)	Figure E-100.22-4
Figure NH-T-1800-E-5	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 482°C)	Figure E-100.22-5
Figure NH-T-1800-E-6	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 510°C)	Figure E-100.22-6
Figure NH-T-1800-E-7	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 538°C)	Figure E-100.22-7
Figure NH-T-1800-E-8	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 566°C)	Figure E-100.22-8
Figure NH-T-1800-E-9	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 593°C)	Figure E-100.22-9
Figure NH-T-1800-E-10	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 621°C)	Figure E-100.22-10
Figure NH-T-1800-E-11	Average Isochronous Stress–Strain Curves (9Cr–1Mo–V 649°C)	Figure E-100.22-11
Table NH-3225-1	Tensile Strength Values (S_u)	Table E-100.1-1
Table NH-3225-2	Tensile and Yield Strength Reduction Factor Due to Long Time Prior Elevated Temperature Service	Table E-100.1-2
Table NH-3225-3A	Yield Strength Reduction Factors for 2¼Cr–1Mo	Table E-100.1-3
Table NH-3225-3B	Tensile Strength Reduction Factors for 2¼Cr–1Mo	Table E-100.1-4
Table NH-3225-4	Tensile Strength Reduction Factors for 9Cr–1Mo–V	Table E-100.1-5
Table NH-I-14.1(a)	Permissible Base Materials for Structures Other Than Bolting	Table E-100.3-1
Table NH-I-14.1(b)	Permissible Weld Materials	Table E-100.3-2
Table NH-I-14.2	S_o — Maximum Allowable Stress Intensity, MPa, for Design Condition Calculations	Table E-100.3-3
Table NH-I-14.3A	S_{mt} — Allowable Stress Intensity Values, MPa, Type 304 SS — 207-YS, 518-UTS (207-YS, 483-UTS)	Figure E-100.4-1
Table NH-I-14.3B	S_{mt} — Allowable Stress Intensity Values, MPa, Type 316 SS — 207-YS, 518-UTS (207-YS, 483-UTS)	Figure E-100.4-2
Table NH-I-14.3C	S_{mt} — Allowable Stress Intensity Values, MPa, Ni–Fe–Cr (Alloy 800H)	Figure E-100.4-2
Table NH-I-14.3D	S_{mt} — Allowable Stress Intensity Values, MPa, 2¼Cr–1Mo	Figure E-100.4-4
Table NH-I-14.3E	S_{mt} — Allowable Stress Intensity Values, MPa, 9Cr–1Mo–V	Figure E-100.4-5
Table NH-I-14.4A	S_t — Allowable Stress Intensity Values, MPa, Type 304 SS	Figure E-100.5-1
Table NH-I-14.4B	S_t — Allowable Stress Intensity Values, MPa, Type 316 SS	Figure E-100.5-2
Table NH-I-14.4C	S_t — Allowable Stress Intensity Values, MPa, Ni–Fe–Cr (Alloy 800H)	Figure E-100.5-3
Table NH-I-14.4D	S_t — Allowable Stress Intensity Values, MPa, 2¼Cr–1Mo	Figure E-100.5-4
Table NH-I-14.4E	S_t — Allowable Stress Intensity Values, MPa, 9Cr–1Mo–V	Figure E-100.5-5
Table NH-I-14.5	Yield Strength Values, S_y , Versus Temperature	Table E-100.6-1
Table NH-I-14.6A	Expected Minimum Stress-to-Rupture Values, MPa, Type 304 SS	Figure E-100.7-1
Table NH-I-14.6B	Expected Minimum Stress-to-Rupture Values, MPa, Type 316 SS	Figure E-100.7-2
Table NH-I-14.6C	Expected Minimum Stress-to-Rupture Values, MPa, Ni–Fe–Cr (Alloy 800H)	Figure E-100.7-3
Table NH-I-14.6D	2¼Cr–1Mo — Expected Minimum Stress-to-Rupture Values, MPa	Figure E-100.7-4
Table NH-I-14.6E	Expected Minimum Stress-to-Rupture Values, MPa, Ni–Cr–Fe–Mo–Cb (Alloy 718)	Figure E-100.7-5

Table E-100.24-1
Cross-Reference Table of Section II, Part D and Section III, Subsection NH 2015 Edition (Cont'd)

Subsection NH Designation	Subsection NH Title	Nonmandatory Appendix E Designation
Table NH-I-14.6F	9Cr-1Mo-V, S_r — Expected Minimum Stress-to-Rupture Values, MPa	Figure E-100.7-6
Table NH-I-14.10A-1	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E 308T and E 308LT; SFA-5.4 E 308 and E 308L; and SFA-5.9 ER 308 and ER 308L	Table E-100.8-1
Table NH-I-14.10A-2	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 EXXT-G (16-8-2 Chemistry); SFA-5.4 E 16-8-2; and SFA-5.9 ER 16-8-2	Table E-100.8-2
Table NH-I-14.10A-3	Stress Rupture Factors for Type 304 Stainless Steel Welded With SFA-5.22 E 316T and E 316LT-1, -2, and -3; SFA-5.4 E 316 and E 316L; and SFA-5.9 ER 316 and ER 316L	Table E-100.8-3
Table NH-I-14.10B-1	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E 308T and E 308LT; SFA-5.4 E 308 and E 308L; and SFA-5.9 ER 308 and ER 308L	Table E-100.9-1
Table NH-I-14.10B-2	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 EXXT-G (16-8-2 Chemistry); SFA-5.4 E 16-8-2; and SFA-5.9 ER 16-8-2	Table E-100.9-2
Table NH-I-14.10B-3	Stress Rupture Factors for Type 316 Stainless Steel Welded With SFA-5.22 E 316T and E 316LT-1 and -2; SFA-5.4 E 316 and E 316L; and SFA-5.9 ER 316 and ER 316L	Table E-100.9-3
Table NH-I-14.10C-1	Stress Rupture Factors for Alloy 800H Welded With SFA-5.11 ENiCrFe-2 (INCO A)	Table E-100.10-1
Table NH-I-14.10C-2	Stress Rupture Factors for Alloy 800H Welded With SFA-5.14 ERNiCr-3 (INCO 82)	Table E-100.10-2
Table NH-I-14.10D-1	Stress Rupture Factors for 2 $\frac{1}{4}$ Cr-1Mo (415/205) Welded With SFA-5.28 E 90C-B3; SFA-5.28 ER 90S-B3; SFA-5.5 E 90XX-B3 (>0.05C); SFA-5.23 EB 3; SFA-5.23 ECB 3 (>0.05C); SFA-5.29 E 90T1-B3 (>0.05C)	Table E-100.11-1
Table NH-I-14.10E-1	Stress Rupture Factors for 9Cr-1Mo-V Welded With SFA-5.28 ER 90S-B9; SFA-5.5 E90XX-B9; SFA-5.23 EB9	Table E-100.12-1
Table NH-I-14.11	Permissible Materials for Bolting	Table E-100.13-1
Table NH-I-14.12	S_o Values for Design Conditions Calculation of Bolting Materials S_o Maximum Allowable Stress Intensity, MPa	Table E-100.14-1
Table NH-I-14.13C	S_{mt} — Allowable Stress Values, MPa, Alloy 718, Bolting	Figure E-100.15-3
Table NH-U-1	Recommended Restrictions	Table E-100.23-1

INTENTIONALLY LEFT BLANK

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 occurring 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 *CASTI Guidebook to ASME Section II, B31.1 & B31.3 – Materials Index*, latest edition.
- 5 *Metals & Alloys in the Unified Numbering System*, SAE HS-1086 and ASTM DS-56, latest edition.

INTENTIONALLY LEFT BLANK

2025 ASME Boiler and Pressure Vessel Code

AN INTERNATIONAL CODE

The ASME Boiler and Pressure Vessel Code (BPVC) is a globally recognized and trusted source of technical requirements and guidance for the design, construction, and certification of boilers, pressure vessels, and nuclear components. With each new edition, the Code continues to evolve, introducing new technologies and processes to promote safety across pressure equipment applications and disciplines. Developed through a rigorous consensus process and fueled by the foresight of leading industry experts from around the world, the ASME BPVC is an ever-evolving set of standards that meets the needs of a changing world.

ASME provides BPVC users with an integrated suite of related offerings, which includes

- referenced standards
- related standards, reports, and guidelines
- conformity assessment programs
- conferences, seminars, and other events
- learning and development solutions
- ASME Press books and journals



For additional information and to order:

Phone: 1.800.THE.ASME

(1.800.843.2763)

Email: customercare@asme.org

Website: go.asme.org/bpvc

ISBN 978-0-7918-7706-7

